IPSACON 2025

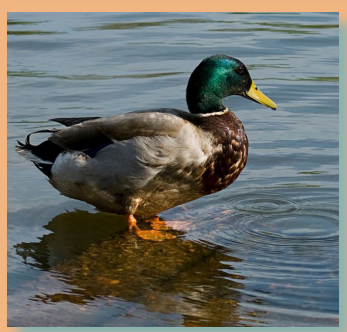
40th Annual Conference & National Symposium of Indian Poultry Science Association on

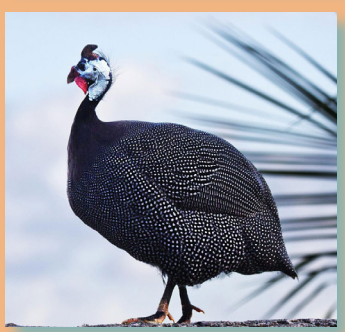
"Flock to the future: Embracing technology, innovation, entrepreneurship and sustainability in poultry production for protein security in Viksit Bharat"

9th - 11th December 2025

Volume - II

Abstracts





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ICAR-Directorate of Poultry Research

Rajendranagar, Hyderabad-500 030, Telangana, India

Indian Poultry Science Association

IPSACON 2025


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Genetics and Breeding: Oral Presentations

GBO-01

Heritability estimates for growth traits and response to selection on egg production in desi chicken breed (Khukhri)

Ravindra Kumar[1], DhawalKhant Yadav[1], Nishant Patel[1], Nandani Kumari[1] and K.T. Krishnagupta[1]

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This research aimed to assess heritability and selection response for the body weight of Desi chickens at 0, 8, 12, 16, and 20 weeks of age, shank length at 8 and 16 weeks, and egg production up to 322 days, focusing on developing a dual-purpose breed. Data were gathered across five generations, and the response to selection was recorded. The heritability estimates for body weight were moderate up to 16 weeks of age and low at 20 weeks, indicating that body weight can be enhanced through selective breeding of the birds. The correlations between genotype and phenotype for growth traits were found to be high. A sex effect was noted, with males showing a greater response than females. Following five generations of selection, the pooled body weight of hens and cocks at 20 weeks increased by 148.94g. The increase in shank lengths was minimal. Heritability for shank length at 8 weeks was moderate. In the fifth generation, egg production showed an improvement of 20 eggs when compared to the first generation. The findings indicate that it is possible to enhance the Desi chicken, making it a promising dual-purpose indigenous breed suitable for free-range and semi-intensive rearing systems.

GBO-02

Morphological and performance evaluation of Kashmir Favorella chicken

Azmat Alam Khan, Zulfqarul Haq, Snober Irshad, Asma Altaf Malik, Aiman Khursheed, Henna Hamadani* and Islam U Din Sheikh

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The Kashmiri Favorella, a native dual-purpose breed of Jammu and Kashmir, exhibits striking phenotypic diversity, yet remains poorly characterized. This study evaluated growth performance, carcass yield, morphometric traits and egg quality across six phenotypes—Normally Feathered, Naked Neck, Gul Hapuch, Pure White, Jet Black, and Barred. Sixty day-old chicks (n = 10 per phenotype) were reared under uniform management, and data were analyzed using a completely randomized design. Feed intake declined from 0.95 kg to 0.81 kg bird^{-1} month^{-1} as birds matured (1–9 months), while weight gain remained steady (170–195 g month^{-1}), improving feed conversion ratio from ~5.2 to ~4.4. The Normally Feathered strain achieved the highest live (1656 g) and dressed weights (1153 g) and dressing percentage (69.1%), whereas Naked Neck showed the lowest (64.8%). Breast yield was greatest in Naked Neck (21.2%), while Pure White recorded the highest thigh yield (13.2%). Morphometric analysis revealed consistently larger combs, wattles, chest girth, keel length, and shank dimensions in Naked Neck birds, traits associated with improved thermoregulation and meat yield. Egg quality remained uniform across phenotypes, with mean egg weight of ~41 g, shell thickness of ~0.15 mm, Haugh units of 70–71, and yolk index of ~0.40. Overall, Kashmir Favorella demonstrates desirable carcass, egg, and meat quality traits typical of slow-growing indigenous poultry, with notable within-breed diversity supporting its conservation and potential for selective breeding to enhance rural poultry production.

Keywords: Morphometric traits, carcass traits, feed conversion ratio, indigenous germplasm.

GBO-03

Comparative evaluvation of egg production characters of indigenous *Siruvidai*, TANUVAS Aseel and White Leghorn breeds of chicken

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Indigenous *Siruvidai* is the native ecotype of Tamil Nadu; while TANUVAS Aseel is an improved variety of Aseel developed by selective breeding. The while Leghorn used in the study was procured from commercial breeding company. A study was conducted to evaluate the egg production characters of indigenous *Siruvidai*, TANUVAS Aseel and White Leghorn breeds of chicken. A total of 300 female indigenous *Siruvidai*, 30 females each of TANUVAS Aseel and White Leghorn were used in this study up to 48 weeks of age. The age at first egg (AFE) and ages at 5 and 25% egg production were 149 ,151 and 179 days in Indigenous Siruvidai, 151,151 and 163 days in TANUVAS Aseel and 128, 128 and 131 days in White Leghorn, respectively. There was significant (P<0.01) differences in Hen Day and Hen Housed egg production (both number and per cent) among the three genetic groups with significantly (P<0.05) higher values in White Leghorn (148.3 ± 3.72 and 66.24 %) followed by indigenous *Siruvidai* (60.23 ± 1.65 and 60.12 ± 1.42and 31.0 & 30.67 and TANUVAS Aseel (55.93 ± 4.08 and 28.53%). The Survivor egg production was significantly (P<0.05) the highest recorded in White Leghorn followed by indigenous *Siruvidai* and TANUVAS Aseel. The average age at sexual maturity was significantly (P<0.05) higher in indigenous *Siruvidai* (175.22 ± 0.94) and TANUVAS Aseel (173.9 ±3.45) when compared to that of White Leghorn(135.7 ±2.24). The average weight of first egg was significantly (P<0.05) higher in White Leghorn (41.05 ± 0.50 g) and TANUVAS Aseel (41.00 ± 0.21g) as compared to that of indigenous *Siruvidai* (35.00 ± 0.28g).

Keywords: Egg production, Egg weight, Native chicken, Average age at sexual maturity White Leghorn.

GBO-04

Evaluation of growth performance on weekly body weight in Kadaknath chicken after selection

Deepti Kiran Barwa, K. Mukherjee, O.P. Dinani, Shailesh Vishal, Naveen Kumar
Sahu College of Veterinary Science and A.H.,
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Kadaknath birds are having low to moderate growth rate. As it is hardy, has ability to thrive under adverse rearing conditions and its meat and eggs command better price in the market, this germplasm can be improved for production potential through selective breeding. Change in mean growth performance of Kadaknath chicken population under constant selection over three generation was evaluated. The data, on 3000 birds divided in 3 generations and 3-4 hatches in each of the 3 generations were raised and recorded for the study, maintained at Poultry Experimental and Demonstration Unit of the College of Veterinary Science and A.H., Anjora, Durg (C.G.) under Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidalaya, Durg. The data were classified on the basis of generation, hatch and sex. There were three generations i.e. parent generation, first progeny generation and second progeny generation, within each generation data were classified hatch-wise and sex-wise. The traits studied was weekly body weight (g). There were significant differences between generations across the age periods and the body weight at all age. This was mainly due to selection performed in the parent generation. There was significant effect of sex in all the age and it can be noticed that the difference at earlier ages is less and this difference becomes more with increasing age. At 20 weeks of age the difference between male and female body weight is to the tune of 228g. In each hatch of all the three generations the hatch effect was highly significant across all the weekly body weights from day old to 20 weeks of age. The probable reason might be the variation of environmental factors over three generations as the performance varied with one another.

GBO-05

Genetic parameters and trend analysis in *Gramapriya* female line chickens using REML and Bayesian approaches

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The present study was undertaken to evaluate genetic parameters of the *Gramapriya* female line (PD-3) chicken maintained at ICAR-Directorate of Poultry Research, Hyderabad, using data collected over eleven consecutive generations (G2–G12). Variance components, heritability estimates, genetic correlations, and breeding values for key economic traits were estimated through Restricted Maximum Likelihood (REML) and Bayesian approaches. The overall means for adult body weights were 1378.71 g at BW20 and 1720.20 g at BW40, with later generations (G10–G12) showing higher values. The mean ASM was 163.26 days, demonstrating a desirable reduction over generations. The mean EP40 was 83.24 eggs, with the highest (108.26 eggs) recorded in G12. EM40 averaged 4.57 kg, increasing to 5.89 kg in G12. Egg weights improved progressively with age, from 50.09 g (EW28) to 54.13 g (EW40). Genetic correlations between BW20 and BW40 were high and positive (REML: 0.95 ± 0.06; Bayesian: 0.89 ± 0.01). BW20 and BW40 exhibited negative correlations with ASM, EP40, and EM40, while ASM showed a strong negative correlation with both EP40 and EM40. Positive correlations were observed among egg weights across ages. Breeding value trends indicated steady improvement in egg production, and egg mass traits, while ASM showed a desirable decline across generations. The results indicated moderate heritabilities and consistent genetic progress across generations. Both REML and Bayesian methods yielded comparable estimates, with few exceptions. The findings from both approaches confirm considerable genetic variability in the PD-3 line, and continued selection is expected to enhance egg production efficiency and sustainability of the terminal cross *Gramapriya* variety under backyard rearing systems.

Keywords: PD-3 chicken, Gramapriya, REML, Bayesian, egg production, heritability, selection response.

GBO-06

Effect of different-sized eggs during incubation on yolk sac and intestinal expression of nutrient transport genes in Japanese quails

K Martina, Mohd Matin Ansari, Gautham Kolluri, Jagbir Singh Tyagi, Jaydip Rokade, Prashant Bhutekar, Adnan Naim and Medasani Geethanjali

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The yolk sac plays a vital role in nutrient absorption during embryogenesis, while the intestine gradually assumes this function as hatching approaches. The efficiency of this transition depends largely on the expression of nutrient transporter genes, which mediate the uptake of amino acids, glucose, and lipids essential for embryonic development. However, limited information is available on how egg size influences the regulation of these transport genes during incubation in Japanese quails (*Coturnix coturnix japonica*), a species widely used in research and poultry production. This study aimed to investigate how egg size influences the expression of nutrient transporter genes in the yolk sac membrane and small intestine of Japanese quail during incubation. Eggs were categorized as small (8-10 g), medium (10-12g) and large (12-14g) based on weight. Expression of nutrient transport genes in yolk sac and intestine were observed on EDD9, EDD15 and DOH. The relative expression of *PepT1*, *SGLT1*, and *EAAT3* in the yolk sac showed no significant variation among different egg sizes across all developmental stages (EDD9, EDD15 and DOH). In the intestine, *PepT1* expression exhibited highly significant variation among the egg size groups at EDD9 ($p< 0.001$) and DOH ($p< 0.05$). *SGLT1* expression also varied significantly among egg sizes at EDD9 ($p< 0.05$) and DOH ($p< 0.05$), whereas *EAAT3* exhibited slight, non-significant variation across all stages. Our results suggest that egg size influences the expression of nutrient transporter genes in the small intestine of Japanese quail embryos.

GBO-07

Differential mRNA expression of immune response genes in guinea fowl and Kadaknath chicken

Girraj Goyal[1], V. Upmanyu[2], Sonal[2], GVVPS Ravikumar[2], RK Sharma[1] and VK Saxena[3]

NDVSU, Jabalpur[1], IVRI, Izatnagar[2], CARI, Izatnagar[3]

Guinea fowl, an important poultry species comes under family numidae under order galliformes. Guinea fowl differs from the domestic fowl not only in their phenotypic appearance but also in behavioural and production characteristics. As well as guinea fowl has a unique characteristic of resistance to the common diseases occurring in chicken. Therefore, guinea fowl may be established as an excellent model for studying these interactions, towards a predictive and integrated understanding of immunity and pathogenesis, and this should accelerate the development of the specific knowledge required for innovative and effective control strategies, using genetics and vaccination, and their application through translational research. Since cytokines have been shown significant and concerted role in innate and acquired immunity to the individuals against pathogens, whilst differential expression of cytokines have enlightened the basics of immune cells interactions and cytokine functions in host immunity, characterization and differential expression analysis of different cytokine genes in guinea fowl in comparison to kadaknath chicken, may provide significant information for better understanding of the mechanism of disease resistance in poultry. Expression of Pro-inflammatory cytokines (IL1β, IL-6 and TNF- α) was very high in guinea fowl in comparison to kadaknath breed. Guinea fowl spleenocytes expressed anti-inflammatory cytokines (TGF- β4) at lower level than kadaknath. Higher expression of Pro-inflammatory cytokines (IL1β, IL-6 and TNF- α) and lower expression of anti-inflammatory cytokine (TGF- β4) in guinea fowl exhibited the better resistance to *Salmonella enteritidis* infection in spleenocyte culture as compared to kadaknath chicken. These differences in the expression of different cytokines may be instrumental for the higher immune response in the guinea fowl against pathogens compared to kadaknath breed of chicken.

Keywords: Guinea fowl, Kadaknath, differential Expression, Immune genes, cytokines.

Genetics and Breeding: Poster Presentations

GBP-01

Characterisation and socio-economic impact of Khukhri, an indigenous chicken of Jharkhand

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The present study was conducted to characterize the Khukhri chicken reared under backyard system in three districts of Chotanagpur plateau of Jharkhand. Data on phenotypic and body measurements were recorded of 540 adult chickens; 180 male and 360 females drawn from 270 households. The overall flock size differed significantly ($p \leq 0.01$) in the study area. In males, mixed and red plumage were the dominant phenotypic traits. However, female chickens were characterized by brown plumage. The predominant shank colour was yellow. The colour of ear lobe and comb were red and skin was white in all the birds. The predominant comb type was single followed by pea and rose. The present study has developed the baseline data of indigenous chickens for recognition as a distinct breed in future. The overall value of age of first egg laying, clutch size, clutch interval, number of clutches per cycle, number of eggs per cycle, cycle per year, pause period and annual egg production was 216.51±0.9, 5.16±0.6, 1.311±0.001, 2.64±0.026, 13.16±0.107, 3.32±0.025, 107.6±0.423 and 43.39±0.395. The overall mean percent hatchability on total egg set basis recorded was 76.11±0.432. The overall average body weight of male and female chicken was 1552.18±27.46 and 1182.04±14.30 g, respectively in Chotanagpur plateau of Jharkhand. The body weight of males was observed to be significantly ($p<0.05$) heavier than females. The overall average shank length of adult male and female was found to be 9.85±0.08 and 8.73±0.05 cm respectively. The B:C ration of economics under backyard condition was observed to be 2.55. Indigenous Khukhri bird of Jharkhand is a dual-purpose bird, providing both meat and eggs. It is a valuable and profitable asset for local farmers, particularly given its resilience and adaptability. The findings suggest that with appropriate support and market linkages, Khukhri bird rearing has the potential to significantly enhance the livelihood and food security of rural households in Jharkhand.

Keywords: Khukhri, Indigenous chicken, Characterisation, backyard.

GBP-02

Performance, carcass and egg quality traits across various strains of Kashmir Favorella chicken

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The Kashmiri Favorella, a native dual-purpose breed of Jammu and Kashmir, exhibits striking phenotypic diversity, yet remains poorly characterized. This study evaluated growth performance, carcass yield, morphometric traits andegg quality across six phenotypes-Normally Feathered, Naked Neck, Gul Hapuch, Pure White, Jet Black, and Barred. Sixty day-old chicks (n = 10 per phenotype) were reared under uniform management, and data were analyzed using a completely randomized design. Feed intake declined from 0.95 kg to 0.81 kg /bird/month as birds matured (1–9 months), while weight gain remained steady (170-195 g/month), improving feed conversion ratio from ~5.2 to ~4.4. The normally feathered strain achieved the highest live (1656 g) and dressed (1153 g) weights and dressing percentage (69.1%), whereas Naked Neck showed the lowest (64.8%). Breast yield was greatest in Naked Neck (21.2%), while Pure White recorded the highest thigh yield (13.2%). Morphometric analysis revealed consistently larger combs, wattles, chest girth, keel length, and shank dimensions in Naked Neck birds, traits associated with improved thermoregulation and meat yield. Egg quality remained uniform across phenotypes, with mean egg weight of ~41 g, shell thickness of ~0.15 mm, Haugh units of 70–71, and yolk index of ~0.40. Overall, Kashmir Favorella demonstrates desirable carcass, egg, and meat quality traits typical of slow-growing indigenous poultry, with notable within-breed diversity supporting its conservation and potential for selective breeding to enhance rural poultry production.

Keywords: Kashmir Favorella, Strains, Performance, Quality.

GBP-03

Production performance and egg quality of Kuzi duck of Odisha being selected for higher body weight for last five generation

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Duck improvement programme in the country is very limited compared to chicken. Further, in indigenous duck the selection pogramme still less. In the present study the production performance of Kuzi duck which is native to Odisha is recorded. This breed is selected for higher eight week body weight since last five generation. A total of 800 ducklings produced using 50 sires and 250 dams. At 8 weeks of age 300 females are being selected for higher 8 week body weight and kept for growing and laying period data recording. Standard deep litter brooding, feeding and management practices were followed. Laying period body weights were recorded along with the production and egg weight data. Egg quality data were recorded at 40 weeks of age. Body weights at 16, 20 and 40 weeks of age were 1388±7, 1488±8 and 1536±10g, respectively. The flocks reached 50 % duck day egg production at 152±1.48 days of age. Egg production upto 40 and 72 weeks of age of Kuzi duck were 106.58±1.80 and 247.77±3.78 eggs, respectively. The egg weight at 40, 52 and 70 weeks of age were 73.73±0.44, 77.03±0.74 and 75.25±0.65 g, respectively. As the age advances the egg weight increases except some decrease at 70 weeks of age. Egg quality parameters revealed that the eggs are of good quality. The results revealed that Kuzi performing well in respect to different production traits and egg quality. So this breed may be use as a purebred egg type birds in the rural area for backyard farming.

Keywords: Body weight, egg production, egg quality, egg weight, Kuzi duck.

GPB-04

Evaluation of growth performance during the juvenile phase in a long-term selected coloured broiler male line (PB-1)

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PB-1, a synthetic coloured broiler male line, is utilized as the male parent in producing the commercial coloured broiler terminal cross Krishibro™, a popular bird suited for semi-intensive rearing systems in rural areas. This line has been under continuous selection for higher 5-week body weight for several generations at the Experimental Farm of ICAR–Directorate of Poultry Research (ICAR-DPR), Hyderabad. To enhance the genetic variability of the population, germplasm of PB-1 was introduced from the Bengaluru and Ludhiana Centres of the All India Coordinated Research Project on Poultry Breeding (AICRP-PB). The present study aimed to evaluate the juvenile growth performance of the PB-1 line (S-3 generation) to assess the current status of the flock. The population was regenerated through random mating involving about 60 sires and 300 dams. A total of 3,629 eggs were set for hatching, resulting in 2,884 good-quality chicks. The fertility, total egg set (TES) hatchability, and fertile egg set (FES) hatchability were 91.1%, 82.3%, and 89.4%, respectively. Body weights were recorded at day-old, 2, 4, and 5 weeks of age to assess growth performance. The average pooled body weights of PB-1 chicks at day-old, 2, 4, and 5 weeks of age were 40.67 ± 0.07 g, 270.7 ± 0.95 g, 871.4 ± 4.96 g, and 1,120 ± 4.15 g, respectively. The body weights of male chicks were 940.7 g and 1,219 g at 4 and 5 weeks of age, while the corresponding body weights of female chicks were 812.8 g and 1,035 g, respectively. The average shank length at five weeks of age was 86.57 ± 0.13 mm, and the average breast angle was 78.74 ± 0.17°. The evaluation of the PB-1 synthetic coloured broiler male line (S-3 generation) revealed satisfactory growth performance, fertility, and hatchability parameters, indicating that the line is maintaining its genetic potential as an efficient male parent for the commercial Krishibro™ cross. The variation within the population suggests ample scope for further genetic improvement through continued selection and optimized management practices to enhance growth rate and overall performance in future generations.

GPB-05

Inheritance of growth and production traits in Gramapriya female line chicken population

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The present study was conducted to evaluate and further improve the performance of Gramapriya female line (PD-3) chicken selected for higher 40 week egg mass (EM40) based on Osborne index for the last 10 generations to improve the egg production without compromising the egg weight. The data collected on 2988 chicks produced with 50 sires and 250 dams in a pedigreed mating during S-11 generation were subjected to least squares analysisin the study. The adult body weights and production traits were analyzed in 488 hens in S-11 generation. The genetic parameters for production traits were estimated using REML animal model (WOMBAT). The fertility observed was 83.78%, while hatchability was 84.18% on a fertile egg set (FES) basis and 70.53% on a total egg set (TES) basis respectively. The fertility and hatchability were fairly good and maintained over the generations, overcoming the incidence of low fertility and hatchability during the earlier generations in the line. The lease squares mean for body weight at 4 and 6 weeks of age were of180.4 ± 1.17 and353.2 ± 1.57 g respectively, with corresponding shank lengths of 45.30 ± 0.12and 58.64 ± 0.12 mm. The body weight has shown an increasing trend over the generations, though selection is not practiced for body weight as correlated response. Age at sexual maturity (ASM) was 160.9 ± 0.53 days. The least squares mean for 20 and 40 week body weight in hens were 1476 ± 7.21 and 1840 ± 10.01g, respectively. The part-period egg production up to 40 weeks was 90.34 ± 0.96 eggs with an egg weight of 56.89 ± 0.20 eggs. The LSM for EM40, the primary trait of selection was 5342± 2.55 g in S-11 generation. Progressive genetic gain was evident in EM40 with 40-week egg mass and egg production improving by 222.3 g per generation over the last 11 generations. The associated traits EP40 and EW40 also increased with an annual gain of 3.09 eggs and 0.38 g, respectively, over 11 generations of selection. The selection for egg mass improved the egg production significantly and maintained the egg weight in the population. Genetic analysis indicated moderate heritability for EW40 (0.34 ± 0.04), suggesting good potential for further genetic improvement. Conversely, ASM (0.19 ± 0.04), EP40 (0.11 ± 0.03), and EM40 (0.12 ± 0.04) exhibited low to moderate heritability, which might be due to the prolonged long term selection for egg production initially and egg mass at present in the line. The genetic correlations between egg production and weight were negative and high in magnitude. Egg mass had positive genetic correlations both with egg production and egg weight. In conclusion, the results demonstrate significant genetic improvement in production traits, reaffirming PD-3 as a genetically robust and highly suitable line as a female parent line for production and development of backyard poultry chicken varieties.

GPB-06

Characterization of Aseel chicken for growth and production traits up to 52 weeks of age

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Aseel is one of the important indigenous chicken breeds of India, which is known for its martial qualities, pugnacity and agility. Aseel chickens have attractive multi coloured plumage, pea comb, upright body with majestic gait. *Aseel* hens are poor layers but excellent mothers with high broodiness and mothering ability. The birds were maintained in deep litter management under a backyard type of housing with a free range facility for movement of the birds to retain the breed characteristics up to the grower phase at ICAR - Directorate of Poultry Research, Hyderabad, Telangana, India. Hens were housed in cages during the laying phase. The data collected from 525 birds (345 hens and 180 cocks) in G-9 generation on reproductive and various growth and production traits were analyzed in the present study.A total 1118 chicks were produced in random mating with pooled semen. The fertility was 84.09% and the hatchability on fertile egg set (FES) was 81.90% and on total egg set was 68.87 %. The juvenile body weight and shank length at 4 and 6 weeks

was 102.3±1.18 and 242.6 ± 3.06 with a corresponding shank length of 37.11±0.17 and 54.57±0.29 mm respectively. The adult body weights at 20 and 40 weeks of age were 1180± 15.12 and 1863± 28.54 g in hens and 1858 ± 39.12 and 3115± 60.45 g in cocks, respectively. The significant variation in body weights between the sexes is clear indication of sexual dimorphism in Aseel, as the females are smaller in size. Cocks are heavier, bigger with upright majestic gait and attractive in appearance making them a preferred bird for game and fancy purposes. The age at sexual maturity (ASM) was 203.5 ± 0.68 days, higher than the ASM of other recognized breeds and hybrid varieties of chicken. The birds laid brown coloured small sized eggs. The egg weight at 32,36,40 and 52 weeks of age was 42.23±0.23, 42.87±0.15, 45.38±0.16 and 47.26±0.22 respectively. The egg production up to 40 and 52 weeks of age was 18.49 ±0.53 and 31.87±1.11 respectively. The egg production was lower as the hen's showed broodiness for a longer duration, which has been the characteristic features of the Aseel breed. The Aseel chicks were distributed to the farmers enabling the *in-situ* conservation of the breed in field conditions. Efforts are on to improve the Aseel chicken for growth and production traits without compromising the natural characters.

Keywords: Aseel; Growth; Egg Production; Egg weight.

GPB- 07

Genomic diversity profiling in two Indian native duck populations

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The indigenous duck (*Anas platyrhynchos*) populations of India, Kuzi (native of Odisha: east coast) and Chemballi (native of Kerala: southern coast), evolved in their distinct milieu and their geographical location is almost two thousand Kilometres apart which rarely allows genomic communication. In the present investigation, an endeavour has been made to assess the genomic diversity of two un-explored Kuzi and Chemballi duck populations of India. The whole genome sequence clean reads were acquired from raw reads following the quality control process to remove unstable reads. A combined sum of 382.52 Gb (201.63Gb for Chemballi and 181.89 Gb for Kuzi) of raw base reads was acquired from eight individual of each duck population. The sequencing quality was exceptional, with a Q30% ranges from 94-96% for raw reads while for cleaned reads the Q30 % is >98%. The clean reads were aligned against the reference genome (ZJU1.0) from NCBI using the Burrows–Wheeler aligner (BWA) software. The percentage of Aligned reads for each sample is >99%, confirmed the high accuracy and resolution of this genetic analysis. Genetic diversity analysis was performed by using the number of SNPs as a way of determining diversity level of individuals. The population genetic statistics for each population Chemballi and Kuzi are calculated by STACKS. The observed heterozygosity in the Chemballi and Kuzi duck population is 0.25494 and 0.27829 respectively. The results of the genetic diversity analysis of the two-population showed that the observed heterozygosity in both the population was greater than the expected heterozygosity that it indicates that the population is not in Hardy-Weinberg equilibrium and that certain evolutionary forces favouring heterozygotes. Nucleotide diversity (π) a parameter to measures the genetic diversity within a population, is higher in Kuzi duck population (π = 0.28452) compared to Chemballi.The study offers new insights on genetic diversity that could be utilized to improve the productivity of indigenous ducks by genome associated duck breeding.

GPB- 08

Data mining and development of microsatellites markers database for *Meleagris gallopavo*

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The turkey (*Meleagris gallopavo*), a large bird native to North America, is primarily valued for its lean, nutritious meat. As of the 2019 Livestock Census, there were over 257 million turkeys in the world and the practice of turkey

farming has been growing, especially in recent years. Simple Sequence Repeats (SSRs) or microsatellites, are short, tandemly repeated DNA motifs that are abundant and uniformly distributed throughout eukaryotic genomes. Due to their co-dominant inheritance, high polymorphism and ease of detection, SSRs are invaluable molecular markers for genetic diversity studies, linkage mapping, and marker-assisted selection in poultry species. The recent availability of a high-quality turkey genome assembly (GCF_000146605.3) enables comprehensive genome-wide identification of SSRs and the development of robust SSR markers. In this study, the complete genome assembly of the domesticated turkey (GCF_000146605.3) was mined using bioinformatics pipelines and MISA tools to detect tandemly repeated motifs ranging from mono- to hexanucleotide repeats. A total of 72859 SSR loci were identified across the turkey genome, including diverse repeat motifs (di, tri, tetra, penta, and hexanucleotides) distributed throughout both genic and intergenic regions. Mono nucleotide repeats were not considered in the study as they are not useful because their high mutation rate introduces scoring errors and artifacts, they provide lower true polymorphism, and are technically challenging to score compared to SSRs with longer motifs. Dinucleotide (37007) and trinucleotide (16490) repeats were the most prevalent. The database was developed using a three-tier architecture that includes the client layer, middleware, and database layer. Both the user interface and the database were created on the OutSystems platform, which offers a low-code environment for designing responsive web applications. This genome-wide survey of SSRs in turkey will establish a foundational resource for the genetic improvement and conservation of turkey germplasm. The comprehensive characterization of SSR loci and the associated marker resources are expected to accelerate progress in turkey genomic diversity, support association studies, and enhance genomic selection practices for economically valuable traits.

Keywords: Turkey, simple sequence repeats, genome assembly, genomic diversity.

GPB-09

Sex determination of duck embryos using CHD1 gene

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Ducks (*Anas platyrhynchos*) play an essential role in the rural economy of India, contributing to household livelihoods, food security, and integrated farming practices. Ducks are 2nd important poultry species after chicken and provide valuable products such as eggs, meat, and manure, and are especially well-suited to wetland and low-input farming systems. Indigenous duck breeds are known for their adaptability, efficient foraging behaviour, and resilience, making them a vital asset in sustainable and resource-poor agricultural environments. Accurate sex identification of avian embryos is essential for developmental biology and molecular studies, particularly when selecting gonadal tissue for gene expression analysis. This study aimed to efficiently determine the genetic sex of duck embryos using molecular techniques targeting the Chromodomain Helicase DNA-binding 1 (CHD1) gene, located on the Z and W sex chromosomes. Liver tissue samples from 26-day-old embryos were used for genomic DNA extraction via the phenol-chloroform method. Polymerase chain reaction (PCR) was carried out using CHD1-specific primers, targeting sex-specific fragments of 495 bp (Z chromosome) and 351 bp (W chromosome). Amplified products were resolved on 2% agarose gels and visualized under a UV transilluminator. Male embryos (ZZ) exhibited a single band corresponding to the 495 bp fragment, while female embryos (ZW) showed two distinct bands at 495 bp and 351 bp. This method provided clear differentiation between male and female embryos, demonstrating the effectiveness of CHD1 gene amplification as a reliable and reproducible approach for molecular sexing in ducks.

Keywords: Chromodomain Helicase DNA-binding 1, Duck, Molecular sexing, Sex determination.

GPB-10

Performance evaluation of Rhode Island Red chicken breed under farm conditions

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The growth and production performance of a newly introduced Rhode Island Red (RIR) female line up to 40 weeks of age was evaluated in the present study. A total of 1,756 chicks, produced from 50 sires and 250 dams, were utilized for assessment in the base generation. The primary objective was to characterize the line for key economic traits to determine its potential for future selective breeding. The reproductive performance indicated a fertility rate of 75.12%, with hatchability of 89.82% on fertile egg set (FES) and 67.48% on total egg set (TES). The chicks recorded an average day-old body weight of 35.75 ± 0.22 g. At 6 weeks of age, the body weight increased to 269.2 ± 3.6 g, with a shank length of 55.19 ± 0.32 mm, indicating good early growth. Sex-wise performance revealed superior growth in males compared to females, with male and female body weights recorded as 900.3 ± 20.72 g and 806.2 ± 14.68 g at 12 weeks, and 1537 ± 24.69 g and 1260 ± 17.57 g at 16 weeks, respectively. A similar trend was observed for shank length, with males measuring 91.20 ± 0.88 mm and 112.6 ± 0.77 mm, and females 86.41 ± 0.71 mm and 100.1 ± 0.62 mm at 12 and 16 weeks, respectively. The age at sexual maturity (ASM) was recorded as 147.3 ± 2.34 days. Part-period egg production at 28 and 32 weeks averaged 27.86 ± 0.96 and 51.23 ± 1.20 eggs, with corresponding egg weights of 52.03 ± 0.27 g and 53.91 ± 0.29 g, respectively. By 40 weeks, the birds attained a body weight of 1807 ± 33.17 g, with an average egg weight of 54.88 ± 0.57 g and part-period egg production of 92.97 ± 2.46 eggs. The egg production up to 40 weeks of age was slightly higher by 2 eggs compared to PD-3 line, established female line. Overall, the results demonstrate promising growth and production attributes of the newly introduced RIR female line, suggesting its suitability for genetic improvement programs and potential for enhanced performance under field conditions.

GPB- 11

Differential gene expression of candidate genes related to egg shell strength in White Leghorns

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This study was conducted to evaluate the effect of selection for higher egg production on the egg shell strength (ESS) in White Leghorns through candidate gene expression. ESS was recorded during peak production age of 32 weeks over three consecutive days from 120 birds of the IWH line (selected for higher egg production up to 64 weeks) and 120 Layer Control (LC) birds. The ESS was measured in the form of peak load (PL, unit= Newton or N) and compressive strength (CS, unit = N/mm^2). Subsequently, three groups *viz.* IWH-T (six IWH birds with strongest ESS estimates), IWH-B (six IWH birds with weakest ESS estimates) and LC (six random LC birds with average ESS estimates) were created. The birds in all the three groups were slaughtered and uterine samples were collected to measure the gene expression of three major candidate genes *viz*., *Calbindin 1 (CALB1)*, *Osteopontin (SPP1)* and *Carbonic Anhydrase* 2 *(CA2)*. Results showed that the average ESS in the IWH population (13.30 N; 0.10 N/mm^2) was significantly ($p < 0.001$) higher than the corresponding estimates in the LC population (11.43 N and 0.08 N/mm^2). Further, RT-qPCR ($2^{-\Delta\Delta Ct}$ method) results revealed that *CALB1* gene was upregulated in IWH-T birds as compared to both LC (fold change of 16.202) and IWH-B (fold change of 2.810). Both *SPP1* and *CA2* genes showed higher expression in IWH-T as compared to IWH-B (8.145 and 1.660, respectively). However, both these genes were downregulated in the two IWH groups as compared to the LC group. All these differences in the expression levels were not found to be significant ($p<0.05$) thereby, indicating that the egg shell strength in the selected IWH population is still optimum.

Keywords: Differential gene expression, egg shell strength, Calbindin, Osteopontin, Carbonic Anhydrase.

GPB- 12

Genetic analysis of Avian Leukosis virus incidence in White Leghorn populations

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Avian Leukosis is a neoplastic disease caused by Avian Leukosis virus (ALV) in chickens. It severely impacts the egg production performance of laying birds through reduced productivity and immunosuppression, thus causing huge economic losses to the commercial flocks. Although routine monitoring of ALV and culling of positive birds is critical for eradication of virus from the layer breeder flocks, understanding the genetic basis of ALV incidence is crucial to breed layer populations resistant to the disease. Therefore, this study was conducted to estimate the additive genetic variability of ALV incidence in White Leghorn populations. The dataset comprised of 1,355 birds spanning two generations (2023-2024) and belonging to three White Leghorn populations *viz*., IWH, IWI and LC strains. Avian leukosis was diagnosed in the population based on antigen ELISA test and the consequent SPR values were considered as the dependent variable for ALV incidence. The data was transformed so as to bring to normal distribution. Strain (N=3), sex (N=2) and generation (N=2) were identified as the non-genetic factors and additive heritability of ALV incidence was estimated using simple animal model in AIREML. All the non-genetic factors were significantly influencing the trait and were further considered for heritability estimation. The trait was found to be having medium heritability estimate (0.20±0.05), thus indicating that there is a scope to select for genetically resistant ALV birds. These findings are particularly important in the light of the fact that some endogenous strains of the virus can integrate genetically and inherited further. Also, the innate immunity offered by the host genetics may be responsible for the resistance or susceptibility against ALV. Further studies with larger dataset could be planned to validate the findings.

GPB-13

Evaluation of egg quality traits in Red Cornish and Plymouth Rock Black chickens

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The study was conducted at the Poultry Research and Training Centre, Bihar Animal Sciences University, Patna, to compare the egg quality traits of Red Cornish (RC) and Plymouth Rock Black (PMR Black) chickens at 28 weeks of age under uniform farm conditions. Both breeds were maintained following standard management practices, and a total of 18 eggs per breed were collected by sampling six eggs daily for three consecutive days. The eggs were evaluated for key external egg quality parameters, including egg weight, length, width, shell thickness and shell weight. The collected data were subjected to statistical analysis to determine the extent of variation between the two breeds. The results showed that the mean (±SE) egg weight of Red Cornish was 51.33 ± 0.36 g, while Plymouth Rock Black recorded a similar value of 51.75 ± 0.33 g. The egg length averaged 5.55 ± 0.05 cm in Red Cornish and 5.51 ± 0.10 cm in Plymouth Rock Black, whereas the egg width was 4.08 ± 0.12 cm and 4.12 ± 0.06 cm, respectively, indicating close similarity between the breeds. Noticeable variation was observed in shell characteristics, where Plymouth Rock Black exhibited comparatively superior shell traits. Shell thickness in PMR Black averaged 0.91 ± 0.01 mm, nearly double that of Red Cornish at 0.49 ± 0.01 mm, and shell weight was also slightly higher in PMR Black (5.70 ± 0.11 g) compared to Red Cornish (5.44 ± 0.09 g). Overall, the findings indicate that while both breeds perform similarly in terms of general external egg quality traits, Plymouth Rock Black shows an advantage in shell robustness. These results provide useful baseline information that can guide selection and breeding strategies aimed at enhancing egg quality attributes in dual-purpose poultry breeds under farm production conditions.

Keywords: Red Cornish, Plymouth Rock Black, egg quality, shell thickness, indigenous chicken.

GPB-14

Precision phenotyping and genomic technologies in poultry breeding

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What is the potential of integrating next-generation genomic tools with real-time precision phenotyping to optimize breeding outcomes for sustainability, animal welfare, and productivity in broiler production? Comprehensively organized into sections covering:

- Genetic technologies (MAS, GS, WGS, CRISPR-Cas9, ZFNs, TALENs)
- Genomic resources (INDICHICK SNP chip specifications)
- Precision phenotyping systems (IoT, AI/ML, computer vision, infrared thermography)
- Data integration approach

This study examines the integrated use of marker-assisted selection (MAS), genomic selection (GS), whole-genome sequencing (WGS), and gene editing technologies, viz., CRISPR-Cas9, ZFNs, andTALENs, combined with automated digital phenotyping systems. Precision phenotyping combines IoT devices, AI/ML algorithms to continuously monitor physiological, behavioural, and environmental factors in commercial farms. This comprehensive method allows for the simultaneous evaluation of various phenotypic traits with higher accuracy and better temporal resolution directly on the farm. Using computer vision with deep learning, it can detect diseases and recognise complex behavioural patterns with over 98% accuracy. The INDICHICK SNP chip, with 74k to 75k markers, a collaborative result of ILRI and ICAR-DPR, serves as a specialised genomic tool for native chicken breeds. During development, around 7 million SNPs were identified across ten indigenous breeds and two exotic lines, with 75,192 SNPs selected for the final chip, including 62 breed-specific markers. This platform facilitates breed authentication, genomic selection for traits like growth, egg production, disease resistance, and meat quality, as well as GWAS and marker-assisted selection. By integrating genomic data with sensor-derived phenotypes using statistical and AI models, accurate GEBV predictions are possible, helping bridge the gap between genotype and phenotype. Data standardisation, high infrastructure costs, and farmer training persist. Synthesized summary with insights on the paradigm shift in poultry breeding, integration benefits, and the foundation this work provides for sustainable production practices.

Keywords: Genomic selection, marker-assisted selection, infrared thermography, precision phenotyping.

GBP-15

Growth, production, reproduction, egg and carcass characters of indigenous chicken of Chhattisgarh plain region

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The present study was undertaken to study the physical character, growth, productive and reproductive performance and carcass characteristics of the native chicken of Chhattisgarh plain. Parameters were considered as physical character, growth, productive and reproductive performance, biochemical and microelements status in blood serum and carcass characteristics. To produce pure native germplasm 1522 pure desi eggs were collected from different villages of Durg, Rajnandgaon and Khairagarh districts. The most predominant plumage color observed in native chicken of Chhattisgarh was brownish black with birds with mostly single comb. Average weekly body weight 12th and 16th week of age were 103.52 ± 0.69, 246.65 ± 0.86, 453.09 ± 1.31, and 704.08 ± 2.93 g, respectively. The average egg production per laying cycle was 12.69±0.54 eggs with average laying period of 19.34 days with average clutch size 3.06±0.11 and average clutch interval as 1.60±0.19 days. The average egg weight was 35.84 ± 0.20g. with average specific gravity, egg length, egg width and shape index as 1.065, 4.7 ± 0.21cm, 3.6 ± 0.13cm and 77.66 % respectively. The average albumin weight, percent albumin, yolk weight, percent yolk, albumin height, yolk height, albumin index, yolk index, haugh unit

score, egg shell weight, percent shell and shell thickness obtained was 21.60±0.20g, 60.74%, 10.82±0.08g, 30.22%, 5.26±0.08mm, 14.75±0.13mm, 9.59%, 43.79%, 80.68, 3.25±0.05g, 9.09% and 0.30±0.002 mm, respectively. At the time of slaughter average live weight of birds was 1176.77 ±43.02 g yielding the dressed weight as 850.78 g. The dressing percentage recorded as 72.79%. The meat composition analysis revealed that moisture content and dry matter content was 74.60±0.22% and was 25.39±0.22% respectively in which composition of crude protein, ether extract and total ash were 84.66 ± 0.02%, 3.35 ± 0.13% and 5.84 ±0.10%, respectively.

Keywords: Native chicken, Chhattisgarh, physical characteristics, reproductive, productive, egg quality traits, carcass traits.

GBP-16

Growth performance evaluation of Red Cornish x Kadaknath Crossbred chickens over two generations under farm conditions

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The present study was undertaken to evaluate and compare the growth pattern of Red Cornish × Kadaknath crossbred chickens across two generations (F_1 and F_2) reared under farm conditions from hatch to 12 weeks of age. The experiment was conducted at the Poultry Research and Training Centre, Bihar Animal Sciences University, Patna. A total of 500 chicks of the first-generation (F_1) Red Cornish × Kadaknath cross were reared under standard managemental practices, and individual body weights were recorded at hatch (0 day) and at monthly intervals up to 12 weeks of age to assess their growth trajectory. The second-generation (F_2) birds were produced through inter-se mating of the F_1 generation, and 250 chicks were similarly maintained under identical management conditions, with body weights recorded at hatch, 4, 8, and 12 weeks. The Least Square Mean (±SE) body weights of the F_1 generation were 27.72 ± 0.09 g at hatch, 243.26 ± 1.59 g at 4 weeks, 455.16 ± 5.05 g at 8 weeks, and 646.37 ± 8.16 g at 12 weeks. In comparison, the corresponding body weights for the F_2 generation were 29.69 ± 0.16 g at hatch, 210.79 ± 1.24 g at 4 weeks, 431.57 ± 4.60 g at 8 weeks, and 615.22 ± 8.07 g at 12 weeks. Although the F_2 chicks were significantly heavier at hatch, the F_1 birds exhibited significantly higher body weights at 4, 8, and 12 weeks of age. This pattern indicates that the F_1 generation had superior growth performance throughout the post-hatch period, suggesting the influence of heterosis in the first generation and possible segregation of growth-related genes leading to reduced growth in the F_2 generation. Overall, the study highlights that the F_1 Red Cornish × Kadaknath crossbred birds possess better growth potential than the F_2 birds and may therefore be more suitable for low-input and backyard poultry production systems.

Keywords: Crossbreeding, Growth performance, Heterosis, Kadaknath, Red Cornish.

GBP-17

Egg production and egg quality traits of Kadaknath breed of chicken

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Kadaknath breed, (Kalamashi) is famous for its black-coloured meat, reared by tribal communities in Jhabua and Dhar (M.P.). Native rural chicken are valuable genetic resources due to their adaptability to local conditions and resistance against common diseases. the present investigation was undertaken with objectives to assess the egg production performance and various egg quality characteristics of Kadaknath breed of poultry. Day old, 50 female chicks of Kadaknath birds were obtained from the Hatchery Unit of the College of Veterinary Science and Animal Husbandry, Rewa. All the chicks were reared up to the age of 40 weeks on deep litter following standard managemental practices for chick, grower and laying stages. Birds were fed standard feed during chick, grower and laying stage having CP20%, 14% and 18% and ME 2600 Kcal/Kg feed, 2400 Kcal/ Kg feed and 2600 Kcal/Kg feed, respectively. The egg collection period was divided in to three different age groups i.e. 20-26th weeks, 27-33th weeks, 34- 40th weeks of age. The body

weight, growth rate, egg production, egg quality, FCR, Mortality and cost economics were estimated. The body weight at first egg was 1124 gm at 22 weeks of age. The growth rate was highest during 8-12th week. During 28-32nd and 32-36th & 36-40th weeks the growth rate was very less. The egg production was highest during 2nd Interval then it decreases during 3rd Interval. The FCR for production of one dozen eggs was very poor during first interval. The egg weight was increasing with age and reached upto 47.07 gm during 3rd interval. The egg shell percentage was highest during 2nd interval whereas the albumen percentage was slightly decreasing however the yolk percentage was increasing with age. The yolk index and albumen index was found decreasing with age. The total mortality was only 12% from day old to 40th week of age. The cost of production for 20-40th week was Rs. 15.38 per egg

Keywords: Kadaknath, egg production, egg quality traits.

GBP-18

Genetic analysis of juvenile traits in *Gramapriya* female line chicken: Insights for strengthening rural poultry sustainability

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Backyard poultry farming plays a pivotal role in enhancing rural livelihoods by providing nutritional security and supplementary income with minimal inputs. Among improved backyard varieties, *Gramapriya* is a dual-purpose developed using the *Gramapriya* female line (PD-3) and PD-6 male line. The PD-3 line is an egg laying variety contributes desirable red plumage and tinted-egg characteristics, making it suitable for rural rearing. Selection based on early growth traits such as body weight is crucial for improving skeletal strength, advancing sexual maturity, and enhancing laying performance. Shank length also serves as an important indicator of skeletal development and mobility, aiding survival under backyard conditions. The present study evaluated the genetic parameters of the PD-3 line using data recorded over eleven consecutive generations (G2–G12). Variance components, heritability estimates, and breeding values for key economic traits were estimated using Restricted Maximum Likelihood (REML) and Bayesian approaches. Juvenile growth traits showed significant ($P \leq 0.01$) variation across generations and hatches. The least square means for BW4, BW6, and shank length at 6 weeks (SL6) were 164.95 g, 285.12 g, and 54.82 mm, respectively. Heritability estimates for BW4 (0.20 ± 0.03) and BW6 (0.24 ± 0.03) indicated moderate heritability, while SL6 showed low heritability (REML: 0.18; Bayesian: 0.19). Strong positive genetic correlations were observed among these early growth traits. Overall, the PD-3 line exhibited considerable genetic variability across generations, demonstrating consistent genetic improvement and both approaches gave similar results. Enhancement of juvenile growth traits in the PD-3 line is expected to further improve the performance of the terminal cross *Gramapriya*, thereby contributing significantly to the productivity and sustainability of backyard poultry farming.

Keywords: PD-3 chicken, *Gramapriya*, REML, Bayesian, juvenile growth, heritability, backyard poultry.

GBP-19

Hatching and production performance of Anand Bantamized White Leghorn

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The *Anand Bantamized White Leghorn (ABWLH)* strain was developed and released for better feed efficiency and evaluated for its hatching and production performance in the 14th generation (S_{14}). A total of 321 pullets were housed individually under standard managemental conditions and Artificial Insemination was practiced. Fertility was recorded 81.05%, while hatchability on total egg set (TES) and fertile egg set (FES) basis was 61.28% and 75.62%, respectively. A total of 983 chicks were produced. The average age at first egg (AFE) was 144.23 ± 0.52 days. The mean body weight at 16, 40 and 64 weeks was 1044.37 ± 4.46 g, 1643.00 ± 9.99 g and 1684.33 ± 9.87, respectively. The average egg number up to 64 weeks of age was 249.31 ± 1.97, while average egg weight at 28, 40 and 64 weeks was 45.03 ± 0.23 g, 52.95 ± 0.21 g and 53.46 ± 0.21, respectively.

Keywords: White Leghorn, Fertility, Hatchability, Egg Production, Body Weight.

GBP- 20

Hatching performance of Aravali chicken over generations

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"Aravali" is the native chicken breed of Gujarat. Hatching performance of Aravali chicken was studied over generations. Breeder stock of Aravali chicken was reared in cage system with standard managemental and health care practices. Birds were housed in individual cages. Artificial Insemination was practised. Hatching performance was recorded for three consecutive generations i.e. S_6, S_7 and S_8. Total 3579, 2344 and 2786 eggs were incubated in S_6, S_7 and S_8 generations, respectively. Fertility percentage was found to be 73.28, 72.82 and 94.04 in S_6, S_7 and S_8 generations, respectively. The number of chicks produced were 1435, 1508 and 2114 in S_6, S_7 and S_8 generations, respectively. Hatchability percentage on the basis of total egg set (TES) was 40.09, 64.33 and 75.99 in S_6, S_7 and S_8 generations, respectively. Hatchability percentage on the basis of fertile egg set (FES) was 54.70, 88.34 and 80.80 in S_6, S_7 and S_8 generations, respectively. Results showed increasing trend in hatchability percentage on the basis of total egg set (TES).

Keywords: Aravali, Fertility, Hatchability.

GBP-21

Hatching performance of Ankaleshwar chicken over generations

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"Ankaleshwar" is the native chicken breed of Gujarat. Hatching performance of Ankaleshwar chicken was studied over generations. Breeder stock of Ankaleshwar chicken was reared in cage system with standard managemental and health care practices. Birds were housed in individual cages. Artificial Insemination was practised. Hatching performance was recorded for five consecutive generations i.e. S_0, S_1, S_2, S_3 and S_4. Total 7614, 6299, 6269, 5935 and 5528 eggs were incubated in S_0, S_1, S_2, S_3 and S_4 generations, respectively. Fertility percentage was found to be 64.04, 71.85, 77.68 80.81 and 88.55 in S_0, S_1, S_2, S_3 and S_4 generations, respectively. The number of chicks produced were 3779, 3784, 3964, 4260 and 3879 in S_0, S_1, S_2, S_3 and S_4 generations, respectively. Hatchability percentage on the basis of total egg set (TES) was 49.63, 60.07, 63.23, 71.78 and 70.17 in S_0, S_1, S_2, S_3 and S_4 generations, respectively. Hatchability percentage on the basis of fertile egg set (FES) was 77.50. 83.61, 81.40, 88.82 and 79.24 in S_0, S_1, S_2, S_3 and S_4 generations, respectively. Results were indicative of increasing trend in fertility percentage and hatchability percentage on the basis of total egg set (TES) in Ankaleshwar breed of native chicken.

Keywords: Ankaleshwar, Fertility, Hatchability.

GPB-22

Evaluation of morphological traits using multivariate principal component analysis in native chicken of Himachal Pradesh

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The present study focused on identifying the principal components that determines body conformation and prediction of body weight from body measurements and orthogonal conformation traits using multivariate principal component analysis and stepwise regression analysis in Native chicken. Data was recorded on 180 birds at 40 weeks of age and analyzed by using SPSS software for descriptive statistics and multivariate analysis. A total of eleven morphometric traits viz. body weight, comb length, keel length, body length, back length, breast girth, radius ulna length, shank length, shank circumference, tail length and breast angle were recorded and statistical analysis revealed that mean

for corresponding traits as 1.63±0.03kg, 4.80±0.09cm, 9.88±0.11cm, 44.66±0.34cm, 20.12±0.25cm, 29.50±0.26cm, 8.41±0.09cm, 7.94±0.14cm, 4.31±0.06cm, 13.63±0.19cm and 50.13±0.39 degree respectively. Pearson coefficient of correlation between morphological traits was found to be positive and significant ($p<0.01$) and ranged from -0.028 (breast angle and tail length) to 0.679 (body weight and body length). Principal component analysis extracted three principal components which cumulatively explained 61.50% of the total variability in the original parameters. The first principal component accounted for greatest proportion of variance (39.874%) and had high loading on body weight (0.779), keel length (0.725), body length (0.685), shank length (0.628) and shank circumference (0.722). Thus these five biometric traits can be used for characterization of Native birds instead of eleven original morphological traits. Stepwise regression analysis revealed that body length may be used as key morphological parameter in selection criterion to improve the body weight in native chicken. Regression model based on principal components explained 80.4% of the variation in the body weight and proved to be more effective and useful than original biometric traits in predicting body weight of Native chicken.

Keywords: Body measurements, Correlation coefficient, Native chicken, Principal component analysis, Regression.

GBP-23

Hatching and production performance of Anand Synthetic White Leghorn

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The Anand Synthetic White Leghorn (ASWLH) strain was developed and released for better egg weight and evaluated for its hatching and production performance in the 24th generation (S_{24}). A total of 325 pullets were housed individually under standard managemental conditions and Artificial Insemination was practiced. Fertility recorded was 86.29%, while hatchability on total egg set (TES) and fertile egg set (FES) basis was 64.81% and 75.13%, respectively. A total of 1,534 chicks were produced. The average age at first egg (AFE) was 148.12 ± 0.55 days. The mean body weight at 16, 40 and 64 weeks was 1079.28 ± 5.05 g, 1641.69 ± 9.97 g and 1709.38 ± 12.31 g, respectively. The average egg number up to 64 weeks of age was 231.18 ± 2.04, while average egg weight at 28, 40 and 64 weeks was 50.45 ± 0.27 g, 55.82 ± 0.23 g and 57.02 ± 0.26 g, respectively.

Keywords: White Leghorn, Fertility, Hatchability, Egg Production, Body Weight.

GBP-24

Comparative growth performance of different chicken genotypes under intensive systems in Southern Rajasthan

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The present study was undertaken to evaluate the growth performance of six chicken genotypes under intensive system. Improved chicken genotypes viz. BN cross, Pratapdhan, RIR, Sonali, Chabro and Vanaraja were used for the present study. Chabro, Vanaraja and Sonali hatching eggs were procured from CPDO, Chandigarh, ICAR-DPR, Hyderabad and Indore respectively. Chicks of all genotypes used for the experiment were hatched out in single hatch. A total of four hundred eighty, pooled sex day-old chicks of six chicken germplasm were randomly divided into in to 6 genotypes groups in 4 replicates of 20 birds each. The birds were maintained under deep litter system following standard management practices during chick and grower phase. Birds were fed to meet nutrient requirement according to Bureau of Indian standard (2007) containing 20% Crude Protein and 2800 kcal/kg Metabolizable Energy for chick (0-8 weeks) and for grower phase 16% Crude Protein and 2600 kcal/kg Metabolizable Energy in feed. Significantly ($p<0.01$) higher body weight (2911 g) and body weight gain (2874 g) was observed in Vanaraja at 20 weeks of age. Significantly ($p<0.01$) higher feed intake was observed in Chabro breed (12343.61 g) and least intake was found in RIR breed (6837.34 g) up to 20 weeks of age among all breeds. Feed conversion ratio was significantly better in Vanaraja chicken (4.12) followed

by BN cross (4.18), Pratapdhan (4.51), Chabro (4.60), RIR (4.68) and Sonali (4.92), overall FCR was statistically non-significant between Vanaraja and BN. It may be concluded that Vanaraja genotype of chicken performed better in terms of body weight, body weight gain and overall FCR under intensive system in southern Rajasthan.

Keywords: Body weight gain, feed conversion ratio, Vanraja, Pratapdhan, Chabro and Sonali.

GBP-25

Identification and validation of miRNAs regulating transcellular calcium transport genes in chicken uterus

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The present investigation was carried out in White Leghorn layer chicken lines (IWK and IWI) to identify miRNAs regulating transcellular Ca_2^+ transport associated genes in egg shell gland during eggshell calcification. Uterine tissue samples were collected 18-hour post egg laying at 64 weeks of age in both the lines for the study. Custom sequencing of miRNA was carried out using Hiseq2000 Illumina platform. The total number of raw reads in the uterine tissue samples of IWI and IWK was found to be 19.8 and 26.8 million reads respectively. The miRNA sequences were evaluated using FastQC, Cutadapt, miRdeep2, EdgeR and TargetScan (Version 8.0). The total number of differentially expressed miRNAs identified in the uterine tissues of IWI (IU) and IWK (KU) was 218 and 180 respectively. The total number of novel miRNAs identified in the uterine tissues of IWI (IU) and IWK (KU) was 14 and 28 respectively. No common novel miRNAs were present between IU and KU. The total number of miRNAs that were involved in calcium metabolism pathway was identified to be 177. These 177 miRNAs were related to a total of 688 genes that were in turn involved in calcium homeostasis and of these 177 miRNAs a total of 9 highly differentially expressed miRNAs related to calcium homeostasis were identified. Among the 9 highly differentially expressed miRNAs, two miRNAs were selected based upon their interaction with genes involved in the calcium metabolic pathway for further validation by *in vitro* cell culture method. The primary shell gland cell culture was established using 72 weeks old birds and the expression profile of the CALB, CA2 and ITPR1 genes due to the treatment of upregulated miRNAs (miR92 and miR153) was studied. Both the miRNAs decreased the expression of the genes, whereas the miRNA153 was found to significantly decrease the expression of the genes (CALB, CA2, ITPR1) involved in calcium metabolic pathway.

GBP-26

Phenotypic and morphometric characterization of Kakkera desi chicken in Yadgiri District, Karnataka

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The present study was undertaken to characterize the phenotypic and morphometric traits of the Kakkera, a desi chicken variety found in Yadgiri district, Karnataka. Based on field surveys, it was observed that the non-descript chicken populations in this region are commonly referred to as "Kakkera." These birds have been traditionally reared for many years by specific community groups, primarily for game (fighting) purposes, while older birds are typically utilized for meat. The average flock size maintained by households ranges from 10 to 15 birds. Phenotypic observations revealed that the majority of birds exhibited brown plumage. Males possessed well-developed wattles, which were small and red in color, while most birds showed a pea-type comb, also red in color. The beak was generally small and yellow. The earlobes were predominantly red. Shank color varied among the population, with most birds showing yellow shanks, while some exhibited brown or black shanks. The morphometric assessment indicated that the average body weight of adult cocks and hens was 3.45 ± 0.05 kg and 2.12 ± 0.03 kg, respectively.

Keywords: Kakkera, phenotypic, plumage, flock, breed, characterize.

GBP-27

Phenotypic characterization of native chicken in plain region of Chhattisgarh

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Distinct breed population can be determined by phenotypic characterization with this objective the present research was conducted by taking 1027 native chicken having breeding tract in two districts namely Rajnandgaon and Mohla Manpur-Ambagarh Chowki of Chhattisgarh plain region. The parameters considered were phenotypic and morphometric characteristics, growth, productive, reproductive, egg quality traits and the carcass traits. The most frequent plumage colour of native chicken was black (30.64%) and black with white patches (28.4%). The most frequent plumage pattern observed was normal (89.59%) The skin colour was pink (88.82%). The ear lobe 52.14% balck and 35.53% white in colour. The common eye colour was black with grey ring (87.58%). Majority of the birds showed single type comb (96.29%). The frequency of medium red comb was 89.71%. The shank colour was found mostly yellow (96.29%). There was significant effect of district on all the traits expect in plumage pattern, comb type and comb colour. The effect of sex was non-significant in all the traits expect earlobe colour and comb colour. The adult body weight of male was 2124.20±18.89gm and in female 1979.13±17.51gm. The average age at sexual maturity was found to be 205.8±4.2days. The hatchability on total egg basis and fertile egg basis was 75.76±1.42 and 82.26±1.23, respectively. There was no significant difference ($p<0.05$) between two districts. The average annual egg production was 40eggs. The cream egg shell colour was most common (82.4%). The percent of albumen was recorded as 59.54±0.84 and yolk was 33.92±0.67. The Haugh unit score was observed as 83.15±0.80. The Dressing percentage of native chicken in female was found as 71.16 ± 0.93 in male was found as 68.25 ± 0.36. The Overall Meat bone ratio of native chicken was 4.3 ± 0.03. There was significant difference ($p<0.05$) between sex for dressing percentage except meat to bone ration.

GBP-28

Functional identification of minimal promoter regions of FASN and ACACA genes in chicken hepatocytes

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Promoter architecture plays a central role in determining the strength, tissue specificity, and regulatory responsiveness of gene expression. Identifying the minimal promoter region, the shortest DNA fragment capable of directing basal transcription is crucial for understanding transcriptional control and for developing efficient gene expression constructs for functional genomics, transgenesis, and metabolic engineering. In the present study, we aimed to identify the minimal promoter sequences of two key lipogenic genes, Fatty Acid Synthase (FASN) and Acetyl-CoA Carboxylase Alpha (ACACA), in chicken. Based on in silico prediction of transcription factor binding sites using GENE2PROMOTER and MATINSPECTOR, the 5′-upstream regions of 1221 bp (FASN) and 919 bp (ACACA) were selected and subdivided into two overlapping fragments each (FASN: 563 bp and 1221 bp; ACACA: 744 bp and 919 bp). All fragments were successfully amplified, cloned into the promoter-less pAcGFP1-1 reporter vector. Recombinant constructs were confirmed by colony PCR, restriction digestion, and sequencing. These plasmids were transfected into primary chicken embryo hepatocytes. Promoter functionality was evaluated through GFP expression at DNA (PCR), mRNA (qPCR), and protein (Western blot) levels. Both genes showed functional promoter activity. For FASN, the 1221 bp fragment exhibited an 8.73-fold higher GFP expression compared to the 563 bp fragment, indicating that additional transcription factor binding motifs enhance promoter performance. However, the smaller 563 bp fragment retained clear transcriptional activity, suggesting its suitability as a functional minimal promoter in vitro. For ACACA, both fragments displayed comparable activity,

with only a modest 2.21-fold increase in the larger fragment, indicating that essential regulatory elements are largely confined within the shorter region. In conclusion, this study provides the minimal promoter fragments of FASN and ACACA capable of driving basal transcription in hepatic cells. These minimal promoters provide valuable regulatory elements for designing liver-specific expression systems and for advancing functional studies on lipid metabolism and genetic manipulation strategies in poultry.

Keywords: Minimal promoter, FASN, ACACA, Lipogenesis, Reporter assay, Hepatocytes.

GBP-29

Molecular Characterization and Association of Growth Hormone Gene Polymorphisms with Growth and Biometrical Traits in Native Kuttanad Ducks of Kerala

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Indigenous ducks have the innate potential to emerge as a sustainable source of animal protein and rural livelihood in the coastal and wetland regions of the country. Recognising the scarcity of systematic genetic improvement efforts, a study was undertaken to identify genetic variability of the duck-growth hormone (*GH*) gene and its association with biometrical traits from hatch to 16 weeks of age at fortnightly intervals in 125 native Kuttanad ducks of Kerala. Pooled DNA sample sequencing of *GH* 227 bp fragment (exon 3 and partial intron 3) revealed a novel SNP at 190th position, A>G and further genotyping by HRM technique revealed three genotypes viz., AA, AG and GG. The GG genotype ducks had higher length of trunk with neck (LTN), length of shank (LS) and length of neck (LN) at 6th, 6thand 8th weeks of age, respectively in addition to higher chest girth (CG) from 10 to 16 weeks and greater body weight at 6, 14 and 16 weeks of age compared to AA and AG genotypes ($p<0.05$). The PCR-SSCP analysis of a *GH* 366 bp fragment (exon 5 and partial intron 4) revealed a novel SNP g.74G>A at the locus with two genotypes, GG and GA. The GG genotype ducks had higher estimates of LTN, length of breast bone (LBB), CG, LN and LS from 2-16, 2-10, 4-12, 2-6 and 4-16 weeks of age ($p<0.05$) than GA heterozygotes. The PCR-SSCP sequence analysis of *GH* intron 3 (355 bp) revealed two SNPs g.31 G>A and g.59 C>T with diplotypes (GC/GC and AT/AT) at the locus wherein GC/GC diplotype ducks had higher body weights and body measurements ($p<0.05$). Overall, the study demonstrates that polymorphisms in the duck *GH* gene are significantly associated with growth and conformation traits and can serve as potential candidate markers for early selection of superior ducks with enhanced growth potential and adaptable biometrics.

Poultry Nutrition: Oral Presentations

PNO-01

Assessing the impact of supplementing nano forms of zinc, manganese and copper in commercial broilers

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A research work was carried out to evaluate the effect of dietary supplementation of nano forms of zinc, manganese and copper on growth performance of broiler chicken. Nano particle source of zinc, manganese and copper were synthesized from feed grade zinc oxide, manganese sulphate and copper sulphate, respectively through physical method using planetary ball mill. A biological study was carried out for 35 days in 150 numbers of commercial broiler chicken and randomly distributed in 5 treatment groups *viz.,* T_1 (Inorganic 100 %), T_2 (Organic 100 %), T_3 (Nano 100 %), T_4 (Nano 50 %) and T_5 (Nano 25 %) comprising of 30 birds in each group. T_1, T_2 and T_3 groups were supplemented with zinc, manganese and copper at 80 ppm, 100 ppm and 12 ppm, respectively in feed. T_4 group was supplemented with zinc, manganese and copper at 40 ppm, 50 ppm and 6 ppm, respectively in feed. Whereas, T_5 group was supplemented with zinc, manganese and copper at 20 ppm, 25 ppm and 3 ppm, respectively in feed. The results revealed that body weight, cumulative body weight gain and feed intake of broiler chicken increased significantly ($p<0.01$) in the 50 % and 100 % nano Zn, Mn and Cu supplemented groups when compared to other groups without any significant change in FCR. Serum uric acid concentration was reduced significantly ($p<0.01$) in nano mineral supplemented groups. T_3 and T_4 groups were found to have higher serum manganese content when compared to other groups without significant change in zinc and copper levels. All treatment groups showed adequate immunity against Newcastle Disease virus and Infectious Bursal Disease virus. The birds supplemented with 100 % nano minerals (T_3) and 50 % nano minerals (T_4) exhibited significant ($p<0.05$) improvement in serum *superoxide dismutase* activity, tibia bone morphometry and total ash content of tibia. The mRNA expressions of metallothionein, manganese - *superoxide dismutase* and ceruloplasmin were upregulated in T_3 (100 % nano) and T_4 (50 % nano) groups revealing that the nano trace mineral supplementation had better bioavailability. Therefore, it is concluded that supplementation of nano forms of zinc, manganese and copper at 50 % requirement level is optimum to improve productivity and health in commercial broiler chicken.

Keywords: Nano zinc, manganese and copper, Broiler chicken, Growth performance, Bioavailability.

PNO-02

Effect of dietary inclusion of pure alpha-mono lauric acid on growth, anti-oxidant status, gut health and immune response in broiler chicken under hot climatic conditions

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A total of 250-day-old Cobb-400 broiler chicks were used in the experiment and randomly allocated into five treatment groups, each comprising 50 birds. Each group was further subdivided into 10 replicates with 5 chicks per replicate. A standard corn–soybean meal-based basal diet containing an antibiotic growth promoter (AGP) served as the control, while four experimental diets were prepared without AGP and supplemented with pure alpha-monolauric acid (α-MLA) at inclusion levels of 0.025%, 0.05%, 0.075%, and 0.1%. The inclusion of α-MLA in the diet didn't show any significant effect ($P>0.05$) on body weight gain, cumulative body weight, or feed intake during the pre-starter (0–14 days), starter (15–28 days), and finisher (29–35 days) phases, as well as over the entire experimental period. Similarly, feed conversion ratio did not differ significantly ($P>0.05$) among the treatment groups and remained comparable to that of the control. However, a significant difference ($P<0.05$) was observed in the activities of antioxidant enzymes, including glutathione peroxidase (GPx), superoxide dismutase (SOD), and lipid peroxidation (MDA), among the dietary treatments. The activity of glutathione reductase (GRx) remained unaffected ($P>0.05$) by the supplementation. Dietary inclusion of α-MLA significantly ($P<0.05$) influenced the cortisol, and birds in the α-MLA-supplemented groups exhibited significantly higher ($P<0.05$) humoral immune responses against Newcastle disease. No significant differences ($P>0.05$)

were observed among the control and supplemented groups with respect to duodenal villus height, crypt depth, or the villus height to crypt depth ratio. Dietary supplementation of α-MLA up to 0.1% did not influence growth performance or intestinal morphology in broiler chickens. However, it exerted a positive effect on antioxidant status, immune status and cortisol levels, indicating potential physiological benefits.

Keywords: alpha-monolauric acid.

PNO-03

Evaluation of essential oil-based microemulsion through water as a replacement of dietary antibiotic growth promoter in broiler

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The present study was designed to evaluate the effects of dietary supplementation with a microemulsion of essential oils (thyme, menthol, carvone, and carvacrol) administered via drinking water at a dosage of 0.160 mg/kg of live body weight per day. This supplementation was provided alongside an antibiotic growth promoter (AGP) at a rate of 250 g/ton of feed. The study aimed to assess the impact of these additives on growth performance, immunity and gut health in straight-run broiler chickens over a 42-day period. A total of 192 one-day-old Vencobb broiler chicks were randomly assigned to four experimental groups, with 48 chicks per group, each further divided into four replicates. The control group (T1) was fed a basal diet without any supplementation while the other three groups T2, T3 and T4, received the basal diet supplemented with 250g/ton Lincomycin), essential oil based micro emulsion (B+C) and essential oil based micro emulsion (B+C+D) respectively for 40 days. Throughout the 42-day experimental period, no significant differences in live body weight (LBW) were observed among the control and supplemented groups. However, during the pre-starter phase (0–12 days), the control and antibiotic-supplemented groups (T1 and T2) exhibited significantly higher LBW compared to the essential oil-supplemented groups (T3 and T4). The hemagglutination inhibition (HI) titer against Newcastle Disease Virus (NDV) at 42 days of age did not differ significantly among the treatment groups. However, significant differences were observed in villus height (VH), villus height-to-crypt depth ratio (VH:CD), and crypt depth among the supplemented groups. Conclusively, supplementing broiler diets with an EO-based microemulsion enhanced gut health compared to traditional antibiotic supplementation. These findings support the potential of EOs as effective, natural alternatives to AGPs in poultry production.

Keywords: broiler, essential oil based micro emulsion, growth performance, gut health, immunity.

PNO-04

Effect of feeding fermented toasted guar meal (FTGM) on the performance, nutrient retention, carcass traits, serum biochemical constituents, immune response and gut health of commercial broiler chicken

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A biological trial was conducted to evaluate the effects of varying levels of fermented toasted guar meal (FTGM) on performance, nutrient retention, carcass traits, serum biochemical parameters, immune response, and gut health in commercial male broiler chickens. A total of 300 day-old Vencobb 430Y chicks were randomly allotted to five dietary treatments with 12 replicates per treatment and five birds per replicate. The diets were iso-nitrogenous and iso-caloric, containing 0% toasted guar meal (control), 10% toasted guar meal (TGM 10), 15% toasted guar meal (TGM 15), 10% fermented toasted guar meal (FTGM 10), and 15% fermented toasted guar meal (FTGM 15). The results indicated that body weight gain (BWG) in 10% FTGM group was comparable to the control, while 15% FTGM produced significantly ($P<0.05$) higher BWG than 15% TGM. Feed intake was not significantly affected however, the 10% FTGM diet showed

better feed conversion ratio (FCR) (P<0.05) than the control. Carcass traits and nutrient retention (dry matter, crude protein, crude fibre, ether extract, and nitrogen-free extract) were unaffected (P>0.05) by FTGM inclusion. Gut morphometry revealed significantly (P<0.05) higher duodenal, jejunal, and ileal villus height (VH) and VH/crypt depth (CD) ratio in FTGM-fed groups compared to the control. Serum biochemical analysis showed higher (P<0.05) total protein in 10% FTGM birds, while triglycerides, total cholesterol, and VLDL were significantly (P<0.05) reduced in FTGM groups. Other parameters such as globulin, A/G ratio, HDL, and LDL remained unaffected. Furthermore, birds fed FTGM exhibited significantly (P<0.05) enhanced antibody titres against ND vaccine and improved cell-mediated immune (CMI) responses. It is concluded that inclusion of FTGM up to 15% in broiler diets improved growth performance, gut morphology, and immune competence without adverse effects.

Keywords: Guar meal, Body weight gain, Nutrient retention, Gut health.

PNO-05

Solid state fermentation - mediated improvement of deoiled rice bran as a functional feed ingredient for broiler diets

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The incorporation of non-conventional feed ingredients and agro-industrial by-products into poultry diets has become essential for reducing feed costs. Deoiled rice bran (DORB), a readily available by-product of the rice bran oil industry, is commonly included as an intermediate energy and protein source. However, its use is limited due to the presence of anti-nutritional factors such as phytates, crude fiber, hemagglutinins, lectins, and protease inhibitors. Increasing its inclusion level requires improving its nutritional value through physical, chemical, or biological treatment methods. Among these, microbial fermentation is a promising approach, as it enhances nutrient availability while reducing anti-nutritional components. The present study was aimed to evaluate the efficacy of solid-state fermentation (SSF) using one percent (v/w) *Saccharomyces cerevisiae* and *Aspergillus oryzae* in improving the nutritional quality of DORB. A completely randomized design with five treatments and three fermentation durations (24, 48, and 72 hours) was employed. The treatments included: unfermented DORB (T1/control), DORB fermented with *S. cerevisiae* (T2), *S. cerevisiae* + 5 % cane sugar (T3), *A. oryzae* (T4), and a mixed culture of both microbes (T5). Fermented samples were analyzed for dry matter yield, bulk density, proximate composition, amino acid profile, fatty acid composition, available phosphorus, and mycotoxin residues. Fermentation, particularly with *A. oryzae* and mixed cultures, significantly (P≤0.01) increased crude protein (up to 21.35%) and total essential amino acids (up to 16.70%), and altered fatty acid composition by increasing palmitoleic acid and saturated fatty acids. Dry matter content decreased (P≤0.01) by maximum of 13.5% after 72 hours of fermentation due to microbial utilization of substrates, while bulk density varied slightly among treatments. Mycotoxin levels showed a minor reduction, indicating possible microbial detoxification. These findings demonstrate that SSF is an effective strategy to enhance the nutritive value of DORB, making it a more sustainable and economical feed ingredient for poultry.

Keywords: Deoiled rice bran, Incorporation in poultry diet, Solid state fermentation.

PNO-06

Dietary replacement of soybean meal with fermented rapeseed meal on growth performance and economics of broiler production

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The experiment was conducted on 400-day-old Vencobb-430Y straight run broiler chicks randomly distributed into five treatment groups with 4 replicates having 20 chicks each for 42 days. The control group A received maize-soya basal diet.

The treatment groups B, C, D and E were offered diet containing inclusion levels of fermented rapeseed meal (FRSM) at 5%, 7.5%, 10% and 12.5%, respectively replacing soybean meal. All the diets were *iso-caloric* and *iso-nitrogenous*. It was observed that the biochemical parameters such as total protein, albumin, globulin, total cholesterol, triglycerides and antibody titers against New Castle Disease were statistically non-significant in all the treatment groups at 21st and 42nd days. Histopathological examination of liver samples from broiler birds in groups A, B, C and D revealed no appreciable changes and found to be apparently normal. However, liver sections from group E (fed 12.5% FRSM) showed mild to moderate, focal to diffuse degenerative changes in hepatocytes, along with multifocal mononuclear cell infiltration in the hepatic parenchyma. Nitrogen retention was significantly better up to 10% inclusion level of FRSM compared to inclusion of 12.5% FRSM. The nitrogen retention (g/d) and nitrogen retention (%) were significantly ($P<0.05$) decreased in birds from group E fed 12.5% FRSM as compared to all other groups. There were non-significant differences for dry matter digestibility, ether extract digestibility and crude fibre digestibility percent among all the treatment groups. At the end of 6th week, the eviscerated yield (%), giblet (%), abdominal fat percentage as well as the liver, heart and spleen percent were non-significant among all treatment groups.Thus, it could be concluded that the inclusion of 10% FRSM replacing soybean meal in the broilers diet do not have any adverse effect on biochemical parameters, immune response, histopathology of liver, nutrient digestibility and carcass traits in commercial broiler production.

Keywords: Fermented rapeseed meal, Rapeseed meal, Biochemical, Immune response, Liver histopathology, Nutrient digestibility, Carcass traits, Broilers.

PNO-07

Use of protein rich unconventional feed on growth performance and cost effectiveness of native chicken

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Native chicken are the precious natural resources for every country due to their compliance in extreme climatic conditions and resistance against infectious diseases. They perform well with fibre rich diets and have better feed conversion ratio in low energy and low protein diets through unconventional resources. In this connection, a study was conducted to assess the effect of protein rich waste from pulse processing industry on weight gain, feed intake and feed efficiency of native chicken for a period of eight weeks during growing period. One sixty growing desi birds were randomly divided into five treatment groups and each treatment group had four replicates of 8 birds each, fed with 0, 10%, 20%, 30% and 40% protein rich pulse processing waste in iso-calorie and iso-nitrogenous diets. All birds were fed weighed quantity of complete feed contain protein rich pulse processing waste with free access of drinking water and reared with standard manage mental practices. The feed intake was measured daily and body weight was obtained in weekly interval. The feed efficiency was calculated and the economics was also worked out. The weight gain, feed intake and feed efficiency were not significantly differed among the treatment groups. A non-significant difference was also observed in the cumulative weekly weight gain, feed intake and feed efficiency among the pulse processing waste fed groups. The quality characteristics of meat were similar among the treatment groups. The feed cost per kg weight gain was significantly ($p<0.01$) lowered from 17 to 26%, while the supplementation of pulse processing waste increased from 20 to 40% when compared to control. It was concluded that the protein rich pulse processing waste at 40% inclusion level reduced the feed cost per kg weight gain to the maximum extent.

Keywords: Native chicken, Unconventional feed, Growth performance, Cost effectiveness

PNO-08

Effect of *in ovo* supplementation of glucose on post hatch performance and expression profiling of CDX gene in coloured broiler

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The present research work was carried out to study the effect of in ovo supplementation of glucose on post hatch performance and expression profiling of CDX gene in coloured broiler in which fertile eggs were distributed in *in-ovo* glucose, sham control

and un-injected control and chicks hatched from them are further divided in to immediate feed, 24 and 36 hr fasting groups and response criteria were measured. The percent hatchability reported significantly higher (P<0.05) in sham and un-injected control group compared to *in-ovo* glucose supplemented group. Irrespective of period of fasting, the biweekly body weight, weight gain, feed conversion ratio and EPEF factor were significantly better (P<0.05) in *in-ovo* fed groups compare to sham and un-injected control group, while irrespective of treatments it was reported significantly better in (P<0.05) immediately fed groups than 24 and 36 hr fasting groups. At 24 and 36 hr post hatch, yolk sac weight was found significantly lower (P>0.05) in *in-ovo* and immediately fed groups compare to other control and fasting groups. GIT developmental (CDX) genes expression increased in i*n-ovo* glucose supplemented than sham and un-injected control groups. Net return and Benefit cost ratio reported higher in *in-ovo* and immediate fed group while lower in 36 hrs fasting control groups. In conclusion, irrespective of period of fasting *in-ovo* glucose supplemented chicks had better production performance and the economy than the sham and un-injected control chicks, while *in-ovo* glucose supplemented with 24 and 36 hr fasted chicks had comparable result with that of un-injected control and immediately fed chicks.

Keywords: In ovo supplementation, Glucose, Post hatch performance, Coloured broiler.

PNO-09

Integrative in-silico and molecular insights into boron-mediated modulation of oxidative, endocrine, and bone health genes in layer hens

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Boron plays a pivotal role in maintaining redox balance, hormonal regulation, and skeletal health key determinants of productivity and longevity in layer hens. The present study aimed to predict potential boron-binding domains in critical proteins governing oxidative defense (SOD1, SOD2), inflammation (NFKβ-2), endocrine modulation (Cortisol receptor and Thyroid receptor), and bone metabolism (Alkaline phosphatase and Osteoprotegerin) using integrative in silico and molecular approaches. Protein sequences were retrieved from the UniProt database, and corresponding AlphaFold 3D models were analyzed using fpocket and CASTp to identify ligand-binding cavities. Docking simulations were performed in AutoDockVina using boric acid as the ligand to predict boron-protein interactions. Amino acid residues with known affinity for boron coordination (Ser, Thr, His, Lys, Asp, Glu, Tyr) were screened, with focus on metal-binding, catalytic or receptor-ligand domains. Distinct boron-binding patterns were observed across target proteins as follows: SOD1 and SOD2: High-affinity binding was predicted near the metal cofactor-binding domain containing His and Asp residues, suggesting boron-mediated stabilization of the catalytic structure and enhancement of superoxide dismutation activity. NFKβ-2: Docking localized boron near the Rel homology domain (RHD), rich in Ser/Thr residues, implying attenuation of pro-inflammatory transcriptional activation via conformational modulation. Cortisol receptor: Predicted binding occurred within the ligand-binding domain (LBD)adjacent to hydrophilic residues (Lys, Glu, Thr), indicating potential alteration of glucocorticoid affinity and stress response. Thyroid receptor: Moderate binding affinity was observed in the hormone-binding cavity adjacent to the DNA-binding interface, enriched in Ser/Thr residues, suggesting fine-tuning of thyroid hormone signaling and metabolic regulation. Alkaline Phosphatase (ALP): Strong boron interactions were detected near the active-site pocket containing Ser and His residues, consistent with potential enhancement of enzymatic activity and mineralization. Osteoprotegerin (OPG): Boron docked near the TNF receptor-like cysteine-rich domain, involving Lys and Asp residues, predicting modulation of RANKL binding and inhibition of osteoclastic bone resorption. Boron exhibits domain-specific interactions with proteins integral to oxidative defense, endocrine regulation, and bone remodeling in layer hens. The most responsive domains were the metal-binding grooves of SODs, active site of ALP, and ligand-binding interface of OPG, collectively enhancing antioxidant protection and osteogenic signaling while modulating stress and inflammation. These integrative in silico and molecular insights establish a mechanistic foundation for the development of boron-enriched micronutrient formulations aimed at improving skeletal strength, metabolic stability, and laying performance in hens.

Keywords: Boron, Layers, Bone.

PNO-10

Effect of *in ovo* feeding of guanidinoacetic acid at graded levels in broilers on cloacal temperature, growth performance, economics and immune competence traits during heat stress

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Increasing feed costs and rising ambient temperatures driven by climate change cause major production and economic losses in broiler farming. This study evaluated the effect of *in ovo* feeding of guanidinoacetic acid (GAA) at graded levels on growth performance, FCR, economics and immunity of broilers under heat stress. 588 fertile CARIBRO Vishal broiler breeder eggs were incubated and divided on 18th day of incubation into seven groups: T1(un-injected control), T2 (sham control) injected with 0.5 ml distilled water, T3 to T7 injected with 0.5 ml w/v solutions containing 0.02%, 0.04%, 0.06%, 0.08%, and 0.10% GAA, respectively. After hatching, 315 straight run chicks were divided into seven subgroups (three replicates of 15 birds each) and reared under deep litter system. Basal diet was fed as per BIS, 2007 (starter till 3 weeks: 22% CP, 3100 kcal/kg ME and finisher till 6 weeks of age: 20% CP, 3200 kcal/kg ME). Average environmental conditions: 0-3 weeks (30.75°C, 81% RH, THI 84.82), 3-6 weeks (29.94°C, 89.33% RH, THI 84.22) and 0-6 weeks (30.51°C, 85.16% RH and THI 84.52) indicated heat stress. There was no significant difference in the cloacal temperature throughout the experiment among the different treatment groups. FCR was significantly better (P=0.007) and feed cost per kg live weight gain was significantly lower (P=0.006) in T5 birds compared to T1 during day old to 3 weeks of growth phase. *In ovo* GAA supplementation significantly elicited HA (log2) (P<0.0001) and IgM (P=0.006) titre against 1% goat red blood cells and apparently increased serum IgG concentration (P=0.029) and foot web index in T5 birds compared to T1. Thus, *in ovo* feeding of GAA at 0.06% resulted in significantly better FCR (0-3weeks), reduced feed cost (day old to 3 weeks) and enhanced immunity in heat-stressed broilers offering an economical and practical nutritional strategy to mitigate climate-induced thermal stress.

Keywords: *In ovo* feeding, Guanidinoacetic acid, Broiler, Immunity, Heat stress, Feed cost.

PNO-11

Effect of feeding Rice Distiller's Dried Grains with Solubles (RDDGS) at different dietary levels on performance of commercial broiler chicken

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Rice Distiller's Dried Grains with Solubles (RDDGS), a by-product of ethanol manufacturing, is utilized as an alternate protein source in poultry diets. The current investigation was carried out to examine the effect of feeding different dietary levels of RDDGS on performance of commercial broiler chicken. The experiment was conducted for a period of six weeks. Total 144 straight-run day-old commercial broiler chicks were randomly distributed to 6 treatments. Each treatment group consisted of 4 replicates and in each replicate, 6 chicks were there, leading to 24 chicks per treatment. The experimental diets consisted of control diet (T_1) without the inclusion of RDDGS and the remaining treatments i.e., T_2 to T_6, in which basal diet was included with the RDDGS @ 5%, 10%, 15%, 20% and 25%, respectively. The body weight (2418.25 g) of birds fed with T_1 diet was significantly ($p<0.05$) higher than all the treatment groups. Birds fed with T_2 diet had significantly ($p<0.05$) higher BWG (2162.65 g) than those fed with T_3, T_4, T_5 and T_6 diet, but was significantly ($p<0.05$) lower than T_1 (2374.34 g) diet at 6th week of age. There were no significant differences in total feed consumption from 0-6 weeks of age between birds fed with T_3, T_4, T_5 and T_6 diets. However, the highest total feed consumption (4014.14 g) was observed in T_1 followed by T_2, T_5, T_4, T_3 and T_6 diets at 6th week of age. Overall Feed Conversion Ratio (FCR) was significantly ($p<0.05$) better in T_2 (1.47) and T_3 (1.62) treatment groups as compared to T_1, T_4, T_5 and T_6 diet. The highest Return Over Feed Cost (Rs. / bird) was obtained in the birds fed with T_2 (117.26) diet as compared to other treatment groups. Hence, it can be concluded that 5% level of RDDGS in broiler diet can be more economical and used as alternative of protein source than 10%, 15%, 20% and 25% levels of RDDGS in broiler diet.

Keywords: Commercial broiler chicken, Growth performance, Protein source, RDDGS.

PNO-12

Impact of liquorice root powder supplementation on the performance, gut pathogens and prevalence of AMR genes in broiler chickens

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Antibiotics have historically been widely used in broiler chicken production to promote growth, prevent disease, and improve feed efficiency, but this practice has contributed to the rapid rise of antimicrobial resistance (AMR) in poultry. Consequently, poultry researchers and producers have prioritized the evaluation of natural alternatives that can maintain productivity and animal health without exacerbating AMR risks. This study evaluated the efficacy of liquorice root powder as a natural alternative to antibiotic growth promoters for enhancing performance and reducing gut pathogens and decreasing the prevalence of antimicrobial resistance (AMR) in broiler chickens. A total of 456 day-old Cobb broilers were randomly assigned to three dietary treatments: basal diet (T1) (control), virginiamycin (40 g/ton) (T2), and liquorice root powder (400 g/ton) (T3), reared for 42 days on deep litter system. The T3 group showed improved ($P<0.05$) mortality adjusted feed conversion ratio and exhibited higher livability compared to both control and antibiotic groups. Cell-mediated immunity (PHA-P response), antioxidant enzymes (glutathione peroxidase and superoxide dismutase), and liver enzyme profile (ALT, AST) were maintained without any adverse effect on the body. Based on the conventional plate count method there was a significant reduction ($P<0.05$) in faecal *Escherichia coli* count and caecal total bacterial count in T3 group. Quantitative evaluation of *E. coli* in the caecal content showed similar ($P>0.05$) load by Real-Time qPCR method in between the treatment groups. PCR assays revealed that there was lower prevalence of AMR genes in the T3 group compared to the T1 and T2 groups. Economic analysis confirmed that liquorice root powder additive was beneficial than the antibiotic. Thus our findings demonstrate liquorice root powder as an effective, safe, and economical alternative to antibiotics in broiler feed, supporting enhanced productivity, reducing gut pathogen load and reduced risk of AMR dissemination in poultry production.

Keywords: Alternative to antibiotic growth promoter, FCR, Livability, Gut pathogen, AMR.

PNO-13

Estimation of standardized Ileal digestibility coefficient of calcium in major calcium sources

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This study aimed to determine the standardized ileal digestibility (SID) of calcium (Ca) in major Ca sources using the direct method. This study comprised of eight experimental diets: a Ca and Phosphorus (P)-free diet and seven Ca source diets each containing stone grit, limestone powder, shell grit, marble chips, monocalcium phosphate (MCP), dicalcium phosphate (DCP), tricalcium phosphate (TCP) as the sole sources of Ca. These diets were formulated to provide 9.5 g/kg of Ca in all the diets. Monosodium phosphate was added to provide phosphorus at the level of 4.75g/kg in the Ca source diets without phosphorus. Titanium dioxide was added to the diets as an indicator. Ca–P-free diet was used to measure the ileal endogenous calcium loss. Birds were fed standard pre-starter (1-14d) and starter (15-20d) diets till the start of the trial. 400 male broilers were individually weighed and randomly assigned to eight treatments with an average body weight (951.2g±34.7g) on day 21. All the treatment has ten replicates of five birds per replicate. These birds were fed with experimental diets from day 21 to 24. On day 24, the birds were euthanized, and ileal digesta samples were collected. The standardized ileal Ca digestibility of stone grit, limestone powder, shell grit, marble chips, MCP, DCP and TCP were found to be 0.53,0.51,0.46, 0.48,0.60,0.47 and 0.29, respectively. It is important to consider the specific types of Ca Source and their digestibility in precise diet formulation, because the digestibility of Ca varies between different Ca Sources.

Keywords: Broiler, Calcium, Phosphorus, Ileal digestibility.

PNO-14

Comparative expression of HSP70 and HSP90 genes reveals breed-specific thermotolerance mechanisms in indigenous and commercial chickens under acute heat stress

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The experiment was conducted during November 2023 at Madras Veterinary College, Chennai. Heat stress was a major constraint in poultry production, particularly in tropical regions, as it impaired growth, feed efficiency, immunity, and overall performance. This study evaluated the expression of HSP70 and HSP90 genes in four chicken genotypes namely, indigenous *Siruvidai*, TANUVAS Aseel, White Leghorn, and commercial broiler subjected to acute heat stress (38 ± 1 °C for 1 h). Heat shock proteins (HSPs) were essential molecular chaperones that protected cells by stabilizing misfolded proteins and preventing aggregation under stress. Liver tissues were collected from six heat-treated and three control birds per group. Total RNA was extracted, reverse transcribed to cDNA, and analyzed by quantitative real-time PCR using β-actin as a reference gene. Relative expression was calculated using the ΔΔCt method. Results showed that HSP70 expression was upregulated in indigenous *Siruvidai* (1.42-fold), TANUVAS Aseel (1.19-fold), and White Leghorn (7.57-fold), but downregulated in broilers (0.40-fold) compared to their respective controls. In contrast, HSP90 was strongly upregulated in indigenous *Siruvidai* (4.76-fold), but downregulated in TANUVAS Aseel (0.63-fold), White Leghorn (0.17-fold), and broilers (0.18-fold). These findings suggested that indigenous breeds exhibited a balanced and adaptive thermotolerance strategy with moderate HSP induction, whereas White Leghorns mount an exaggerated HSP70 response and broilers showed a blunted chaperone response, reflecting their thermal susceptibility. Overall, the results highlighted the genetic potential of native breeds for heat resilience and supported the use of HSP70 and HSP90 expression profiles as molecular markers in breeding programs to enhance thermotolerance in commercial poultry.

Keywords: Heat stress, HSP70, HSP90, Siruvidai, Tanuvas Aseel, White Leghorn, Broiler chicken, Thermotolerance.

PNO-15

Feeding value of stone grit as an alternate calcium source in Namakkal Quail-1

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A study was conducted to evaluate the effect of replacing calcite with stone grit in the diet of Namakkal Quail-1 on production performance, carcass traits, bone health, cost of production, and mineral retention. A total of 360 day-old chicks were randomly allotted to five dietary treatments T1: 100% calcite (control), T2: 100% stone grit (4 mm), T3: 100% stone grit (2 mm), T4: 50% calcite + 50% stone grit (4 mm), and T5: 50% calcite + 50% stone grit (2 mm) with six replicates of 12 birds each in a completely randomized design. Production parameters were recorded for four weeks, followed by carcass evaluation, serum biochemical analysis, and a metabolic trial for mineral retention. Birds in T2 and T3 showed significantly higher ($P \leq 0.01$) body weight and weight gain at weeks 2, 3, and 4 compared to T4 and T5, but did not differ from T1. Feed intake was significantly higher ($P \leq 0.05$) in T2 and T3 than in T4 and T5, with T2 exceeding T3. Bone parameters, including tibia length, dry weight, and mineral density, were significantly higher ($P \leq 0.05$) in T2 and T3 compared to T4 and T5, while tibia ash, calcium, and phosphorus were highest ($P \leq 0.01$) in T5. No significant differences ($P \geq 0.05$) were observed among treatments for carcass traits, serum calcium, phosphorus, alkaline phosphatase, feed efficiency, or mineral retention. The

results indicate that calcite can be completely replaced with 2 mm stone grit in starter mash and 4 mm stone grit in finisher mash of Japanese quails without adverse effects on production performance, bone health, or carcass yield.

Key words: Namakkal quail, stone grit, calcium stone.

PNO-16

Effect of dietary microbial phytase supplementation on the performance, bone status and nutrient retention of broilers fed with inorganic phosphate-free diet

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A study was conducted to evaluate the efficacy of microbial phytase supplementation in broiler chickens fed an inorganic phosphate-free diet and its impact on growth, bone mineralization, nutrient retention, and economic efficiency. Six-week feeding trial was conducted with 300 straight-run, day-old commercial broiler chicks of the Cobb-430Y strain. The chicks were randomly divided into five treatment groups: A, B, C, D, and E, with three replicates of each. Group A was the Positive Control, fed as per nutrient requirements of strain in broiler prestarter (BPS), broiler starter (BS), and broiler finisher (BF). Group B was the Negative Control (NC), with reduced levels of calcium (0.60%, 0.58%, and 0.58%) and Total Phosphorus (TP) (0.42%, 0.43%, and 0.37%) in the BPS, BS, and BF phases, respectively. Groups C, D, and E were offered the NC diet with supplementation of microbial phytase (Natuphos® E 10000 FTU/g) at 1000, 1000, and 1000 FTU for group C, 2000, 2000, and 1500 FTU for group D, and 3000, 3000, and 2000 FTU/kg for group E, respectively, in BPS, BS and BF diets. The overall study revealed that microbial phytase supplementation at 2000, in BPS, BS, and 1500 FTU/kg BF diet with low Ca and TP significantly ($P \leq 0.05$) improved BW, BWG, FC, and reduced FCR, equivalent to the PC. Tibia mineralization (ash, Ca, and P), however, tibia breaking strength was unaffected. Moreover, the retention of nutrients such as Ca and P significantly ($P \leq 0.05$) improved with microbial phytase supplementation compared to NC. It can be concluded that theaddition of microbial phytase (2000, 2000, 1500 FTU/kg) to a low-Ca and inorganic phosphate-free diet significantly enhanced growth performance, tibia mineralization, nutrient retention and found to be cost-effective.

Keywords: Microbial phytase, inorganic phosphate-free diet, broiler.

PNO-17

Effect of dietary supplementation of bamboo (*Bambusa tulda)* leaf powder on the performance of broiler chickens

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A total of 144 day-old straight run broiler chicks (Cobb 430Y) having uniform body weights were utilized to assess the effect of supplementation of bamboo (*Bambusa tulda*) leaf powder on productive performance of broiler chickens. The chicks were divided into 4 different groups with 36 chicks each, which were further divided into 3 replicates with 12 chicks each. The chicks were kept in deep litter system under standard management and were fed with *iso*-caloric and *iso*-nitrogenous basal diet without any bamboo leaf powder (T_0) and basal diets with bamboo leaf powder @ 0.25 (T_1), 0.50 (T_2) and 0.75% (T_3) respectively up to 42 days of age. The results of indicated that, total feed consumption of broiler chickens up to 6th week of age did not show any significant ($P<0.05$) difference among different groups, however the final body weight at 6th week was significantly ($P<0.05$) higher in T_3followed by T_2, T_1 and T_0. The final feed conversion ratio (FCR) at 6th week of age were found to be 1.69, 1.75, 1.80 and 1.84 in T_3, T_2, T_1 and T_0 groups respectively. The BPEI values were observed to be 120.03, 120.79, 128.97, and 137.92 for T_0, T_1, T_2, and T_3 groups, respectively. The T_3

group demonstrated the highest BPEI, followed by T_2, T_1, and T_0 groups. The gross profit per broiler was ₹3.56, ₹10.35, ₹16.94, and ₹24.02 for T_0, T_1, T_2, and T_3 groups, respectively. The cost of production was found to be highest in T_3 group and was lowest in T_0group.Therefore, the highest gross profit was observed in the T_3 group, followed by T_2, T_1, and T_0 groups. The dressing percentage (71.60±0.49), breast (23.40±0.10) and thigh yields (11.76±0.21) were significantly ($P<0.05$) higher in T_3group than other groups. From the above study it may concluded that supplementation of bamboo leaf powder in feed resulted in improved weekly body weight gain and feed conversion ratio and thereby enhanced gross profit per bird and could be recommended in broiler feed @ 0.75%.

Key words: bamboo, broiler chickens, body weight.

PNO-18

Effect of Rice-Based Distiller Dried Grain Solubles (RDDGS) with or without enzyme supplementation on production performance of commercial layer chicken

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The objective of this study was to evaluate the effect of rice-based distiller dried grain solubles (RDDGS) with or without enzyme Supplementation on daily percent hen day egg production, feed intake, feed conversion ratio (feed intake/ egg mass), egg quality (shell thickness and strength, yolk colour, yolk index) and Total cholesterol. Two hundred forty commercial layer chickens at 26 weeks age were randomly allotted to 10 treatments with 6 replicates and 4 layers in each replicate. The birds were raised in cage system under uniform management. A standard layer ration (CP 18%, ME 2600 kcal/kg diet) was offered to birds. The test compound, RDDGS was supplemented at different levels (0, 5, 10, 15 and 20%) with or without Cocktail enzyme supplementation @250gm/ton of feed. Birds were adapted to respective treatment diets for a week (26th week) before the commencement of the actual data collection. The feed and water were provided *adlib* during the entire experimental period (4 periods of each 28 days from 27 to 42 weeks). The results revealed that the egg production was significantly higher ($P<0.05$) in 15% RDDGS with enzyme supplemented group when compared to control group. The feed intake was significantly ($P<0.05$) influenced by RDDGS with or without enzyme supplemented groups compared to control. The best feed conversion ratio (feed intake/ egg mass) 1.942 was observed in 15% RDDGS without enzyme supplemented groups. The overall egg weight and egg mass was significantly ($P<0.05$) higher in 15% RDDGS with enzyme supplemented diets. It was observed that in Period-P3 (35-38wks), Period-P4 (39-42wks) and over all period (27-42wks) there was significant ($P<0.05$) difference in yolk index among different levels of treatment fed groups. Yolk colour was significantly higher ($P<0.05$) in RDDGS with enzyme (15, 10 and 5%) supplemented groups compared to other treatments. The shell thickness and shell strength showed a significant ($P<0.05$) difference in fourth (39-42wks) period and shell percentage during the third period (35-38wks). A lower serum cholesterol level was noticed in 15% RDDGS with enzyme supplemented groups.

Keywords: Rice based distiller dried grain soluble, egg Production, Feed conversion ratio, egg weight, shell breaking strength, Haugh unit, yolk index and Total protein.

PNO-19

Evaluation of *Saccharomyces cerevisiae* based postbiotic on growth performance, immunity and gut health in broiler chickens

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The present study was conducted to evaluate the effects of dietary supplementation of *Saccharomyces cerevisiae* based postbiotic on growth performance, immune response, gut morphology and gut microbial profile of broiler chickens. A total of 144-day-old Vencobb-400F chicks were randomly assigned to three dietary treatments: a basal diet (control), basal diet + 500 mg postbiotic/kg (PB-500) and basal diet + 1000 mg postbiotic/kg (PB-1000), with 8 replicates of 6 birds

each, for a period of 35 days. Dietary supplementation with 1000 mg postbiotic/kg diet significantly ($P < 0.05$) improved body weight gain and reduced feed conversion ratio compared to control, indicating enhanced growth performance and feed efficiency. Antibody titres against Newcastle Disease virus were significantly ($P < 0.05$) higher in PB-1000 birds, reflecting improved humoral immunity, while PB-500 showed intermediate values. Caecal microbial analysis revealed that postbiotic supplementation significantly ($P < 0.05$) reduced total bacterial and *Escherichia coli* counts and increased *Lactobacillus* counts compared to control, demonstrating better microbial balance. Gut histomorphometric evaluation showed a significant ($P < 0.05$) increase in villus width in the duodenum and villus height to crypt depth ratio in the ileum of postbiotic fed birds, suggesting improved intestinal absorptive surface and gut integrity. Overall dietary supplementation with *S. cerevisiae* based postbiotics, particularly at 1000 mg postbiotic/kg basal diet, significantly improved growth performance, immune response and intestinal health of broiler chickens, highlighting their potential as a safe and effective growth promoter.

Keywords: Postbiotics, *Saccharomyces cerevisiae,* chickens.

PNO-20

Effect of supplementing feed emulsifier on the digestibility of energy and performance of broiler chicken fed sub-optimal levels of metabolizable energy

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A study was conducted to evaluate the efficacy of supplementing graded concentrations of a commercial feed emulsifier on the growth performance, carcass characteristics, and ileal energy digestibility of broiler chickens fed diets containing sub-optimal levels of metabolizable energy (ME). A total of 1,250 day-old male Cobb-430 broiler chicks were randomly allotted to five dietary treatments with ten replicates of twenty-five birds each. The control diet (CD) was formulated to meet the recommended nutrient requirements, whereas a basal diet (BD) was prepared with 0.42 MJ/kg lower ME than the control. The BD was supplemented with a commercial feed emulsifier containing lyso-phosphatidylcholine (5%) and phosphatidylcholine (5%) at four graded concentrations: 0, 100, 200, and 300 g/ton. All diets were maize–soybean meal-based and were fed ad libitum from day 1 to 42 days of age. The performance data revealed a linear ($P = 0.056$) improvement in feed efficiency (FE) with increasing inclusion levels of the feed emulsifier. Birds fed the BD containing 300 g/ton of emulsifier showed FE comparable to that of the control group, indicating partial recovery of performance despite reduced dietary energy. Breast meat weight was significantly reduced ($P < 0.05$) in birds fed the unsupplemented low-energy diet, while emulsifier supplementation ameliorated this reduction. Furthermore, ileal digestibility of energy improved markedly ($P < 0.05$) in groups supplemented with 100 or 200 g/ton of emulsifier compared to the control group, suggesting enhanced utilization of dietary fat and energy. In conclusion, inclusion of the feed emulsifier at 300 g/ton in a diet reduced by 0.42 MJ/kg ME can maintain feed efficiency and carcass yield comparable to an energy-adequate diet. The beneficial effects are likely attributed to improved emulsification and increased ileal digestibility of dietary energy.

Keywords: Broiler chicken, Feed emulsifier, Metabolizable energy, Growth performance, Carcass traits, Ileal digestibility, Energy utilization.

PNO-21

Comparative study of supplementation of essential oil and coated sodium butyrate for gut health in commercial laying hens

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An experiment was conducted to investigate the effects of essential oil and coated sodium butyrate supplementation on production performance, egg quality, immunological status, gut health and serum biochemical parameters in laying hens during late laying phase. A total of 192 BV-300 white leghorn layers (67 wk old) were randomly allotted to 4 treatments on the basis of laying performance. Each treatment had 6 replicates with 8 birds each (48 birds per treatment). Dietary treatments were basal diet supplemented with 0 (T1), thymol (@50ml/ton) (T2), menthol (@50ml/ton) (T3), and 750

(T4) mg/kg coated sodium butyrate. Feed conversion ratio per dozen of eggs, hen day egg production and egg shell thickness were found to be better (P<0.05) in group T4 receiving 750 mg/kg coated sodium butyrate. The egg quality parameters like egg surface area, haugh unit and yolk colour score showed significant (P<0.05) rise in coated sodium butyrate treated groups than the control group while all other parameters like egg weight, egg shape index, albumen index and egg shell weight did not show any significant difference. Humoral immune response against new castle disease was more (P<0.001) in T2 and T3 group followed by T4 than the control group. The total viable count of caecal content was non-significant (P>0.05) whereas *E. coli* count was observed maximum in control group. The significant difference (P<0.001) was observed in villi height and villi width of jejunum whereas group supplemented with 750 mg/kg coated sodium butyrate found to be highest (P<0.001) villi height and crypt depth in ileum. Serum protein level was significantly (P<0.05) highest in all the treatment groups compared to control group (T1) whereas serum cholesterol level was significantly (P<0.05) raised in T4 group compared to all other groups. Serum triglyceride value was non-significant (P>0.05) in all experimental groups. In conclusion, dietary supplementation of coated sodium butyrate @750mg/kg improved egg production, egg quality, gut health and immunity in laying hens.

Keywords: Coated sodium butyrate, egg quality, essential oil, gut health, laying hens.

PNO-22

Effect of *in ovo* supplementation of nano dicalcium phosphate and vitamin D_3 on the production performance and metabolomic profile of commercial broilers

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Modern broiler lines are intensively selected for higher growth rate and increased size of muscles, which leads to an enhanced requirement of chicken embryos for various nutrients. Growth and development of bone are mainly programmed during embryogenesis. Several approaches have been tried to find remedies for bone related conditions due to the rapid growth rate of broilers. Hence, an *in ovo* trial was conducted to investigate the effect of *in ovo* infusion of nano dicalcium phosphate (nano-DCP) along with Vitamin D3 on the production performance and serum metabolomic profile of commercial broiler chicken up to five weeks of age. Nano dicalcium phosphate was prepared by physical ball milling method and found to have particle size of 10-20 nm under TEM and 62.6 ± 3.4 nm by particle size analyzer. A total of 600 embryonated eggs with uniform weight were randomly divided into six treatment groups each with four replicates of 25 eggs each. On 18th day of incubation, the embryonated eggs were injected with one of the following treatment solutions containing nano DCP at a level of 25 (T3), 50 (T4), 100 (T5) and 200 ppm (T6) along with 100 IU of Vitamin D3 into intra amniotic fluid by following aseptic precautions along with injected (0.5 ml of normal saline) and non-injected control. The incubation was continued up to 21 days. On day of hatch, 384 viable healthy chicks were sorted out as per treatment at the rate of 16 chicks per replicate. Standard managemental practices were followed up to 35 days of age. Data on production parameters and tibial osteomorphometry, tibial mineral profile, serum metabolomic profiling, relative expression of Bone Morphogenetic Protein (BMP 3) and Matrix Metallopeptidase (MMP 9) were collected and statically analyzed. The results revealed that the per cent hatchability was significantly (p<0.05) affected by different *in ovo* treatments with the lowest (64 per cent) in 200 ppm nano DCP and highest (74 per cent) in 25 and 50 ppm injected groups. The day-old broiler chick weight was significantly (p<0.01) increased from 38.18 to 38.48 g by *in ovo* nano DCP treatments. The marketing body weight and weight gain at fifth week was significantly (p<0.05) increased 2000.54 to 2060.46 g and 1961.98 to 2021.94 g respectively by *in ovo* intervention when compared to non-injected controls. The cumulative feed consumption up to fifth week was significantly (p<0.01) increased by *in ovo* nano DCP infusion except at 100 ppm level at which the value is comparable with control birds. The fifth week cumulative feed conversion ratio was non-significantly improved. *In ovo* infusion of nano DCP + Vitamin D3 significantly increased tibial weight, length, diameter, tibial ash, tibial calcium but not seeder index and phosphorus content of tibia. The mRNA expression of BMP 3 gene was significantly (p<0.05) down regulated in the bone marrow of broilers at day-old and first week of age but not at second week of age except at 200 ppm level. Whereas, MMP 9 gene was significantly up regulated

only at day old age but not at first and second week of age. Serum metabolites Cis-9, 10-epoxystearic acid, Clidinium, Doxercalciferol, 2-oxo-10-methylthiodecanoic acid and 12-keto-leukotrine B4 revealed apparent differences between *in ovo* treated and control broilers. The net profit per kg of live weight was Rs.3.90 to 5.74 more in the broilers subjected to *in ovo* treatments. Based on the result, it is concluded that the *in ovo* injection of 25 ppm nano DCP + Vitamin D3 improved production performance, reduced leg weakness and increased net profit.

Keywords: Broilers, *in ovo*, nano dicalcium phosphate, Vitamin D3, growth performance, bone strength, BMP 3 and MMP 9 gene expression, metabolomics, economics.

PNO-23

Effect of partial replacement of methionine by betaine on growth performance, meat quality, nutrient retention and histological changes in broiler chicken

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The present study investigated the efficacy of partially replacing methionine with betaine on growth performance, meat quality, nutrient retention, and histological changes in broiler chickens. Betaine, also known as trimethylglycine, plays a crucial role as a methyl donor in biochemical reactions and functions as an osmolyte. A total of 200 one-day-old Cobb 400Y broiler chicks were randomly assigned to four treatment groups, with five replicates of ten birds per replicate, and reared for 35 days. Treatment T1 consisted of a basal diet containing 0.5% methionine; T2 contained the basal diet with 0.5% methionine + 0.1% betaine; T3 contained 0.325% methionine + 0.1% betaine; and T4 contained 0.325% methionine + 0.125% betaine. Growth performance in terms of body weight gain, feed intake, feed conversion ratio (FCR), and performance index was recorded weekly. At the end of the experiment, ten birds per treatment were sacrificed to assess meat quality, nutrient retention, and histological changes. The results indicated that birds in the T2 group had significantly ($P < 0.05$) higher body weight gain and lower FCR compared to the other treatment groups. The performance index was also significantly ($P < 0.05$) influenced, with T2 achieving the highest value, indicating superior overall performance. Overall growth performance was significantly ($P < 0.05$) reduced in the methionine-deficient diet (T3), while improvements were observed in T2 and T4, followed by T1 (0.5% methionine). There was a significant ($P < 0.05$) reduction in pH and drip loss, along with increased water-holding capacity (WHC) in birds from T2 and T4. Meat pH differed significantly ($P < 0.05$) among treatments. WHC also showed significant differences ($P < 0.05$), with T2 and T4 having higher WHC compared to T1. Drip loss was significantly lower ($P < 0.05$) in T2, followed by T3 and T4, compared to the control. Nutrient retention of DM (%) and CP (%) improved significantly ($P < 0.05$) in T2, followed by T4, compared to the control. Histological examination of visceral organs (liver, kidney, and spleen) showed normal structures with no significant changes among treatment groups. It is concluded that 25% of dietary methionine can be safely spared by supplementing 0.125% betaine without adversely affecting the performance of broiler chickens.

Keywords: Methionine, Betaine, Growth, Meat, Histology, Broiler Chicken.

PNO-24

Carbon quantum dots essential oils complex as a substitute for antibiotic growth promoter in broiler chicken diets

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Essential oils (EO) are effective antimicrobial agents but highly volatile. To enhance their stability and efficacy, seven EO were complexed with carbon quantum dots (CQDs), forming a carbon quantum dots essential oil complex (CQEC). The CQEC showed equal or superior in vitro antimicrobial activity minimum inhibitory concentration and minimum bactericidal concentration compared to the antibiotic growth promoter bacitracin methylene disalicylate (BMD) against Salmonella, E. coli, and Clostridia. Two in vivo feeding trials were conducted to evaluate the efficacy of CQEC as an AGP alternative in broilers. In Experiment 1, CQEC was supplemented at 200 and 250 g/ton of feed; in Experiment 2,

levels of 100, 250, 500, and 1000 g/ton were tested. Each experiment included a positive control (PC) containing BMD and a negative control (NC) without AGP or CQEC. Diets (mash form) were fed to 10 replicates of 25 birds per pen. Feed efficiency (FE) significantly declined in NC compared to PC. Regression analysis demonstrated a nonlinear improvement in FE with increasing CQEC supplementation in NC diets. Similar nonlinear enhancements were observed in immune responses (cell-mediated immunity and HI titres), antioxidant status (higher SOD activity, lower lipid peroxidation), and reduced caecal counts of E. coli and Salmonella. Gut microbiome analysis showed an increased abundance of Bacteroides in CQEC-fed birds. Overall, CQEC supplementation successfully maintained broiler performance in AGP free diets. The improved performance is attributed to reduced pathogenic bacteria, enhanced beneficial gut microbiota, and improved immune and antioxidant responses. CQEC can therefore serve as a promising alternative to conventional AGP in broiler production.

Keywords: Carbon quantum dots Essential oils (CQEC), Broiler, Antibiotic growth promoter alternative.

PNO-25

Effect of *in ovo* feeding of graded levels of L-glutamine on cloacal temperature, growth performance, economics and immunity of coloured chicken during heat stress

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Four hundred and eighty six fertile eggs of coloured chicken (Chabro) were set for incubation. On 18th day of incubation, fertile eggs were divided into five treatment groups – un-injected control (T1), injected with distilled water (Sham Control) (T2), injected with 0.5 ml of 0.5% L-glutamine (Gln) (T3), injected with 0.5 ml of 1% Gln (T4) and injected with 0.5 ml of 2% Gln (T5). After hatching, three hundred sixteen day-old straight-run coloured chicks were further sub divided into three replicates with fifteen birds in each replicate. Birds were reared for 8 weeks and kept on a Basal or Control diet (BIS, 2007; broiler starter diet, 22% CP and 3100 ME till 4 weeks and thereafter broiler finisher diet, 20% CP and 3200 ME till 8 weeks of age). Average temperature, RH and THI were 34.34^{0}C, 64.14% and 86.76 respectively. Cloacal temperature was significantly lower (P=0.025) in T4 and T5 during day old to 8 weeks of growth phase compared to T1. Body weight gain of T4 birds was significantly higher (P=0.004) during 4–8 weeks and significantly higher (P=0.008) during day old to 8 weeks growth phase compared to other treatment groups. FCR was significantly better (P=0.005) and feed cost per kg live weight gain was significantly lower (P=0.005) in T4 and T5 birds compared to T1 during 4 - 8 and day old to 8 weeks of growth phase. There was no significant difference in humoral immune response (HA, IgG, IgM) (log2 titer) against 1% goat red blood cells, foot web index (cell mediate immune response to PHAP) and plasma IgG and IgM level after 4 weeks of age. Hence, it may be concluded that *in ovo* feeding of 1% L- Gln resulted in significantly higher body weight gain, better FCR and lower feed cost per kg live weight gain during day old to 8 weeks of growth phase.

Keywords: *In ovo* feeding, L-glutamine, Growth performance, Immunity, Economics, coloured chicken, Heat stress.

PNO-26

Dietary Supplementation of Jackfruit (Artocarpus heterophyllus) seeds in broilers for performance indices evaluation

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Jackfruit (Artocarpus heterophyllus) tree is a tropical evergreen tree that grows throughout in India. A trial to know the impact of dietary supplementation of jackfruit seeds in broiler chicken on performance indices was planned. Conventional diet (T1-control diet) was compared with diets of Jackfruit seeds inclusion at two levels (T2-4% Jackfruit seed and T3-8% Jackfruit seed). A total of ninety-day old broiler chicks were randomly allocated into three groups, each containing three replicates of ten chicks (totalling 30 chicks per group). The trial lasted for 6 weeks, during which feed intake, body weight gain, feed conversion ratio (FCR), and survivability were recorded. The performance index score is the relationship of weight gain, per cent livability, FCR as well as time period that has been worked out treatment wise. Results showed that as the level of Jackfruit seed increased, body weight and gain reduced gradually. However,

cumulative feed conversion ratio was statistically similar between control (T1) and 4 per cent Jackfruit seed fed group (T2) throughout the trial. Similarly, survivability of birds is one of the most important indications of profitability. In the present study, there was no mortality observed in any of the treatment groups during entire experimental period of six weeks. Hence, supplementation of Jackfruit seed in the diets had no negative influence on survivability. Finally, values of performance index score for various dietary treatment groups was 356.70 in T1 group, 325.62 in T2 group and 262.00 in T3 group. Statistical analysis revealed no significant difference between T1 and T2. However, T3 differed significantly ($P \leq 0.05$) among T1 and T2 groups. Hence, the present research concluded to include 4 per cent Jackfruit seed in broilers.

Keywords: Broiler, FCR, Jackfruit seed, Performance Index Score.

Poultry Nutrition: Poster Presentations

PNP-01

Field-based nutritional evaluation of farmer-formulated feeds and socioeconomic insights into backyard poultry rearing in rural Andhra Pradesh

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Backyard poultry farming is a vital livelihood activity in rural Andhra Pradesh, contributing to household nutrition, food security, and supplemental income for smallholder farmers. Despite its socioeconomic importance, most backyard farmers depend on low-cost feed ingredients such as waste grains and by-products, which often lack balanced nutrients essential for optimal bird performance. A comprehensive field survey involving sixty-four backyard poultry farmers from seven villages in Yerraguntla Mandal, YSR Kadapa district, was undertaken to assess their production systems and feed quality. The study evaluated demographic features, management practices, and marketing trends, while parallel proximate analysis was performed on sixty-four feed samples collected. Samples were categorized as farmers feeding rice (n=42), jowar (n=15), rice–jowar-ricebran (n=5), and bajra (n=2), these feed ingredients are sourced from local mills in Proddatur and Yerraguntla. Proximate analysis was conducted for the feed samples collected from farmers. The study revealed dry matter (DM) values ranging from 88.5% to 91.2% ($p>0.05$). Mean crude protein (CP) content was 9.12% in rice, 9.75% in jowar, 10.52% in the rice–jowar-ricebran mixture, and 8.02% in bajra. Survey data indicated that 93% of farmers reared desi breeds with single-ingredient feeding practices, high disease incidence (93%), and mortality (10%), while 43% earned less than 10% of their income from poultry. The predominance of rice (77%) and jowar (75%) in rations reflected nutritional inadequacy. As the feeds above contain less than 16% CP as recommended for layers (BIS, 2007), improving feed formulation using local feed ingredients (40% rice bran, 10% jowar, 20% rice, 10% bajra and 18% gingely cake) along with calcium supplements, trace mineral mix, and salt; A combination of 80% formulated feed and 20% household waste can meet nutrient requirements. This with capacity building of farmers and targeted government subsidies can enhance egg production by 20–30% while ensuring sustainable rural livelihoods.

Keywords: backyard poultry, crude protein, ration balancing, desi breeds, feed quality, rural livelihoods

PNP-02

Supplementation of probiotic, chicory root powder, coriander seed powder and their combinations on performance, immunity, serum parameters of broilers

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The trial was conducted using a completely randomized design (CRD) to evaluate the synergistic effects of probiotic (Pro), chicory root powder (CRP), and coriander seed powder (CSP) on the performance of broiler chickens. A total of 240-day-old broiler chicks were randomly allotted to 6 dietary treatments, each consisting of 8 replicates with five birds per replicate. Treatment groups included T1 as control i.e., basal diet (BD) without any growth promoter and T2 - BD + antibiotic (BMD @ 500 gm/ton). In the remaining experimental diets, T3 - pro (@ 10 gm/100 kg) + CRP (@ 1.0%), T4 - pro (@ 10 gm/100 kg) + CSP (@ 1.5%), T5 - CRP (@ 1.0%) + CSP (@ 1.5%) and T6 - pro (@ 10 gm/100 kg) + CRP (@ 1.0%) + CSP (@ 1.5%). The results revealed that supplementation with the Pro + CRP group significantly ($P < 0.05$) increased body weight gain during the pre-starter, starter, and finisher phases, and also improved feed conversion ratio (FCR) during the finisher phase compared to other treatment groups. Supplementation of different dietary treatments did not show any significant ($P > 0.05$) effect on feed intake and slaughter parameters of broilers. However, the humoral immune response to the ND vaccine and immune organ weights were significantly ($P < 0.05$) higher in all test diets (T_3 to T_6) compared to the control and antibiotic groups. Furthermore, supplementation with the probiotic and chicory combination significantly reduced serum total cholesterol and resulted in higher returns over feed cost compared to other treatment groups. It can be concluded that the combination of probiotic (10 g/kg feed) with chicory root powder (1.0%) was more effective than other additive combinations in improving performance, immunity, and profitability of broiler chickens.

PNP-03

Effect of feeding combination of synthetic carotenoid on immunity yolk and shank colour in broiler breeder chickens

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The carotenoids could improve the quality of chicken meat by improving its flavour, delaying oxidation and pigmenting bodies. These pigments could also act as a potent immune-stimulant by increasing IgG level in association with proliferation of T cells. Carotenoids are deposited in yolk and then transferred to embryonic tissue and also be helpful in chicks post hatch life against oxidative stress. This study assesses the efficacy of synthetic carotenoids on immunity and pigmentation in broiler breeders. Ninety (90) healthy broiler breeders were divided equally into three treatments. Each treatment had 15 male and 15 female birds. Experimental diets (male and female feed separately) were prepared as per the recommendations of ICAR (2013). The experimental treatment groups were, control diet and two different dose (T1 and T2) levels (combination of canthaxanthin and apocarotenoid each 6 and 12 mg/kg diet). The birds were supplemented from 12 to 30 weeks of age. Serum samples were collected to assess the HA titre against NDV; while the cell mediated immune (CMI) response was assessed against PHA-p injection. The egg yolk color and shank pigmentation were measured with the roche color fan. The CMI response was significantly ($P<0.05$) higher in higher dose of synthetic carotenoid fed group (male and female). In female's, carotenoid fed groups showed higher antibody titre (2.61±0.05) against NDV than control group. The yolk color was significantly ($P<0.05$) higher in T2 group (9.33±0.42) followed by T1 and control. Shank color was higher ($P<0.05$) (105.30±0.21) in T2 group. Supplementation of higher dose of carotenoids (12mg) improves the immunity, yolk and shank colour in broiler breeders.

Keywords: Broiler breeder, Carotenoids, Immunity, Yolk and Shank colour.

PNP-04

Omega-3 fatty acid enriched egg production in Khaki Campbell ducks through dietary manipulation

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Omega-3 fatty acids play a crucial role in supporting overall body functions of heart, lungs and immune system in human beings. People prefer to consume ω3-fatty acid through food and bh egg can be an excellent way for it. Therefore, present study was conducted to produce ω3-fatty acid enriched eggs in Khaki Campbell laying ducks by feeding a composite diet formulated with inclusion of Broken rice (BR), moringa leaf meal (MLM), azolla meal (AM), earthworm meal (EWM) and egg shell powder (ESP). Experimental composite diet was formulated with inclusion of BR, AM, MLM, EWM, and ESP while control diet was formulated with wheat, soybean meal, fish meal and DORB; both the diets were made isonitrogenous and isocaloric. Randomly both the diets were fed *ad libitum* to the two experimental groups, each with five replicates of 8 Khaki Campbell (6F+2M) ducks housed on deep litter floor for 153 days. Data were recorded for egg production, fertility, hatchability and egg quality. Fatty acid composition of egg, serum cholesterol and triglyceride contents were estimated. Improvement was recorded in egg production (8.71%), FCR (2.06 %), cost of feed per dozen egg (Rs)(6.67%), fertility (13.18%), hatchability on FES and TES(7.49 % and 21.88%) due to composite feed. The egg quality was improved i.e. haugh unit (2.17%) and shell% (8.13%). Omega-3 fatty acid contents were increased i.e. linolenic acid (14.4%) and eicosa pentaenoic acid (EPA) (27.58%). Serum cholesterol content was decreased by 54 %. It may be concluded that ω3-fatty acid enriched eggs can be produced in Khaki Campbell ducks by feeding specially formulated composite diet with improvement in egg production, FCR, fertility, hatchability, egg quality, reduction in serum cholesterol and triglyceride contents and low cost of egg production.

PNP- 05

Effect of phytogenic feed additives on growth performance, antioxidant status and immune response in broilers under summer stress

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Today, many phytogenics are known to have various beneficial properties on the overall health and performance of broilers. This study was conducted to evaluate the effect of some phytogenic feed additives (PFA) on growth performance, immune response, antioxidant status, carcass parameters and serum biochemistry in broiler chicken during summer stress. A total of 240-day-old commercial male broiler chicks were randomly allotted to either of four dietary treatments with twelve replications of five birds each and reared in battery brooder up to 42 days of age. The treatments consist of a control diet (CD), CD supplemented with PFA-I containing clove and eucalyptus essential oil @25g/100kg, PFA-II containing blend of oregano, cinnamon, citrus peel and fructo-oligosaccharides @10g/100kg and PFA-III containing amla and linseed powder @10g/100kg. At the end of 42 days, the results indicated that body weight gain (BWG), feed intake, feed conversion ratio (FCR) and carcass parameters were significantly ($P<0.05$) improved in the phytogenic supplemented groups. Dietary supplementation with phytogenics reduced lipid peroxidation (MDA levels) significantly ($P<0.05$). Serum biochemistry indicated that supplementation with phytogenics significantly ($P<0.05$) reduced serum total glucose, SGOT, SGPT and serum corticosterone levels. However, humoral immunity (NDV titer) and cell-mediated immune response to PHA-P were not affected by different phytogenic supplementation.

Keywords: broilers, body weight, feed conversion ratio, immunity, peroxidation, serum biochemistry.

PNP-06

Evaluation of production performance of Kuroiler chicken fed graded levels of kitchen waste under intensive system of rearing

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The present study was conducted to study the effect of feeding different levels of household waste on the performance of Kuroiler birds under intensive system of management. A total of 150 day old Kuroiler chicks were procured and brooded in battery cages for a week. On 8th day, chicks were distributed randomly into five treatment groups viz. T_1, T_2, T_3, T_4 and T_5, having 3 replicates with 10 chicks in each. The T_1 (control) group was fed basal diet and in T_2, T_3, T_4 and T_5 the basal diet was replaced by kitchen waste at 25, 50, 75 and 100% level. The study was conducted up to six weeks of age. The body weight (BW) and body weight gain (BWG), FCR and economics of feeding were calculated. The body weight (BW) and body weight gain (BWG) revealed significant ($P\leq0.05$) differences between control and various treatments. A significant ($P\leq0.05$) decrease in BW and BWG was observed as the percentage of kitchen waste in the basal diet was increased from 25 to 100% in the diet of birds. A significant ($P\leq0.05$) decrease in weekly and cumulative feed consumption (CFC) was observed in birds over the control group as the inclusion level of kitchen waste was increased in the diet. The feed conversion ratio (FCR) was, which significantly ($P\leq0.05$) better in T1 (2.19±0.05) and T2 (2.21±0.02) groups and poorest in T_5 group (2.35 ± 0.01). The benefit cost (B:C) ratio was found to be increased and cost of production/kg live weight (Rs.) decreased linearly as the inclusion of kitchen waste was increased. Therefore, it can be concluded that kitchen waste can be included up to 25% in the diet of Kuroilers without any adverse effects on the performance and health of the birds.

Key words: Kitchen waste, Kuroiler, performance, economics, intensive system

PNP-07

Impact of different dietary additives-ammonium chloride sodium bicarbonate betaine and vitamin c on broilers

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The experiment was conducted to study the impact of different dietary additives- ammonium chloride, sodium bicarbonate, betaine and vitamin C on broilers. The trial was conducted on 300 (Vencobb 430Y) straight-run broilers for five weeks. The day-old chicks were randomly divided into five equal groups of 60 birds each. Each group was further subdivided into six replicates of ten birds each. Group A was control, which received corn-soybean diet; group B received control diet supplemented with Ammonium chloride @ 1 kg/T of feed; group C received control diet supplemented with Sodium bicarbonate @ 2 kg/T of feed; group D received control diet supplemented with Betaine @ 500 g/T of feed and group E received control diet supplemented with Vitamin C @ 200 g/T of feed. Results showed that supplementation of sodium bicarbonate @ 2 kg/T of feed recorded numerically higher live weight and gain in weight in broilers. However, supplementation of vitamin C @ 200 g/T in diet recorded the lowest total feed consumption while, ammonium chloride @ 1 kg/T in diet recorded the best cumulative feed conversion ratio among all the treatments. Supplementation of sodium bicarbonate @ 2 kg/T in diet recorded numerically lower heterophil to lymphocyte ratio and significantly lower ($P \leq 0.05$) serum corticosterone levels at the end of fifth week. The net profit per bird and per kg were calculated the highest in birds receiving diet supplemented with sodium bicarbonate @ 2 kg/T in diet. Thus, it is concluded that supplementation of vitamin C @ 200 g/T of feed results in lowering H:L ratio and serum corticosterone level in broilers while, the supplementation of sodium bicarbonate @ 2 kg/T of feed helps to record better production performance with higher profit margins in broilers.

Keywords: Sodium bicarbonate, Betaine, Vitamin C, broilers

PNP-08

Effect of supplementation of Guanidinoacetic Acid (GAA) in low-energy diets of broiler

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The experiment was designed to study the effects of Guanidinoacetic acid (GAA) supplementation with a low-energy diet on growth performance and gut health. Energy is the primary limiting nutrient for growing chickens, particularly due to their rapid muscle growth and development. GAA improves the efficiency of energy use and storage in broilers, supporting their fast growth and muscle development, especially under conditions where dietary energy may be limiting. For this study, a total of 192 broiler (Vencobb 430) birds were reared for 42 days. One-day-old straight-run chicks were randomly divided into four groups, having four replicates and 12 chicks in each replicate. The first group birds were fed with basal diet, the second group birds were fed basal diet along with supplementation of GAA at the rate of 600 g/ton of feed, while the third group birds were fed low-energy (100 kcal/kg ME less) diet and the fourth group birds were fed low-energy (100 kcal/kg ME less) diet along with supplementation of GAA at the rate of 600 g/ton of feed. Data on live body weight, feed conversion ratio (FCR), intestinal morphology and economic returns were analysed. The result showed no significant effect of GAA supplementation on overall growth performance. There were significant ($P<0.05$) improvements in ileal morphology, indicating enhanced nutrient absorption. The economic analysis revealed that GAA supplementation in basal diet or low-energy diet did not improve profitability; the basal diet alone has yielded the highest profit. It was concluded that higher supplementation of GAA (600 g/ton) in either the basal diet or low-energy diet did not improve production parameters or economic viability. Further studies should explore lower doses better to understand the effects of guanidinoacetic acid in broiler birds.

Keywords: Broiler, economics, growth performance, Guanidinoacetic acid (GAA), gut health.

PNP-09

Herbal choline as an alternative to choline chloride in broiler diets

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The objective of this study was to evaluate the effects of replacing choline chloride with a herbal choline on the growth performance, serum biochemistry and gut health in broilers aged 1-42 days of age. Total four hundred and fifty-one-day-old Vencobb 430 broilers were divided into three treatment groups and fed them commercial diets based on corn and soybean meal. The treatments included basal diet without herbal or synthetic choline (control), choline in the form of synthetic choline chloride (commercial) @ 1.0 kg/ton of feed (T1) and choline in the form of herbal choline chloride@ 500 gm/ton of feed (T2). Each treatment group had five replications. Throughout the experiment, body weight, weight gain, feed consumption, feed conversion ratio and mortality were recorded in the birds at 11, 22 and 42 days of age. Serum biochemical parameters such as protein, creatinine, uric acid, SGOT and SGPT levels were estimated on 22nd and 42nd day of age. After slaughter, gut histology parameters such as duodenal villi height, villi width and crypt depth were assessed. The results demonstrated significant ($P<0.001$) improvement in feed conversion ratio and EPEF in the broilers. However no significant differences between treatments in terms of body weight, weight gain, feed consumption suggesting that broilers fed diets supplemented with the plant source did not experience choline deficiency. Additionally, no differences were found between treatments regarding serum biochemistry. The villi width significantly increased and crypt depth significantly decreased in herbal choline supplemented treatment group. Overall, the tested herbal choline (Aminorich Nutrients B.V. - cholinorich) can effectively replace choline chloride without compromise the zootechnical performance in broilers.

Keywords: Broiler, growth performance, gut health, herbal choline, serum biochemistry.

PNP-10

Unlocking synergy: systemic enzyme with or without probiotic blend optimises broiler growth, gut health and economic gains

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An experiment was conducted to evaluate the effects of ImmunoSEB (systemic enzyme formulation) alone or in combination with BioSEB Trio (probiotic blend) on growth performance, gut health and profitability in broilers. A total of 1,600 one-day-old Cobb 430 straight-run chicks were randomly allocated to four treatments in a CRD, with 10 replicates (40 birds/pen). Dietary treatments comprised a corn-SBM basal diet (control), basal supplemented with 250 g/MT ImmunoSEB (T1), 250 g/MT ImmunoSEB + 250 g/MT BioSEB Trio (T2), or 250 g/MT ImmunoSEB + 500 g/MT BioSEB Trio (T3). Diets were fed in four phases (pre-starter d 0-11; starter d 12-21; grower d 22-32; finisher d 33-42) meeting Cobb 430 requirements. Body weight gain (BWG), feed intake (FI) and FCR were measured at d 21 and d 42; intestinal lesion scoring (Johnson and Reid system) was performed at d 28. During d 22-42, BWG was higher ($P<0.05$) in T2 (1231 g) and T3 (1250 g) than control (1119 g) and T1 (1171 g); FCR was lower ($P<0.05$) in T2 (1.90) and T3 (1.92) vs. control (2.12) and T1 (2.05). Overall (d 0-42), BWG reached 2021 g (T2) and 2051 g (T3) vs. 1919 g (control) and 1988 g (T1) ($P<0.05$); FCR improved to 1.71 (T2) and 1.73 (T3) vs. 1.84 (control) and 1.79 (T1) ($P=0.01$); FI was reduced ($P<0.05$) in T2 (3449 g) vs. control (3526 g). At d 28, T3 eliminated necrotic enteritis, enteritis and feed passage observed in other groups; litter consistency was superior in T1 and T3. Economic analysis showed additional profit of 0.15, 0.32 and 0.33 USD/bird for T1, T2 and T3, respectively, vs. control. Based on the results, it can be concluded that dietary inclusion of ImmunoSEB at 250 g/MT improved performance over control, while combinations with BioSEB Trio (250:250 or 250:500 g/MT) further enhanced BWG, FCR, gut integrity and economic returns in broilers.

Keywords: ImmunoSEB, BioSEB Trio.

PNP-11

Feed densification and its effect on performance and mortality in Raja II coloured chicken

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PB1 male parental line day old chicks of Raja II coloured birds under AICRP on Poultry breeding, Veterinary College, Bengaluru were classified randomly into two groups with 285 chicks in one group and 345 in another group. The birds were reared under deep litter system in a common shed under similar managemental conditions. The broiler feed as per recommendations of ICAR-DPR in both crumble and mash form was obtained from Hygain Pvt. Ltd., Bengaluru and fed separately to two groups. Feed was given ad libitum. The body weight at day old and at 5th week was recorded for all the chicks. Total feed consumption, mortality rate till 5th week and causes of mortality were recorded. The body weight of PB1 birds fed with crumble feed at 5th week of age was 1489.24±14.15 g (133) in male birds and 1247.89±09.26 g (140) in female birds. Where those fed with mash feed had significantly lower body weights of 1330.41±10.47 g (158) in male and 1138.00±8.52 g (173) in female birds respectively. However, those with mash feed had better feed efficiency of 2.08 and chick survivability of 97.92% compared to those fed with crumble feed with feed efficiency of 2.21 and 95.79% respectively. Higher percent of mortality in Crumble fed birds was due to ascetics. Crumble form with uniform particles, better nutrient retention, lesser wastage may be advantageous. However, PB1 line may genetically prone for ascites when fed with densified feed which needs to be investigated.

Keywords: Coloured Broiler, Crumble feed, Mash feed, Ascites, Mortality

PNP-12

Effect of supplementation of protease enzyme in broiler diets with sunflower extraction with protein levels

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The trial was conducted on 480 Cobb 400 broilers with eight groups divided into six replicates in each group. The live weight, gain in weight, feed consumption, feed conversion ratio, mortality and economics of production were recorded. The protease enzyme used in trial was having protease activity of minimum 75,000 PROT/ g and was used @ 200 g/T. The control group received diet with sunflower extraction protein replacing soybean extraction protein at 15% level and other treatment groups received the control diet along with reduction in crude protein at 5, 10 and 15% levels with or without protease supplementation. It was observed that protease supplementation to the birds receiving control diet helped to get marginally higher live body weights and gain in weights. Moreover, the protease supplementation helped to compensate live weights and gain in weights of birds in spite of reduction of crude protein by 10% in diet. Similarly, protease supplementation resulted in reduction in feed consumption when crude protein levels were further reduced by 5% and 15%. It is also observed that protease supplementation to the control diet and the diet with 5% reduction in crude protein helped to record better feed conversion ratios by birds from respective groups. It is also noted that the protease supplementation was found to be beneficial in recording better profit margins from broilers receiving control diet with sunflower extraction protein replacing soybean extraction protein at 15% level and the diet with 5% further reduction in crude protein. Hence, it is concluded that the supplementation of protease enzyme was helpful for recording better production performance and higher profit margins in broilers receiving diet with replacement of soybean extraction protein with sunflower extraction protein at 15% level as well as from the diet with further reduction in crude protein at 5% level.

Keywords: Sunflower Extraction, Protease enzyme, Broiler.

PNP-13

Study of combination of *Curcuma longa,* lutein and *Cissus quadrangularis* on production performance and egg quality in layers

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The study was undertaken to evaluate the effect of supplementation of *Curcuma longa*, Lutein and *Cissus quadrangularis* on production performance and egg quality in layers. The trial was conducted on 208 White Leghorn (BV 300) layers for 12 weeks. Fifty five weeks old layers were randomly divided into four equal groups, viz A, B, C and D with two replicates per group. The birds from groups A (Control) and C received diets with normal and 25% reduced levels of Calcium (Ca) and Phosphorus (P), respectively. The birds from groups B and D received diets similar to groups A and C supplemented with combination product containing *Curcuma longa*, Lutein and *Cissus quadrangularis* @ 500 g/T, respectively. The birds from group B showed significantly (P≤0.05) better egg production, percent egg production as compared to control group. The birds from group B also recorded numerically lower number of broken eggs and feed consumption per bird per day. However, the birds from group D recorded marginally lower total and percent egg production, feed consumption per bird per day and broken eggs and marginal improvement in FCR on egg number and egg mass basis than birds from group C. The birds from groups B and D showed marginally better yolk colour index, shell thickness and Haugh unit and significant (P≤0.01) reduction in total viable count and marginal reduction in coliform count than the birds from groups A and C, respectively. The birds from B and D groups recorded better profit margins than birds from groups A and C, respectively. It is concluded that, the supplementation of combination product containing *Curcuma longa*, Lutein and *Cissus quadrangularis* @ 500 g/T to the diet with normal levels of Ca (4%) and P (0.05%) is beneficial in improving production performance, egg quality and profit margins in layers.

Keywords: *Curcuma longa,* lutein, *Cissus quadrangularis,* layers.

PNP-14

Dietary supplementation of *β*-mannanase on growth performance and gut health of broilers fed with low energy

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Six-week experiment was undertaken to evaluate *β*-mannanase supplementation in low-energy broiler diets. A total 300, day-old Cobb-430Y broiler chicks were assigned to five groups, containing 60 chicks with three replicates of 20 in each. The group PC was the positive control and contained 3000, 3125, 3250 kcal ME/kg feed in the pre-starter, starter, and finisher phases, respectively. Negative controls (NC1 and NC2) had 75 and 100 kcal less ME/kg diet, respectively, than PC. The 100g/ton *β*-mannanase (Natupulse® TS) was supplemented in these negative controls forming groups NC1 + BM and NC2 + BM. Growth parameters (BW, WG, FI, and FCR) were measured at a weekly interval, and economic performance was assessed at the end of the sixth week. Jejunum histomorphology, *Lactobacillus* and *E.coli c*ount was performed 35th day. Results found that the negative controls low-energy diets (NC1 and NC2) depressed (P≤0.05) broiler growth while *β*-mannanase addition (NC1 + BM and NC2 + BM) improved (P≤0.05) BW, WG and FCR with less FI, with higher net profit achieving the best in NC1 + BM group. The *β*-mannanase supplementation in low-energy diet significantly (P < .05) lowered crypt depth, increased villus height: crypt depth ratio and lowered goblet cell count in the Jejunum compared to PC and negative controls (NC1 and NC2), indicating that *β*-mannanase helps to improve gut health. The *β*-mannanase significantly (P < 0.01) improved *Lactobacillus* count and decreased the *E coli* count of jejunal content. It was concluded that the addition of *β*-mannanase at 100g/ton in a diet containing 75 kcal low energy was found to be more beneficial and economical than a 100 kcal low energy diet. Supplementation of *β*-mannanase @ 100g/ton in low-energy diets (75 and or 100 kcal/kg less ME) alleviates negative effects of dietary mannans and significantly improves broiler gut health.

Keywords: broiler, *β*-mannanase, low-energy, gut health, growth.

PNP-15

Effect of dietary Zinc-enriched yeast on performance, antioxidant status and immunity in broiler chickens

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An experiment was conducted to evaluate the effect of dietary zinc-enriched yeast (organic zinc) on growth performance, antioxidant status and immune response in commercial broilers. A total of 350 male chicks were randomly assigned to seven dietary treatments with ten replicates of five birds each. The basal maize–soybean meal diet was supplemented with organic zinc at 0, 20, 40, 60, 80, and 100 ppm, and one group received 100 ppm inorganic zinc ($ZnSO_4$) as control.The highest ($P<0.05$) body weight gain was observed in birds fed 60 ppm (2308 g) and 100 ppm (2309 g) organic zinc diets, while the lowest gain occurred in the unsupplemented group (0 ppm; 2204 g). At 35 days of age, blood samples were analyzed for antioxidant and immune parameters. Supplementation of organic zinc significantly enhanced humoral and cell-mediated immune responses compared to the control. Improved antioxidant status was reflected by higher activities of glutathione peroxidase, glutathione reductase, and superoxide dismutase (SOD) and reduced lipid peroxidation in the zinc-supplemented groups. Digestibility of dry matter, crude protein, and zinc retention was highest at 100 ppm organic zinc. Zinc deposition in bone, breast muscle, and liver was greater in birds receiving 100 ppm organic zinc, whereas serum zinc levels were significantly higher ($P<0.05$) in 80 ppm and 100 ppm groups. In conclusion, supplementation of 60–100 ppm zinc-enriched yeast improved growth performance, antioxidant defence, and immune competence of broilers. Organic zinc was superior to inorganic zinc in terms of bioavailability and physiological response and may also reduce environmental zinc excretion.

PNP-16

Individual and interactive effects of postbiotic and organic selenium supplementation on growth, immunity, antioxidant status and caecal microbiota in heat-stressed broilers

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The present study was conducted with a total of 192 day-old Vencobb-400F broiler chicks which were randomly assigned to four dietary treatments: control, PB (1000 mg postbiotic derived from *Saccharomyces cerevisiae* /kg diet), OS (0.3 mg Organic selenium/kg diet), and PB+OS (1000 mg postbiotic + 0.3mg organic selenium/kg diet), for a experimental period of 35 days under heat stress conditions. Supplementation with postbiotic and organic selenium significantly ($P < 0.05$) enhanced feed intake, body weight gain and final live weight, with the greatest improvements observed in the PB+OS group. Humoral immune response, measured through antibody titres against ND virus, was significantly elevated ($P < 0.05$) in all supplemented groups, particularly with combined supplementation. Serum antioxidant analysis revealed significantly lower ($P < 0.05$) malondialdehyde concentrations and markedly higher ($P < 0.01$) activities of glutathione peroxidase, glutathione reductase and superoxide dismutase, indicating strengthened antioxidant defense mechanisms. Stress marker serum cortisol concentrations were also significantly reduced ($P < 0.01$) in supplemented birds, reflecting improved stress tolerance. Caecal microbial analysis revealed significant modulation ($P < 0.01$) of the gut microflora, characterized by reduced total plate and *E.coli* counts and a significant increase in *Lactobacillus* populations, with the most favourable microbial balance observed in the PB+OS group. In conclusion, dietary supplementation with postbiotic and organic selenium, either individually or in combination, significantly improved growth performance, antioxidant status, immune function and caecal microbial ecology in broiler chickens under heat stress. The combined supplementation of postbiotic and organic selenium demonstrated the most pronounced protective and synergistic effects during heat stress condition.

PNP-17

Effect of feeding graded levels of different energy sources on growth performance in Mewari chicken

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The study was conducted to assess effect of feeding graded levels of different energy sources viz. maize, bajra and ragi on body weight, body weight gain and feed intake in Mewari chicken at Poultry Farm, Department of Animal Production, Rajasthan College of Agriculture, Udaipur (Raj.).Two hundredpooled sex day-old chicks of Mewari chicken from single hatch were used were randomly divided into five different dietary treatment groups consisting of forty chicks in four replicates of 10 chicks each. The treatments were T1: control, T2: control group having Bajra @ 20%, T3: control group having Bajra @ 40%, T4: control group containing Ragi @ 20% and T5: control group containing Ragi@ 40%. The birds were maintained in deep litter system following standard management practices during chick and grower phase and fed chick and grower feed as per BIS 2007. Significantly ($p<0.01$) higher body weight (1380.56 g) and body weight gain (1350.66 g) was found in T2 group which were fed with 20% Bajra in diet and lowest (1277.06 g and 1246.44 g) in T3 group which were fed 40% bajra. The weekly feed intake was significantly ($p<0.01$) higher in T2 (Body weight gain significantly higher was found in T2 group which were fed with 20% Bajra in diet and lowest in T3 group which were fed 20% Ragi. Total feed intake was significantly ($p<0.01$) (6807.92 g) compared to other groups. The overall FCR for the entire period (20 weeks) was significantly lower ($p<0.01$) in T2 (5.04) as compared to other dietary treatments with lowered ($p<0.01$) FCR of 3.01 and 6.73 for chick and grower phase respectively in T2. It may be inferred that the bajra can replace maize by 40% without any adverse effect on body weight gain and feed conversion ratio in Mewari chicken.

Keywords: Bajra, Ragi, chicken, Body weight, Feed conversion ratio.

PNP-18

Effects of dietary sodium sulfate supplementation on performance and antioxidant responses in broiler chickens

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A study was conducted to assess the impact of supplementing graded concentrations of sodium sulfate (NaS) at a constant dietary electrolyte balance (DEB) and sulfur amino acids in broiler chicken diets. A total of 1,800 one-day-old male broiler chicks (Cobb 430) were evenly distributed into 72 pens, with 25 birds per pen (198 x 122 cm). A control diet (CD), based on maize-soybean-meal were prepared in mash form for three different phases: pre-starter (1-14 days), starter (15-28 days), and finisher (29-42 days). Sodium chloride (NaCl) was used as the sole source of supplemental Na and Cl in the CD. Five additional diets were formulated by supplementing sodium sulfate (NaS) at five graded concentrations (0.05%, 0.10%, 0.15%, 0.20%, and 0.25%) in the CD. Broiler performance was measured based on body weight gain (BWG), feed intake (FI), and the FI to BWG ratio (FCR), evaluated phase-wise. The FCR in the groups fed with 0.15% and 0.20% NaS was significantly superior compared to the 0.25% NaS group. However, there were no significant changes in other production parameters. Additionally, no differences were observed in carcass parameters, immunity and stress variables. Based on the results, it can be concluded that NaS can be included in broiler diets up to 0.20%, at constant Dietary electrolyte balance, without any adverse effects on performance.

Keywords: Sodium sulphate, Broilers, Production, Carcass parameters, Anti-oxidant status, Immunity.

PNP-19

Impact of fermented amla supplementation on carcass traits and meat quality in broiler chickens

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Amla *(Emblica officinalis*) is recognized as a medicinal fruit of high nutritional importance, being one of the richest natural sources of vitamin C. Fermentation of amla enhances its nutritional and functional properties by reducing anti-nutritional factors such as tannins, phytates, and oxalates, thereby improving mineral bioavailability. A total of 240 broiler chicks were reared in a cage system and randomly assigned into six dietary groups. Each treatment included five replicates, with eight birds per replicate. The six experimental diets prepared were T1 (negative control), T2 (positive control), T3 (0.5 g/kg fermented amla), T4 (1 g/kg fermented amla), T5 (2.5 g/kg fermented amla), and T6 (5 g/kg dried amla powder). Carcass yield was significantly improved in moderate fermented amla groups, with T3 (0.5 g/kg) and T4 (1 g/kg) showing the highest yields of 70.41% and 68.47%, respectively, compared to other groups. Heart and gizzard weights were significantly increased in higher inclusion groups T4 and T5 compared to controls. Neck percentage was also affected, with the lowest values in T4. Other traits such as wing, breast, back, thigh, and drumstick percentages did not differ significantly. The pH values significantly varied among treatments ranging from 5.84 in the T3 to 6.26 in the T2. water-holding capacity (WHC) showed highly significant differences across groups, with the highest values observed in T3 and T4. The anti-oxidative compounds in amla, contribute to lowered oxidative stress markers, further protecting muscle tissues, improving meat pH, and WHC critical factors influencing meat tenderness and juiciness. Overall, moderate levels of 0.5g/kg fermented amla improved carcass yield and select organ weights, suggesting beneficial effects on broiler carcass traits with optimal supplementation.

PNP-20

Comparative effects of sodium source in diet on performance, egg quality, and antioxidant variables of WL layers in hot tropical conditions

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An experiment was conducted to study the effect of replacing dietary sodium chloride (NaCl) with sodium sulfate (NaSO4 ProSodium) as well as sodium bicarbonate (NaB). A total of 240 Hy-Line White layers from 69 to 80 weeks of age were randomly divided into three groups each with 4 replicates of 20 birds each, The birds were offered diets having three sources of Na i.e. 100% NaCl (diet 1), NaCl + 1kg/ton NaB (diet 2) and NaCl + 1kg NaS (diet 3). The egg production, feed intake per bird, and egg mass in the fed NaS group were significantly higher than those fed the NaCl and these values in NaB were intermediate between NaCl and NaS. Behavioural pattern like panting and cloacal temperature of the layers remained similar among the groups fed different sources of dietary Na. The activities of serum anti-oxidant enzymes (LP, GSHPx and GSHRx) were increased ($P<0.05$) by the variation in the source of Na (NaB, NaS) in the layer diet compared to those fed on control diet. It can be concluded that supplementation of Prosodium resulted in significant ($P<0.05$) improvement in egg production, feed intake, feed intake per unit egg mass, and egg mass without affecting the shell quality and immune responses compared to those fed the control diet.

Keywords: Pro-Sodium, Layers, Performance, Anti-Oxidant Variables, Tropical Summer.

PNP-21

In-Vitro Assessment of Zinc supplementation effects on biomass yield and Zinc accumulation in *Saccharomyces cerevisiae* strains

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An in-vitro study was conducted to evaluate the effect of different zinc sources and concentrations on biomass yield and zinc enrichment potential of various *Saccharomyces cerevisiae* strains (SC 3455, SC 045, SC 050, SC 101, and SC 186). The yeast strains were cultured in YEPD (2% dextrose) broth medium supplemented with zinc at 0, 30, 60, 90, and 120 ppm concentrations using three zinc sources-zinc sulfate ($ZnSO_4$), zinc chloride ($ZnCl_2$), and zinc nitrate ($Zn(NO_3)_2$). The cultures were incubated in a shaker at 100 rpm and 30°C for 48 hours at an initial pH of 5.8. After incubation, the samples were centrifuged at 4000 rpm for 15 minutes at 10°C, washed twice with sterile distilled water to remove surface-bound inorganic zinc, and the biomass yield was determined after drying the pellet. Results indicated that the biomass yield was highest at 30 ppm zinc concentration across all yeast strains and zinc sources. However, increasing zinc concentration beyond 30 ppm resulted in a gradual decline in biomass yield up to 120 ppm. In contrast, zinc accumulation within the yeast cells increased with higher zinc concentrations, reaching the highest levels at 120 ppm. Among the zinc sources and yeast strains tested, notable variations were observed in both biomass yield and zinc enrichment efficiency. It was concluded that both the zinc source and yeast strain significantly influence biomass production and zinc bioaccumulation. Optimal zinc enrichment was achieved by balancing zinc concentration to maintain both cell growth and biofortification efficiency.

PNP-22

Evaluating fermented rapeseed meal as a soybean meal substitute in broiler diets: impact on liver health, immunity, nutrient digestibility and carcass traits

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The experiment was conducted on 400-day-old Vencobb-430Y straight run broiler chicks randomly distributed into five treatment groups with 4 replicates having 20 chicks each for 42 days. The control group A received maize-soya basal diet. The treatment groups B, C, D and E were offered diet containing inclusion levels of fermented rapeseed meal (FRSM) at 5%, 7.5%, 10% and 12.5%, respectively replacing soybean meal. All the diets were *iso-caloric* and *iso-nitrogenous*. It was observed that the biochemical parameters such as total protein, albumin, globulin, total cholesterol, triglycerides and antibody titers against New Castle Disease were statistically non-significant in all the treatment groups at 21st and 42nd days. Histopathological examination of liver samples from broiler birds in groups A, B, C and D revealed no appreciable changes and found to be apparently normal. However, liver sections from group E (fed 12.5% FRSM) showed mild to moderate, focal to diffuse degenerative changes in hepatocytes, along with multifocal mononuclear cell infiltration in the hepatic parenchyma. Nitrogen retention was significantly better up to 10% inclusion level of FRSM compared to inclusion of 12.5% FRSM. The nitrogen retention (g/d) and nitrogen retention (%) were significantly ($P<0.05$) decreased in birds from group E fed 12.5% FRSM as compared to all other groups. There were non-significant differences for dry matter digestibility, ether extract digestibility and crude fibre digestibility percent among all the treatment groups. At the end of 6th week, the eviscerated yield (%), giblet (%), abdominal fat percentage as well as the liver, heart and spleen percent were non-significant among all treatment groups. Thus, it could be concluded that the inclusion of 10% FRSM replacing soybean meal in the broilers diet do not have any adverse effect on biochemical parameters, immune response, histopathology of liver, nutrient digestibility and carcass traits in commercial broiler production.

Keyword: Fermented rapeseed meal, Rapeseed meal, Biochemical, Immune response, Liver histopathology, Nutrient digestibility, Carcass traits, Broilers

PNP-23

Comparative evaluation of dietary Turmeric oil extracted concentrate (TOC) and antioxidant nutrients supplementation on heat stress in broilers.

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This experiment (42 days) was conducted on 288 broiler chicks reared under deep litter system. Birds were randomly categorized into eight dietary treatments with six replicates for each treatment group and six birds in each replicate (8×6×6). A standard Corn-soya based diet was prepared for starter and finisher phases. Eight experimental diets were prepared by mixing the TOC at 0, 0.1, 0.2, 0.3 and 0.4 g/kg diet, Zinc, Vitamin E and Selenium at 60, 100 and 0.2 mg/kg diet levels, respectively. The results of present study revealed that supplementation of TOC at 0.2 g/kg diet significantly improved the body weights compared to control. The highest bodyweight ($P<0.001$) was recorded in Se supplemented group while lowest ($P<0.001$) body weight was observed in TOC supplemented group at 0.4 mg/kg diet. Among TOC supplemented groups, significantly lower feed intake observed in birds fed diet containing 0.3g TOC /kg, while higher feed intake observed in 0.4g TOC/kg group. Among all treatment groups better or lowest ($P<0.01$) FCR was recorded with 0.2 g/kg TOC supplemented group, while higher FCR was recorded with 0.4 g/kg TOC supplementation. The antioxidant enzyme Glutathione reductase (GRx) activity not affected among treatments while Glutathione peroxidase (GPx) activity significantly increased in all groups compared to control. In view of better FCR and improved GPx activity, it was concluded that TOC supplementation at 0.2 g/kg diet optimum to improve the growth performance and alleviate the heat stress.

Keywords: Broiler, Performance, Selenium, TOC, Zinc.

PNP-24

Standardizing dietary energy and protein requirements for CARI Debendra dual purpose chickens

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A biological experiment was conducted to study the response of feeding variable dietary energy and protein levels on the performance of CARI Debendra dual-purpose chicks using a 3x3 factorial experiment with nine dietary treatments, having three levels of energy (3000, 2800 and 2600 kcal/kg ME) each with three levels of crude protein (22, 20 and 18%) in a factorial manner. Each dietary treatment was tested with five replicated groups of eight CARI Debendra dual purpose chicks each, totalling 40 chicks per treatment from 0–15 weeks of age. Results indicated that during 0–4 wks of age significantly higher ($P<0.05$) body weight gain was observed in chicks fed diet having 2800kcal/kg ME with 22% CP followed by 2600kcal/kg ME with 22% CP, 2600kcal/kg ME with 20% CP and 2800kcal/kg ME with 20% CP than those recorded than other dietary combinations. During different growth phases significantly, higher body weight gain was observed at 2800kcal/kg diet than those recorded at other ME levels in the diet. The overall feed intake during 0-15wks of age did not differ significantly due to interaction between energy and protein levels in the diets. However, feed intake during different growth phases was found significantly lower at high energy diet than those recorded at lower energy diets. The overall FCR during different growth phases was found significantly lower and better at high energy diet than those recorded at lower energy levels in the diets. The various immune parameters such as cellular and humoral immune response and immune organs weight (Thymus and spleen) did not differ significantly due to either main effect or interactions between energy and protein levels in the diets. Bursa weight was significantly higher ($P<0.01$) in chicks receiving 3000 kcal/kg ME with 22% CP, indicating enhanced immune organ development with increased protein levels. Based on above observations it seems that a dietary concentrations of 2800 kcal/kg ME with 22% CP, 1.08% lysine, 0.40% methionine and 0.86% threonine was found optimum for optimum growth performance and immune response of CARI Debendra dual purpose chickens during 0-15th weeks of age.

Keywords: Dietary energy, protein, CARI Debendra dual purpose chicks, Growth, Immunity.

PNP-25

Effect of variable dietary energy and protein levels on meat quality and composition of CARI Debendra dual purpose chickens

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An experiment was conducted to evaluate the effects of variable energy and protein levels on the meat quality and composition of CARI Debendra dual purpose chickens. A biological experiment was conducted using a 3x3 factorial design with nine dietary treatments, having three levels of energy (3000, 2800 and 2600 kcal/kg ME) each with three levels of crude protein (22, 20 and 18%) in a factorial manner. Each dietary treatment was tested with five replicates groups of eight CARI Debendra chicks each, totalling 40 chicks per treatment from 0–15 weeks of age. At the end of experiment ten male birds from each dietary treatment (2 birds/replicate, total 90 birds) were slaughtered to analyse the meat quality and composition. The study revealed that the meat quality parameters such as pH, drip loss, shear force and water holding capacity did not changed significantly due to interaction between different energy and protein levels in the diets. The shear force value was significantly higher ($P<0.01$) in birds fed a 22% crude protein as compared to those fed lower CP diets. WHC varied significantly with energy level, being lower values at 3000 kcal/kg ME as compared to other lower ME levels in the diets. For meat composition, moisture, total ash, calcium and phosphorus contents were unaffected by dietary treatments. The ether extract percentage increased significantly ($P<0.01$) with gradual increased in energy levels in the diets. The crude protein percentage in meat was significantly increased with increasing the protein levels in the diets. The results suggest that dietary energy and protein levels selectively influence certain meat quality and compositional attributes in poultry. Based on the results it was concluded that CARI Debendra dual purpose chickens fed a diet with less energy (2800kcal/kg) with higher protein (22%) can be fed for production of lean meat with better quality and composition.

Keywords: CARI Debendra, Energy, Protein, Meat quality, Meat composition.

PNP-26

Growth performance of Japanese quails fed diets incorporated with dried mushroom *(Agaricus bisporus)* waste powder

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A study was conducted for a period of 35 days to assess the impact of dietary inclusion of dried mushroom *(Agaricus bisporus)* waste powder (MWP) on growth performance, utilization of nutrients and carcass characteristics of Japanese quails. A total of 150, day-old quail chicks were distributed among five groups, with three replicates of ten birds each, allotted randomly to one of the iso-caloric and iso-nitrogenous (NRC,1994) dietary treatments (T_1-0, T_2-1.5, T_3-3.0, T_4-4.5 and T_5-6 per cent of MWP, respectively). Results illustrated significant ($p<0.05$) improvement in body weight gain in the groups fed MWP when compared to control. Significantly ($p<0.05$) better FCR, PI and PER were observed in T2 and T3 groups. The digestibility coefficients for OM, EE and NFE remained non-significant ($p>0.05$) with the inclusion of MWP in the diet. DM digestibility was decreased significantly ($p<0.01$) at 4.5 and 6.0 per cent levels of inclusion. However, there was a significant ($p<0.01$) increase in CP digestibility in the T2 and T3 groups and CF digestibility in T2 group. Furthermore, the level of inclusion of MWP up to 6% in the diet had no effect on per cent calcium and phosphorus retention. Inclusion of MWP in the diet up to 6% level did not result in any significant ($p>0.05$) impact on carcass characteristics of Japanese quails. The feed cost/kg gain exhibited a significant ($p<0.01$) decrease in T3 group and increase in T5 group. Based on the results, it may be concluded that MWP can be included up to 3% level in the diet without affecting the performance.

Keywords: Japanese Quails, MWP, Growth performance, Nutrient utilization.

PNP-27

Effect of feeding Biofortified Provitamin-A maize on performance and meat quality parameters in commercial broiler chickens

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An experiment was conducted to evaluate the effect of feeding Biofortified Provitamin-A (Pro-A) maize (Pusa HQPM5) on performance and meat quality parameters in commercial broiler chickens. 240- day old commercial broiler chicks were randomly allotted into three dietary treatment groups with 16 replicates for each treatment group and five birds in each replicate. The birds were raised in battery brooder cages under uniform management and fed with iso caloric and iso nitrogenous corn- soya based diets from day old to 6 weeks of age. Three experimental diets were formulated to contain normal maize (Diet 1), 50% normal maize (NM) and 50% bio fortified Pro-A maize (Diet 2) and 100% biofortified Pro-A maize (Diet 3). At the end of 42 days dietary replacement of normal maize with 50% or 100% Pro-A maize had no significant ($P>0.05$) effect on body weight gain, feed intake, or FCR. Pro-A maize improved cooking yield, skin colour, meat carotenoid and beta-carotene content. Replacement of NM with Pro-A maize reduced meat pH and TBARS values, indicating better oxidative stability. Based on the overall results, it was concluded that replacement of normal maize with biofortified Pro-A maize enhanced meat quality, skin pigmentation, storage stability without affecting growth parameters.

Keywords: Biofortified maize, Normal maize, Broiler chicken, Pusa HQPM5.

PNP-28

Effect of plant derived feed additives (Ashwagandha, Turmeric, Aloevera, Giloy, Amla, Tulasi, Fenugreek, Bhringraj, Karanja, Cinnamon mixture extract) on performance, carcass traits and gut health of broilers

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The aim of this experiment was to study the effect of supplementation of plant derived feed additives mixture (PDFA) containing ashwagandha, turmeric, aloevera, giloy, amla, tulasi, fenugreek, bhringraj, karanja, cinnamon extract on the growth performance, carcass characteristics, immune status, serum biochemical and gut health parameters in broiler chicken from day old to 6 weeks of age. A total of 400-day-old broiler chicks were individually weighed and randomly allotted to five dietary treatments with 16 replicates per treatment and five birds per replicate. The treatment groups were as follows: T1 – basal diet (control, without antibiotic); T2 – basal diet with antibiotic; T3 – basal diet with PDFA mixture incorporated in feed; T4 – basal diet with PDFA mixture added to drinking water and T5 – basal diet with PDFA mixture provided in feed (morning) and water (evening). The results shown that the group of birds supplemented with PDFA in feed, water and in combination have shown significantly ($P<0.05$) higher body weight gain, improved FCR, dressing percentage, immune status and gut health. Based on the overall results, it was concluded that supplementation of PDFA either through feed or water individually or in combination, is beneficial for improving growth performance, carcass traits and immune status of broiler chickens.

Keywords: Broilers, Plant derived feed additives, Production, Immunity, Carcass.

PNP-29

Comparative efficacy of herbal liver tonics on production performance and economics of egg production in Commercial layers

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The experiment was carried out in three tier California cage housing system on 256-layer birds (BV 300 strain) for 12 weeks period from 22nd week to 33rd weeks of age. The layer birds were randomly distributed into four groups: T1, T2, T3 and T4 with 64 birds in each group, having 4 replicates of 16 birds each. The control group T1 received a basal diet, T2 received a basal diet with AV/ELP/19 (Zenex Animal Health) @ 250g/ ton of feed, T3 received a basal diet with Superliv Gold (Zenex Animal Health) @ 7 ml/100 birds/day in drinking water, and T4 received an analogous competitor's product @ 7 ml/100 birds/day through drinking water during the entire 12-week experiment period. The layer diet was prepared as per the nutrient recommendation of BV-300 strain. Results showed that the mean percent weekly egg production and percent hen housed egg production were significantly higher in treatment groups T2, T3 and T4 as compared to control group T1. It was also observed that the treatment groups T2, T3 and T4 recorded significantly better feed efficiency on an egg number basis as well as on an egg mass basis compared to control group T1. The cost of egg production per egg in each experimental group, T1, T2, T3 and T4 was Rs. 4.24, 4.18, 4.18 and 4.17, respectively. It was also noted that the net profit per egg in treatment groups T1 to T4 was Rs. 1.39, 1.45, 1.45 and 1.46, respectively. Thus, it could be concluded that supplementation of herbal liver tonics AV/ELP/19 @ 250g/ ton of feed, Superliv Gold @ 7ml/100 birds/day and Competitor's herbal liver tonic product @ 7ml/100 birds/day through drinking water from 22nd to 33rd weeks of age improved egg production performance, feed efficiency and found to be more economical in commercial layer production.

Keywords: Herbal liver tonics, Egg production, Feed efficiency, Economics, Layers.

PNP-30

Dietary supplementation of Azolla (*Azolla pinnata*) on growth performance and economics of Japanese quail

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The present study was carried out to study the effect of dietary supplementation of Azolla (Azolla pinnata) on growth performance and economics of japanese quail. Six week (0-6 weeks of age) feeding trial was conducted by randomly assigning 96 quail chicks (day old) in four treatments (T0, T1, T2 and T3) and fed with experimental diets prepared by incorporating Azolla meal at 0, 1, 3 and 5% levels respectively by partially replacing soybean meal and other ingredients. Each experimental diet was offered *ad lib* to four treatment groups of chicks from 1-42 days of age. Respeonse criteria were weekly body weight gain, feed intake and feed conversion ratio (FCR). At the end of the feeding trial result revealed that, the treatment group T3 exhibited a significantly ($p<0.05$) higher average body weight as compared to control and other dietary treatments. The feed intake was highest in the treatment T0, while the treatment T3 exhibited the lowest feed intake. The significantly better ($p<0.05$) cumulative FCR reported in the treatment T3 supplemented with 5% azolla meal compared to the control and other treatment group (T0, T1 and T2). The feed cost for production per kg weight gain was lower in T4 treatment group (5% azolla) followed by T3 and T2 and higher cost reported in control group compared to treatment group. Finally it was concluded that the partial replacement of dietary protein with Azolla pinnata at 5% level in maize soybean-based diet is beneficial and recommended for better performance and economics in Japanese quail production.

Keywords: Azolla pinnata, Growth performance, Economics, Japanese quail.

PNP-31

Effect of supplementation of Vitamin C, Vitamin E, and organic chromium and its combination in feed on growth performance of Narmadanidhi birds during summer

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The present study was conducted to study the effect of supplementation of vitamin C (ascorbic acid), vitamin E, organic chromium and its combination in feed on growth performance of Narmadanidhi birds in summer season. A total of 240, day old coloured dual type Narmadanidhi chicks were distributed into 12 dietary treatment groups with 20 chicks in 2 replicates in each treatment. The chicks were housed in individual pens as per treatment groups and reared on litter system. Starter and finisher ration were prepared and fed up to 6 and 7 to 12 weeks of age respectively. Dietary treatment supplements in starter and finisher ration were C0 control, C1 (150 mg AA/kg), C2 (250 mg AA/kg), E1 (125 mg vit E/kg), E2 (200 mg vit E/kg) Cr1 (1.25 mg Cr-propionate/kg), Cr2 (2.0 mg Cr-Propionate/kg). Combined supplements were C2E1, C2E2, C2Cr1, C2Cr2, and C2E1Cr2. The data of growth performance parameters such as body weight, feed intake (FI) and feed efficiency (FE) were recorded to analyse by one way ANOVA. During summer season, dietary supplementation of C2, E2, Cr1, Cr2 had given significantly higher body weight, feed intake and feed efficiency. Among these C2 was significantly superior body weight. All combined supplements significantly improved body weight, feed intake and feed efficiency over single supplement. Among these, C2Cr2, C2E1Cr2 were significantly superior. It was concluded that, supplementation of vitamin C (ascorbic acid), vitamin E, organic chromium and its combination in feed on growth performance reported that combined supplement C2Cr2, C2E1Cr2 had superior growth performance in Narmadanidhi birds in summer season.

Keywords: Vitamin C, Vitamin E, Chromium, Narmadanidhi, Growth performance, Summer season, Feed.

PNP-32

Effect of Nano Dicalcium Phosphate on carcass characteristics in broilers

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A study was conducted to assess the effect of nano di-calcium phosphate (DCP) on carcass characteristics in broilers. Day-old broiler chicks (300 nos., unsexed, Cobb strain) were allocated to five dietary treatments, each with six replicates of ten birds each in a completely randomized design. Five experimental diets were prepared by incorporating different forms of DCP i.e., conventional rock DCP or bone DCP to meet 100 % phosphorus (P) requirement or nano DCP to meet to meet 75, 50 and 25 % of P requirement. The breeder's nutrient specifications in three phases viz., pre-starter (1-10 days), starter (11-21 days) and finisher (22-35 days) was followed for diet formulation. On the terminal day of the experiment, two birds from each replicate were sacrificed and evaluated for dressing percentage, cut up part yield and vital organ weights. The results indicated that the dietary inclusion of nano DCP at lower levels did not significantly ($P>0.05$) affect dressing percentage, eviscerated carcass yield or the proportion of major meat cuts such as breast, thigh, drumstick and wings. Weights of liver, gizzard and heart were also comparable among different treatments. Additionally, abdominal fat deposition remained unchanged, indicating that nano DCP did not alter lipid metabolism or energy partitioning. These findings indicated that nano DCP with inclusion level reduced up to 75% of recommended P level does not compromise carcass quality in broilers.

Keywords: Broilers, Dicalcium phosphate, Nano, Carcass.

PNP-33

Dietary Inclusion of *Moringa oleifera* leaf meal enhances performance and cost of production of broiler Japanese quails (*Coturnix coturnix japonica*)

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The present study aimed to assess the impact of replacing soybean meal with *Moringa oleifera* leaf meal on the growth performance and feed economics of broiler Japanese quails. A total of 300 day-old Japanese quail chicks were procured and reared from 1 to 6 weeks of age. The birds were randomly allocated into five dietary treatment groups (M_0, $M_{0.5}$, M_1, $M_{1.5}$, and M_2) with three replicates per group, based on graded inclusion levels (0, 0.5, 1.0, 1.5, and 2.0%) of *Moringa oleifera* leaf meal. The *M. oleifera* leaf meal was rich in crude protein and fibre. Significant improvements were observed in growth traits, nutrient utilization, and serum biochemistry in quails fed on *M. oleifera* leaf meal based diets. The *M. oleifera* leaf meal based diets reduced feed cost per kilogram of live weight gain in quails by Rs. 9.80-45.84. An inclusion level of 2% *Moringa oleifera* leaf meal was found to be optimal for all studied parameters, and may therefore be recommended in the diets of broiler Japanese quails to enhance economic returns.

Keywords: Broiler, Economics, Japanese quails, *Moringa oleifera* leaf meal.

PNP-34

Effect of probiotic, postbiotic, and their combination on performance and carcass characteristics of broilers under heat stress conditions

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The present study was conducted to evaluate the individual and combined effects of probiotic and postbiotic supplementation on the growth performance and carcass traits of broiler chickens reared under heat stress. A total of 240-day old broiler chicks were randomly allotted to four dietary treatments with ten replicates each: Control (basal diet), Probiotic (basal diet + probiotic), Postbiotic (basal diet + postbiotic), and Pro+Post (basal diet + probiotic and postbiotic combination). Feed intake, body weight gain, and feed conversion ratio (FCR) were recorded throughout the experimental period, and carcass characteristics were measured at the end of the trial. Results revealed that total body weight gain was significantly improved ($P<0.05$) in the Pro+Post group (2282.33 g) compared to the control (1848.68 g), with a corresponding improvement in FCR (1.29 vs. 1.47). Feed intake did not differ significantly among treatments ($P>0.05$). Carcass evaluation showed numerically higher dressing percentage and breast yield, and reduction in abdominal fat percentage in birds supplemented with both probiotic and postbiotic compared to the control. The improved growth and feed efficiency observed in the Pro+Post group may be attributed to the synergistic mechanism of action of probiotics and postbiotics, which enhance intestinal microbial balance, increase short-chain fatty acid production, improve nutrient absorption, and mitigate oxidative and thermal stress. The combination of probiotic and postbiotic supplementation proved more effective than either additive alone, indicating a potential strategy for enhancing broiler performance under heat stress conditions.

Keywords: Probiotic, Postbiotic, Heat stress, Growth Performance.

PNP-35

Impact of supplementation of herbal liver tonics on egg quality traits in commercial layers

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The present experiment was conducted on 256 layers of BV- 300 strain from 22nd week to 33rd weeks of age for the period of 12 weeks. The layer birds were randomly distributed into four groups: T1, T2, T3 and T4 with 64 birds in each group, having 4 replicates, each comprising of 16 birds. The control group T1 received a basal diet, T2 received a basal diet with AV/ELP/19 (Zenex Animal Health) @ 250g/ ton of feed, T3 received a basal diet with Superliv Gold (Zenex Animal Health) @ 7 ml/100 birds/day in drinking water, and T4 received an analogous competitor's product @ 7 ml/100 birds/day through drinking water during the experiment period. From the results, it was observed that the mean values of egg weights were significantly (P<0.01) risen in the treatment group T3 as compared to all other groups. Also, there was significant (P<0.01) hike in mean egg weight in the birds of groups T2, T3 and T4 compared with control group T1. The eggshell breakage percent was significantly (P<0.01) reduced in treatment groups T3 and T4 as compared to control group T1. The external and internal egg quality such as shape index, egg surface area (cm^2), specific gravity, Albumin index, yolk index, haugh unit and yolk color of eggs between the groups were statistically non-significant. The mean values of eggshell weight and eggshell thickness were statistically (P<0.05) higher in treatment groups T3 and T4 as compared to control group T1. Thus, it could be concluded that supplementation of herbal liver tonics AV/ELP/19 @ 250g/ ton of feed, Superliv Gold @ 7ml/100 birds/day and Competitor's herbal liver tonic product @ 7ml/100 birds/ day through drinking water from 22nd to 33rd weeks of age improved egg quality parameters such as egg weight, percent eggshell breakage, eggshell weight and eggshell thickness in commercial layer production.

Keywords: Layers, Egg weight, Eggshell breakage, Eggshell weight, Eggshell thickness, External and Internal egg quality parameters.

PNP-36

Effect of dietary supplementation of *Spirulina* and dried *Moringa* leaf powder on performance of Uttara chicken

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The present study was undertaken to evaluate the comparative and synergistic effects of *Spirulina platensis* and *Moringa oleifera* leaf powder supplementation on growth performance, haemato-biochemical indices, and carcass characteristics of Uttara chicks under intensive management. A total of 160 day-old Uttara chicks were randomly distributed into four treatment groups with four replicates of ten chicks each, following a completely randomized design. The dietary treatments included: T_0 (control – basal diet), T_1 (1% Spirulina), T_2 (3% Moringa leaf powder), and T_3 (combination of 0.5% Spirulina + 1.5% Moringa leaf powder). The experiment was conducted for 84 days. Results revealed a significant (P<0.05) improvement in body weight, weekly weight gain, and feed conversion ratio in supplemented groups compared to the control. Birds receiving combined supplementation (T_3) exhibited the highest final body weight (1007.84 ± 1.39 g) and superior feed efficiency throughout the experimental period. Haematological parameters such as haemoglobin, PCV, TEC, and TLC were significantly higher (P<0.05) in supplemented groups, particularly in T_3, indicating enhanced physiological and immune status. Similarly, serum biochemical analysis showed reduced cholesterol and triglyceride levels and increased total protein and albumin in treated birds. Carcass yield and dressing percentage were markedly improved in T_3, with higher breast, thigh, and organ weights compared to the control. Overall, the combined supplementation of *Spirulina platensis* and *Moringa oleifera* demonstrated synergistic benefits on growth performance, metabolic health, and carcass quality of Uttara chicks. The findings suggest that these natural feed additives can be effectively utilized as sustainable alternatives to antibiotic growth promoters in indigenous poultry production systems.

Keywords: Carcass traits, Growth performance, Haematology, *Moringa*, *Spirulina*, Uttara chicken.

PNP-37

Effect of feeding of sodium butyrate at graded levels in turkeys on development and morphometry of digestive and immune organs

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Seventy-two straight run Beltsville small white poults were divided into four treatment groups comprising of three replicates and six turkey poults in each replicate. The first group (T1) received a basal diet (NRC, 1994; turkey starter diet, 28% CP and 2800 ME), while the other three groups received a basal diet with sodium butyrate (SB) @0.01% (T2), @0.05% (T3) and @0.1% (T4). Poults fed SB had significantly lower (P=0.030) weight of proventriculus compared to poults of T1 group. Percent weight of large intestine was significantly higher (P=0.005) in poults of T2 group compared to poults of other treatment groups while other digestive organ parameters (percent weight of liver, gizzard, small intestine, large intestine, caeca and percent length of small intestine, large intestine and caeca) showed no significant difference after 8 weeks of age.There was no significant differencein development of lymphoid organs (bursa, thymus, and spleen) in poults after 8 weeks of age. However, percent weight of bursa was apparently higher in T4 poults compared to poults of other treatments. Poults of T4 showed significantly lower (P<0.001) crypt depth and higher (P=0.022) villus height/ crypt depth ratio compared to poults of other treatment groups. Poults of T4 showed significantly higher (P=0.007) medulla diameter (µm) and lower (P=0.012) cortex/medulla ratio compared to poults of other treatment groups. In conclusion, feeding of sodium butyrate @0.1% significantly increased villus height/crypt depth ratio reflecting better absorption without any adverse effect on digestive and immune organs in turkey poults.

Keywords: Sodium butyrate, Lymphoid organs, Villus height/Crypt depth ratio, Histomorphology, Turkeys.

PNP-38

Effect of *in ovo* feeding of graded levels of L-glutamine on percent hatchability, weekly cloacal temperature, growth performance and economics of coloured chicken during heat stress

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Four hundred and eighty sixfertile eggs of coloured chicken (Chabro)were set for incubation.On 18th day of incubation, fertile eggs were divided into five treatment groups – un-injected control (T1), injected with distilled water (Sham Control) (T2), injected with 0.5 ml of 0.5% L-glutamine (Gln) (T3), injected with 0.5 ml of 1% Gln (T4) and injected with 0.5 ml of 2% Gln (T5). After hatching, three hundred sixteen day-old straight-run colored chicks were further sub divided into three replicates with fifteen birds in each replicate. Birds were reared for 8 weeks and kept on a Basal or Control diet (BIS, 2007; broiler starter diet, 22% CP and 3100 ME till 4 weeks and thereafter broiler finisher diet, 20% CP and 3200 ME till 8 weeks of age). Average temperature, RH and THI were 34.34^{0}C, 64.14% and 86.76 respectively. There was no significant difference in percent hatchability among different treatment groups. However, chick weight was significantly higher (P=0.001) in T1 and chick weight egg weight ratio was significantly higher (P=0.004) in T1, T3 and T4. Cloacal temperature (CT) of day old chicks was significantly lower(P=0.052) in T3 and T5. Further, CT of birds of T3 and T4 was apparently lower compared to control group throughout the experiment and was significantly lower (P<0.041) at 8thweek of age. Weekly body weight gain (BWG) of chicks was higher in T1compared to other treatment groups till 5thweek of age. However, during 7th week of age, weekly BWG was apparently higher in T4 and significantly higher (P<0.009) at 8th week of age compared to other treatment groups. Feed intake was apparently lower in T4 and T5 chicks compared to T1 chicks throughout the experiment. Further, feed intake was significantly lower (P<0.01) in T4 and T5 birds at 1st and 3rd week of age compared to T1. FCR was significantly better (P=0.037) and feed cost per kg live weight gain was significantly lower(P=0.037) in T4 birds compared to control at 8th week of age.

Keywords: *In ovo* feeding, L-glutamine, Hatchability, Weekly growth performance, Economics, Coloured chicken, Heat stress.

PNP-39

Effect of *in ovo* feeding of graded levels of L-glutamine on hematology, blood biochemical attributes and carcass quality traits of coloured chicken during heat stress

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Four hundred and eighty-six fertile eggs of coloured chicken (Chabro) were set for incubation. On 18th day of incubation, fertile eggs were divided into five treatment groups – un-injected control (T1), injected with distilled water (Sham Control) (T2), injected with 0.5 ml of 0.5% L-glutamine (Gln) (T3), injected with 0.5 ml of 1% Gln (T4) and injected with 0.5 ml of 2% Gln (T5). After hatching, three hundred sixteen day-old straight-runcolored chicks were further sub divided into three replicates with fifteen birds in each replicate. Birds were reared for 8 weeks and kept on a Basal or Control diet (BIS, 2007; broiler starter diet, 22% CP and 3100 ME till 4 weeks and thereafter broiler finisher diet, 20% CP and 3200 ME till 8 weeks of age). Average temperature, RH and THI were 34.34^{0}C, 64.14% and 86.76 respectively. After 4 weeks of age, concentration of RBC was significantly higher (P=0.002) in T5 compared to other treatment groups. WBC, MCV and MCHC values were significantly lower (P=0.015) in T5 compared to other treatment groups. There was no significant difference in hematology attributes after 8weeks of age. After 4weeks of age, serum AST was significantly lower (P<0.001) in T3, T4 and T5 compared to control group birds. However, serum total protein, cholesterol and HDL were significantly higher (P<0.001) in T3 compared to T1. After 8 weeks of age, serum AST was significantly lower (P<0.001) in T4 compared to T5 birds. Further, cholesterol and HDL were significantly lower (P<0.001) in T4 and serum total protein was significantly higher (P<0.001) in T3 compared to T1 birds. No significant difference was found in colour and texture of breast and thigh meat and other carcass quality traits. Percent liver weight was significantly higher (P<0.001) in T2 and T3 compared to T1 birds. Hence it may be concluded that *in ovo* feeding of L- Gln resulted in higher serum total protein, cholesterol and HDL and lower serum AST without affecting the carcass quality traits.

Keywords: *In ovo* feeding, L-glutamine, Hematology, Blood biochemical attributes, Carcass quality traits, Coloured chicken, Heat stress.

PNP-40

Effect of varying dietary protein and energy levels on growth performance of Mewari chicken

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A study was conducted to evaluate the effect of varying dietary protein and energy levels on growth production performance of Mewari chicken during 8 to 20 weeks of age. The experiment was conducted at Poultry Farm, Department of Animal Production, Rajasthan College of Agriculture (MPUAT), Udaipur. A total 270 eight week-old Mewari grower of single hatch and similar body weights were randomly assigned to nine dietary groups with 3 x 3 factorial arrangements in CRD. Birds were fed with three levels of metabolizable energy viz. 2400, 2500 and 2600 kcal/kg and three levels of protein viz. 14, 16 and 18%. The birds were maintained following standard management practices under deep litter system. Body weight at 20th week was significantly (P<0.05) higher at 16% protein (1345.00g) and 2400 kcal/kg energy level (1350.90g). Overall body weight gain was found significantly (P<0.05) higher at 16% protein (841.72g) and 2400 kcal/kg energy level (849.67g). Feed intake was found significantly (P<0.05) lower at 2600 kcal/kg energy level, however protein and protein energy interaction had non-significant effect on feed intake of Mewari chicken. Overall feed conversion ratio was found significantly better on 16% protein (6.07) and at 2400 kcal/kg energy level (6.18). Interaction effect of protein and energy levels on FCR was found statistically non-significant. Digestibility coefficient of dry matter, crude fibre, ether extract and nitrogen free extract was non-significantly affected by protein and energy levels and their interaction. While, crude protein digestibility was significantly (P<0.05) affected by dietary protein levels, it found higher (71.21%) at 18% protein levels. It may be concluded that 16% crude protein and 2400 kcal/kg ME in the diet of Mewari chicken was found to be optimum for growth performance

Keywords: Mewari grower, dietary protein, dietary energy, body weight gain and feed conversion ratio.

PNP-41

Effect of *in ovo* feeding of guanidinoacetic acid at graded levels in broilers on development and morphometry of digestive organs during heat stress

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This study aimed to evaluate the effect of *in ovo* feeding of guanidinoacetic acid (GAA) at graded levels in broilers on the development and morphometry of digestive organs. A total of 588 fertile eggs of CARIBRO Vishal broiler breeder birds were incubated. On 18th day of incubation, the fertile eggs were divided into seven groups: T1(un-injected control), T2 (sham control) injected with 0.5 ml distilled water, T3 to T7 were injected with 0.5 ml w/v solutions containing 0.02%, 0.04%, 0.06%, 0.08%, and 0.10% GAA, respectively. After hatching, 315 straight run chicks were further divided into seven subgroups (three replicates of 15 birds each) and reared under deep litter system and fed with basal diet (BIS, 2007, starter till 3 weeks: 22% CP, 3100 kcal/kg ME and finisher till 6 weeks of age: 20% CP, 3200 kcal/kg ME). The average environmental conditions were 30.51°C, 85.16% RH, and THI of 84.52 indicating the broilers were reared under heat stress. No significant difference (P>0.05) was observed in the percent weight of proventiculus, liver, gizzard, small intestine, large intestine, caeca and length of small intestine, large intestine and caeca. However, *in ovo* GAA significantly affected the morphometry of villi. Villus height (VH) was significantly higher (P=0.027) in T6 birds compared to T1 (1559.3 vs. 1168.7). The villus height-to-crypt depth ratio (VH/CD) was also significantly higher (P=0.004) in T5 compared to T2, T3, T4 and T7 birds. Hepatocyte diameter decreased numerically in all GAA-treated groups compared to control indicating improved liver cellular health. In conclusion, *in ovo* administration of GAA, particularly at 0.06% level elicited villus height-to-crypt depth ratio thereby enhancing intestinal absorptive capacity and supporting hepatic efficiency in broilers, demonstrating its potential as a beneficial nutritional intervention for improving gut and liver health.

Keywords: *In ovo* feeding, Guanidinoacetic acid, Broiler, Jejunum, Villus height, Hepatocyte diameter.

PNP-42

Effect of feeding of sodium butyrate at graded levels on weekly cloacal temperature, weekly growth performance, economics, hematological and biochemical attributes of turkeys during heat stress

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Seventy-two straight run Beltsville Small White turkey poults were divided into four treatment groups comprising of three replicates and six turkey poults in each replicate. The first group (T1) received a basal diet (NRC, 1994; turkey starter diet, 28% CP and 2800 ME), while other three groups received a basal diet with sodium butyrate (SB)@0.01% (T2), @0.05% (T3) and @0.1% (T4). Weekly temperature humidity index (THI) was recorded with highest during 5th week (85.81), lowest during 3rd week (83.6) and THI (above 80) throughout the experiment indicating poults were reared during heat stress. Cloacal temperature of poults was significantly lower (P<0.05) in poults of T4 during 1st, 6th, 7th and 8th week of age. Poults of T3 and T4 showed significantly higher (P=0.045) body weight than T1 poults at 1stweek of age, while T2, T3, and T4 poults had significantly higher body weight at 4th (P=0.015) and 8th (P=0.025) week of age. Poults of T3 and T4 showed significantly higher (P=0.049) body weight gain than T1 at 1st week of age, while T2, T3 and T4 poults had significantly higher body weight gain at 7th (P=0.025) and 8th (P=0.032) week of age compared to T1. After 8 weeks of age, uric acid (mg/dL) was significantly lower (P=0.047) in T4 poults compared to poults of other treatment groups. HDL cholesterol was significantly higher (P=0.047) in poults of T3 compared to other groups. In conclusion, SB fed groups showed apparently higher body weight and body weight gain throughout the experiment, with significantly higher body weight and weight gain in poults fed @0.1% SB during the 1st, 4th, 7th, and 8th weeks along with significantly reduced cloacal temperature after 5 weeks of age without any adverse effect on biochemical attributes during heat stress.

Keywords: Sodium Butyrate, Cloacal temperature, Uric acid, Turkeys.

PNP-43

Effect of feeding of sodium butyrate at graded levels on cloacal temperature, growth performance and immunity of turkeys during heat stress

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Seventy-two straight run Beltsville Small White turkey poults were divided into four treatment groups comprising of three replicates and six turkey poults in each replicate. The first group (T1) received a basal diet (NRC, 1994; turkey starter diet, 28% CP and 2800 ME), while the other three groups received a basal diet with sodium butyrate @0.01% (T2), @0.05% (T3) and @0.1% (T4). Temperature humidity index (THI) was highest during 4-8 weeks (84.64), lowest during day old to 4 weeks (84.08) of age and THI 84.36 throughout the experiment indicating the poults were reared during heat stress. Cloacal temperature of poults was significantly lower (P=0.016) in poults of T4 during 4-8 weeks of age. Poults of T2, T3 and T4 showed significantly higher body weight gain than T1 poults during day old to 4 weeks (P=0.0165), 4-8 weeks (P=0.046) and day old to 8 weeks of age (P=0.025). Poults of T3 and T4 showed significantly better feed conversion ratio (P=0.032) and feed cost per kg live weight (P=0.034) during day-old to 4 weeks of age. There was no significant difference in humoral response and IgM titre against 1% Goat Red Blood Cells (GRBC) and cell mediated immune response to PHAP among the poults of different treatment groups. Serum IgG concentration was significantly higher (P=0.032) and IgM concentration of T4 poults was apparently higher as compared to poults of other treatment groups. In conclusion, feeding sodium butyrate at 0.1% significantly reduced cloacal temperature during 4-8 weeks of age. Further, body weight gain was significantly higher, feed conversion ratio was significantly better and feed cost per kilogram live weight was significantly lower during day old to 4 weeks of age. In addition, feeding of sodium butyrate @0.1% significantly increased serum IgG concentration in turkeys reared under heat stress conditions.

Keywords: Sodium Butyrate, Cloacal temperature, Immunity, Turkeys.

PNP-44

Behaviour of Emu Birds

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The study was undertaken on behaviour of emu birds stationed at Livestock Research Station, Palamaner. Emus are unduly alarmed when a stranger enters the shed, but responds to sounds and walks along with the person. They often pick up the pebbles/ small stones that help in grinding of food in gizzard. Emus enjoy the rain and love to puddle in mud water unlike other animals. Emus are aggressive in behaviour during the breeding months of September to February. Emu hens are dominant and vocalize by drumming sound mostly after dusk and before dawn. Running in circles and, aggressiveness are seen during pairing stage and paired birds eat, walk and stay together at specified spots in the pens. The male emu pecks the neck, back and tail region. Female emu raises tail feathers in sitting position for breeding. Male mounts by catching the neck and mates in less than a minute making grunting sounds A peculiar behaviour observed is that male emu takes the responsibility of incubating eggs and tries to covert the eggs with sand and mud present in the pen.

PNP-45

Effect of dietary supplementation of Fenugreek seed powder on growth performance in broiler chicken

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This study aimed to evaluate the effect of dietary supplementation of fenugreek seed powder (FSP) on growth performance and techno-economics in broilers. The experiment period was 42 days from 8th February 2025 to 22nd March 2025. A total of 160

day-old broiler chicks were randomly allotted to five treatment groups include T1 (control), T2 (2.5 g FSP/kg basal diet), T3 (5 g FSP/kg basal diet), T4 (7.5 g FSP/kg basal diet) and T5 (10 g FSP/kg basal diet). The dietary supplementation of FSP at 5 g/kg basal diet significantly ($p<0.05$) improved body weight, body weight gain and better FCR during the first and third weeks compared to other dietary treatments. Consequently, this supplementation also resulted in higher cumulative mean body weight gain and better cumulative mean FCR from 1 to 3 weeks. In contrast, birds supplemented with 2.5 g of FSP per kg basal diet showed improved body weight, body weight gain and better FCR during the second week. Feed consumption was not affected, except during the second week, when the birds in the group supplemented with 10 g of FSP per kg basal diet recorded the highest value. The techno economic analysis revealed that birds supplemented with 5 g of FSP per kg basal diet yielded the highest net profit per kg body weight compared to the other dietary groups. In conclusion, supplementation of 5 g of FSP per kg basal diet can be recommended during the pre-starter and starter phases of broilers to improve growth performance and net profit.

Keywords: Fenugreek seed powder, Broiler performance, Feed conversion ratio, Growth performance, Techno-economics.

PNP-46

Optimization of Dietary Digestible Lysine Levels to Enhance Production Performance in White Leghorn Layers during the Late Laying Phase

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A study was conducted to evaluate the effect of graded levels of digestible lysine (dLys) on the production performance of White Leghorn layers during the late laying phase (57–69 weeks of age). A total of 2,025 layers aged 56 weeks were randomly allotted to five dietary treatments containing 0.56, 0.58, 0.60, 0.62, and 0.64% dLys, each with nine replicates of 45 birds. The experimental diets were offered *ad libitum* for 12 weeks under open-sided colony cage housing. Data were recorded for every 28 days and subjected to statistical analysis. Findings indicated that increasing dietary dLys levels significantly ($P<0.01$) improved egg production, egg mass, egg weight, and feed conversion ratio (FCR), while feed intake, body weight, and livability remained unaffected. Birds receiving 0.62 and 0.64% dLys achieved the highest egg production (88.19 and 88.28%), egg mass (51.04 and 51.23 g/bird/day), and superior FCR (2.184 and 2.173), reflecting enhanced protein utilization efficiency at higher lysine concentrations. Based on performance responses, the optimal dietary dLys requirement for layers during the late production phase was estimated at approximately 0.62%, corresponding to an intake of 690 mg dLys per bird per day in diets containing 15% crude protein. Overall, optimizing digestible lysine at 0.62% was found to enhance productivity and feed efficiency in White Leghorn layers during the late laying period without adversely affecting feed intake or bird health.

Keywords: White Leghorn layers, Digestible lysine, Egg production, Feed conversion ratio, Late laying phase, Performance optimization.

PNP-47

Effect of supplementation of herbal product (Oxy2grow) on growth performance and economics of broiler production

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The present experiment was conducted on 360-day-old Vencobb-430Y straight run broiler chicks randomly distributed into six treatment groups with 4 replicates having 15 chicks each for 42 days. The control T1 was fed basal diet. The treatment groups T2, T3 and T4 were supplemented with the herbal product (Oxy2grow) @ 15g, 25g and 35g /1000lit of water respectively. The test product (Oxy2grow) @ 30g and 50g /Ton of feed was supplemented in the treatment group T5 and T6 respectively. It was reported that, the live body weight and cumulative weight gain at the end of 6th week were significantly ($P<0.05$) increased in T4 (Oxy2grow@35g/1000lit of water), T5 and T6 (Oxy2grow) @ 30g and 50g /Ton as compared to control group T1. At 6th week, significantly ($P<0.05$) higher cumulative feed intake was recorded in groups T1, T2 and T3. However, the feed intake in group T4, T5 and T6 was significantly lower. Improved cumulative FCR was recorded in group T6 (Oxy2grow @50g) followed by T5, T4, T1 and T3. However, T2 recorded significantly very poor ($P<0.05$) FCR. The cost of production Rs/kg was found to be lowest in the group T6 (Rs.76.70/kg) and was

highest (Rs.87.02 and 86.15/kg) in group T2and T3 respectively. Whereas the group T4 and T5 recorded lower cost of production (Rs.77.82 and 78.15/kg) as compared with Control (Rs.85.17/kg). Thus, it was concluded that the inclusion of herbal product (Oxy2grow) @ higher doses 30g, 35g and 50g / through feed and water had resulted in better body weight gain improved feed conversion ratio along with higher returns improving the economics of broiler production.

Keywords: Herbal product, Growth performance, Broilers, Economics.

PNP-48

Effect of supplementation of betaine hydrochloride on growth performance in broilers

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An experiment was conducted on 120 day-old Cobb broiler chicks to study the effect of betaine hydrochloride on growth performance. The chicks were randomly divided into four dietary treatments (T1 to T4) each comprising three replicates of ten birds for 42 days. T1 was fed with control diet based on BIS (2007) [2] standards, while treatments T2, T3, and T4 were supplemented with 0.1, 0.2 and 0.25% betaine hydrochloride, respectively. The studies revealed that supplementation of betaine hydrochloride exhibited significantly higher body weights and improved feed conversion ratio compared to the control group. However, no significant differences were observed in feed intake and survivability across all groups at the end of the experiment. It was concluded that supplementing betaine hydrochloride improved growth performance in broilers.

Keywords: Betaine hydrochloride, Body weight, Feed intake, Feed conversion ratio, Survivability.

PNP-49

Effect of supplementation of betaine hydrochloride on gut health in broilers

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An experiment was carried out using 120 day-old Cobb broiler chicks to evaluate the impact of betaine hydrochloride supplementation on gut health. The chicks were randomly allotted to four dietary treatments (T1 to T4), each consisting of three replicates with ten birds, and reared for 42 days. The control group (T1) received a basal diet formulated as per BIS (2007) [2] standards, whereas T2, T3, and T4 diets were supplemented with 0.1%, 0.2% and 0.25% betaine hydrochloride, respectively. The results indicated that dietary inclusion of betaine hydrochloride significantly enhanced villus height and crypt depth in the duodenum, jejunum, and ileocaecocolic junction. Additionally, it led to a reduction in *Escherichia coli* counts and an increase in *Lactobacillus* populations compared with the control group at the end of the trial. It was therefore concluded that betaine hydrochloride supplementation positively influences gut morphology and microbial balance in broiler chickens.

Keywords: Betaine hydrochloride, *Escherichia coli, Lactobacillus,* Gut microbial load, Gut morphology, Gut health.

PNP-50

Effect of different dietary energy and protein levels on egg production of Aseel cross up to 60 weeks of age

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A study was conducted to optimize energy and protein requirement in native chicken variety (Aseel cross) for a period of 60 weeks age involving 540 chicks. In the first phase, nine diets were formulated with three levels of energy (2500,2600, 2700 kcal ME/Kg) each with three levels of protein (16,17, and 18% CP) following 3x3 factorial design. Each treatment was allotted with six replicates of 10 chicks each. In the second phase (13-20 wks) the birds fed with

same three levels of energy each with three levels of protein (12,13, and 14 % CP) and in third phase (21-60 wks) birds fed with three levels of energy (2400, 2300, 2200 kcal ME/Kg) each with three levels of protein (12,13, and 14 % CP). All the nine treatments received same management practices and eggs were collected for 60 weeks of age and analysed for laying performance. Among the treatment groups, T2 (3.95-9.39) and T3 (4.05-4.09) had significantly ($P<0.05$) better FCR per dozen of eggs than T8 (4.57 - 46.13) and T9 (5.7 - 126.83). HDEP production values significantly ($P<0.05$) higher in high energy and medium energy treatment groups, T3 (HDEP: 28.35 to 35.51%) and T6 (HDEP: 23.53 to 27.46%) from 41 to 60 weeks of age than low energy (T8, T9) treatment groups (HDEP :1.89 to 33.15%) with different levels of protein. Different levels of energy and protein did not significantly influence egg production during 25-36 weeks. During 37-60 weeks of age, birds fed with 2400, 2300 Kcal ME/Kg and 12% CP diet had significant effects on average weekly egg production, egg mass, feed efficiency/ kg egg mass, feed efficiency/dozen eggs, HDEP and HHEP. The results revealed that the diet with 2400 Kcal ME/Kg and 12% CP is found to be optimum for egg production from 21-60 weeks of age in Aseel crossbred birds.

Keywords: Energy, Protein, HDEP (Hen Day egg production), CP (Crude protein), Native Chicken.

PNP-51

Effect of Peppermint leaves and probiotics on performance of Jabalpur colour hens

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A factorial designed experiment was conducted to study the effect of dried peppermint leaves and probiotic on production traits of Jabalpur Colour hens during late laying period (60-72wks). A total of 108 healthy birds were randomly allocated in individual cages, comprising of nine treatment group having 12 birds in two replicates. A basal diet containing 17% protein and 2800KcalME/kg diet was supplemented with 3 levels of peppermint leaves powder @ 0g/kg (P0), 10g/kg (P1) and 20g/kg (P2) diet. Each of this diet was further supplemented with 3 levels of probiotic (Saccharomyces cerevisiae, 10 billion CFU/10g) @ 0g/100kg (B0), 10g/100kg (B1) and 15g/100kg (B2) diet, making a total of nine dietary treatments. Daily measured amount of nine rations was offered to experimental flock for a period of 84 days, to assess production performance traits. The main results shows that weekly average egg production (EP) and egg weight (EW) in each period were non significantly different between P1 and P2 and significantly higher than P0. Similar results were observed for total EP and overall mean EW. B2 probiotic level had significantly better EP and EW than B0 and B1 probiotic. Egg mass (EM) was better in P1¬ peppermint leaves and B2 probiotic levels. Feed intake (FI) between P1, P2 and B1, B2 did not differ significantly and there were significantly better than P0 and B0. Periodically average FE/kg egg mass and FE/ dozen of egg was found better in P1 with significant difference from P0. Probiotic levels B2 showed significantly better FE/kg egg mass and per dozen of eggs produced. Interaction result shown that EP was significantly higher in P2B2¬ whereas EW was significantly better in P1B2 treatment than all other interactions. All periods shown significantly higher EM in P2B¬2. FI of P1B1 and P2B2 was non significantly different and significantly higher than all other interactions during II, III and overall period weekly and overall mean FE per kg egg mass and per dozen egg was non significantly differ in P1B2 and P2B2 and there were significantly better than other combinations. Egg quality traits were mostly non-significant. Feed cost per kg egg mass and per dozen of egg was found lowest in P0B2 treatment. Result concluded that P1 peppermint level, B2 probiotic level significantly better in improving EP, EW, EM, FI and FE. Interactions of P1B1 and P2B2 had significant higher EP, EW, EM, FI and FE. Economically P0B2 diet has lowest FE/ kg egg mass and per dozen eggs.

Keywords: Jabalpur Colour hens, Peppermint leaves, Probiotics.

PNP-52

Effect of nano zinc oxide supplementation on egg weight and egg quality parameters in Kuttanad ducks

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An experiment was conducted at the Avian Research Station, Thiruvazhamkunnu, Kerala, to evaluate the effect of dietary nano zinc oxide (ZnO-NPs) supplementation on egg weight and egg quality parameters in Kuttanad ducks. A total of 160 birds, aged 16 weeks, were randomly assigned to five dietary treatments (T1: basal diet, T2: basal diet + 80 mg/kg inorganic Zn, T3: basal diet + 20 mg/kg Zn-NPs, T4: basal diet + 40 mg/kg Zn-NPs, T5: basal diet + 60 mg/kg Zn-NPs) in a completely randomised design, with four replicates per treatment and eight birds per replicate. The birds were fed with experimental grower and breeder diets from 17 to 20 and 21 to 40 weeks of age, respectively. The data for the experiment were collected over 16 weeks from 24 to 40 weeks of age, divided into five 28-day periods. The egg quality parameters like egg weight, shape index, albumen index and yolk index had no significant difference during the experimental period. However, shell thickness showed significant ($p<0.05$) difference between treatment groups during all periods of study except the last period. The 40 mg Zn-NPs supplemented group had significantly higher shell thickness compared to the other treatment groups. The results of this study highlight the potential benefits of ZnO-NPs supplementation in enhancing the shell thickness of Kuttanad ducks under standard management conditions.

Keywords: Kuttanad ducks, Nano particles, Egg quality, Shell thickness.

PNP- 53

Growth performance and economics of broiler chickens supplemented with amoxicillin, synbiotic and thyme essential oil

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A feeding trial was conducted to investigate the effects of amoxicillin, synbiotic and thyme essential oil as feed additives on growth performance and economics in broiler chickens. A total of200 Cobb broiler chick of one week of age were randomly distributed into 5dietarytreatment groups: T_0(Basal diet only); T_1(Basal diet + amoxicillin @ 200mg/kg); T_2(Basal diet + synbiotic @ 100mg/kg), T_3 (Basal diet + thyme essential oil @ 2ml/kg) and T_4(Basal diet + synbiotic @ 50mg/kg + thyme essential oil @ 1ml/kg). Each group contained 4 replicates with10 birds for 35 days period. The results revealed a significant improvement in body weight and feed conversion ratio in treatment groups T_1 (amoxicillin) and T_4 (combination of synbiotic and thyme essential oil). The highest cumulative body weight and feed intake was observed in treatment group T_1(amoxicillin). However, feed conversion ratio was much improved in the treatment group T_4in which combination of synbiotic and thyme essential oil was given. No mortality was reported in the whole experimental trial in any treatment groups. Highest profit over control was observed in T_1followed by T_4treatment groups. In conclusion, supplementation of synbiotic, thyme essential oil alone or in combination can be beneficial in the commercial broilers.

Keywords: Amoxicillin, economics, mortality, symbiotic and thyme essential oil.

PNP-54

Effect of supplementation of *Moringa oleifera* and citric acid on the protein efficiency of chicken broilers

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An experiment was conducted to study the effect of *Moringa oleifera* and Citric acid supplementation on the performance of broilers. Two hundred and twenty five day old unsexed commercial broiler chicks were subjected to five dietary treatments consisting of 15 broiler chicks in each replicate reared for a period of 6 weeks to find the effect of following treatments namely T_0 group (negative control i.e. basal ration without antibiotic), T_1 group (control i.e. basal ration with antibiotics), T_2 group (basal Ration + 1% *M. oleifera*), T_3 group (basal Ration + 0.5 % Citric acid) and T_4 group (basal Ration + 1% *M. oleifera* + 0.5% Citric acid).Temperature and humidity of the shed were recorded daily to calculate Temperature Humidity Index (THI). Standard feeding and all other managemental practices were followed during the experimental period of 42 days. Supplementation of 1% *Moringa oleifera* and 0.5% Citric acid (T4) gave best result and statistically ($P<0.05$) improved the protein efficiency. Significant ($P<0.05$) difference was observed in the values of Protein efficiency and energy efficiency at 14, 21 and 35 days of age in *Moringa oleifera* and Organic acid supplemented group as compared to control group. There was no detrimental effect of 1% *Moringa oleifera* and 0.5% Citric acid on health and performance of broiler chicken. It can be concluded that addition of 1% *Moringa oleifera* and 0.5% Citric acid alone or in combination can be effectively supplemented as an alternative to antibiotic growth promoter in broiler chicken ration without any adverse effect on survivability of birds.

Keywords: *Moringa oleifera*, Citric acid, Protein efficiency, Chicken Broilers.

PNP-55

Effect of dietary supplementation of bamboo (*Bambusa tulda*) leaf powder on heamato-biochemical parameters of broiler chickens

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A total of 144-day-old broiler chicks (Cobb 430Y) were procured and divided into 4 groups (T_0, T_1, T_2 and T_3), each group was further divided into 3 replicates, 12 chicks each (144÷4=36÷3=12). The birds were reared under deep litter system with *ad libitum* feed and water under standard management condition. The birds were fed with basal diet without bamboo leaf powder (T_0), and basal diets with bamboo leaf powder @ 0.25, 0.50 and 0.75% in T_1, T_2 and T_3 respectively. At 42 days of age, 12 birds (3 birds from each group) were selected randomly and blood (5ml) samples were collected aseptically from wing vein to study heamato-biochemical parameters. The results showed that hemoglobin levels for groups T_0, T_1, T_2, and T_3 were recorded as 10.65 ± 0.13, 10.59 ± 0.12, 10.81 ± 0.27, and 10.78 ± 0.18 g/dl, respectively. The PCV levels (%)were also found to be 33.30 ± 0.25, 33.60 ± 0.31, 33.66 ± 0.12, and 33.52 ± 0.28 in T_0, T_1, T_2, and T_3groups respectively. Similarly, total protein levels (mg/dl) were recorded to be 4.20 ± 0.01, 3.98 ± 0.04, 4.14 ± 0.16, and 4.23 ± 0.22 in T_0, T_1, T_2, and T_3 groups respectively. The uric acid levels (mg/dl) did not show any significant ($P<0.05$) differences among different treatment groups. The ALT levels in groups T_0, T_1, T_2, and T_3 were recorded as 13.69 ± 1.12, 13.52 ± 0.52, 13.89 ± 0.29, and 13.64 ± 0.83 IU/ml, respectively. The AST levels for groups T_0, T_1, T_2, and T_3 were recorded as 61.51 ± 2.09, 60.20 ± 0.73, 61.45 ± 1.33, and 61.45 ± 2.78 IU/ml, respectively. The creatinine levels for groups T_0, T_1, T_2, and T_3 were recorded as 0.36 ± 0.02, 0.37 ± 0.06, 0.37 ± 0.01, and 0.39 ± 0.05 mg/dl, respectively. From the study, it may concluded that the haemato-biochemical parameters did not show any significant ($P<0.05$) difference among treatment groups as compared with control group indicated no adverse effect on broiler chickens fed with bamboo leaf powder.

Keywords: bamboo, heamato-biochemical parameters, broiler chickens.

PNP-56

Carcass traits and relative organ weights of broiler chickens fed with bamboo (*Bambusa tulda*) leaf powder

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A total of 144 day-old straight run broiler chicks (Cobb 430Y) with uniform body weights were utilized to study carcass traits and relative organ weights of broiler chickens fed with bamboo (*Bambusa tulda*) leaf powder. The chicks were divided into 4 different groups with 36 chicks each, which were further divided into 3 replicates with 12 chicks each. The chicks were kept in deep litter system under standard management and were fed with *iso*-caloric and *iso*-nitrogenous basal diet without any bamboo leaf powder (T_0) and basal diets with bamboo leaf powder @ 0.25 (T_1), 0.50 (T_2) and 0.75% (T_3) respectively up to 42 days of age. At 42 days of age, 12 birds (3 birds from each group) were selected randomly and were slaughtered humanely. The birds were eviscerated and different cut-up parts were separated and weighed individually and recorded. The results showed that the mean dressing percentages for T_0, T_1, T_2, and T_3 groups were 70.13±0.37, 70.34±0.47, 71.49±0.42 and 71.60±0.49%, respectively and were found to be significantly ($P<0.05$) higher in treatment groups than control. The breast and thigh yields were also found to be significantly ($P<0.05$) higher in treatment groups than control group. However, in case of neck, back, drumstick and wings the corresponding values did not show any significant difference between control and treatment groups. The mean per cent weights of livers were recorded as 2.37±0.07, 2.23±0.04, 2.24±0.06, and 2.24±0.07 for T_0, T_1, T_2, and T_3 groups, respectively and the values did not show any significant difference between treatment and control groups. Similarly, corresponding values for gizzard, heart, head, shank, intestine, kidney, spleen and Bursa of Fabricius did not show any significant difference between treatment and control groups. Hence, from above study, it may be concluded that, supplementation of bamboo leaf powder had positive effect on dressing percentage, breast and thigh yields, while no adverse effect on other cut-up parts and relative organ weights of broiler chickens.

Key words: Carcass traits, relative organ weights, broiler chickens, bamboo.

PNP- 57

Performance of Khaki Campbell ducks fed on different levels of wheat or broken rice based diets under intensive rearing system

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The present study was conducted to study the performance of Khaki Campbell ducks fed on different levels of wheat or broken rice based diets under intensive rearing system. Khaki Campbell ducklings (240, day old) were divided into three groups having four replicates per group and 20 ducklings per replicate. Three types of diets were prepared, without broken rice (BR-0) and with broken rice, replacing 25 (BR-25) and 50 (BR-100) percent wheat. The three experimental diets were offered randomly to the above three groups for a period of eight weeks. Data were recorded for daily feed intake, weekly body weight and feed conversion ratio; and were statistically analyzed. All the diets were iso-nitrogenous and iso-caloric. The day old body weight (34.66-35.64, g) was similar among the groups. Similarly, at 8th week of age, there was no significant difference in the body weight (1058.93-1096.90, g) among the groups. The daily feed intake (88.43-92.58, g) at 8th week was also similar among the groups. Up to 8th week of age, there was no significant difference in the cumulative feed intake (3522.50-3628.25, g) among the groups. The feed conversion ratio up to 8th week of age in different groups ranged from 3.36-3.44 and was similar. The total feed cost in BR-50 groups (Rs.137.84) was lower than BR-0 group (Rs. 146.91) and BR-25 group (Rs.142.70), which were similar. It can be concluded that rearing of Khaki Campbell ducks up to eight weeks by feeding diets formulated with broken rice with total replacement of wheat is beneficial.

Keywords: Ducks, Egg, Khaki Campbell, Performance, Rice, Wheat.

PNP-58

Enhancement of immunity in broiler chickens through *Moringa oleifera* ethanolic leaf extract supplementation in drinking water

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This study evaluated the immunomodulatory effects of *Moringa oleifera* ethanolic leaf extract (MOELE) in broiler chickens. A total of 144 day-old Vencobb 430 chicks were randomly assigned to four treatment groups, each with three replicates of 12 birds. Treatments included: T_0 (control, no extract), T_1 (2 mL/L MOELE), T_2 (4 mL/L MOELE), and T_3 (6 mL/L MOELE) administered via drinking water. Bursa of Fabricius indices in T_2 and T_3 group were significantly ($P < 0.05$) higher than in T_0 and T_1 group, while spleen and thymus indices were highest in T_3 group. By day 42, heterophil counts were significantly lower and lymphocyte counts significantly higher ($P < 0.05$) in all MOELE groups compared to control, resulting in improved heterophil-to-lymphocyte ratios. Hemagglutination inhibition titres against Newcastle disease virus were significantly greater ($P < 0.05$) in T_2 and T_3 group at day 42. These findings suggest that MOELE supplementation in drinking water enhances immune organ development, improves leukocyte profiles, and strengthens vaccine-induced immunity in broiler chickens.

Keywords: *Moringa oleifera*, Ethanolic leaf extract, Broiler chickens, Immune response, Newcastle disease vaccine.

PNP- 59

Performance of broiler chicken with supplementation of *Moringa oleifera* leaf extract in drinking water

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This study evaluated the effects of Moringa oleifera leaf extract (MOLE) supplementation in drinking water on the productive performance of broiler chickens. A total of 144 day-old Cobb 430Y chicks with uniform body weights were randomly assigned to four groups (T_0–T_3) of 36 birds each, with three replicates per group (12 birds per replicate). Birds were reared under a deep litter system and fed an iso-caloric, iso-nitrogenous diet. MOLE was administered at 0 (control), 2, 4, and 6 mL/L of drinking water for groups T_0, T_1, T_2, and T_3, respectively, up to 42 days of age. Final body weights were significantly higher ($P < 0.05$) in all MOLE-treated groups (2406.61–2454.19 g) compared to the control group (2220.26 g), with no significant differences among the treated groups. Feed intake was lower in T_2 and T_3 compared to T_0 and T_1 group. Feed conversion ratio (FCR) improved progressively from T_0 (1.83) to T_3 group (1.58). Broiler Production Efficiency Index (BPEI) values were higher in all treated groups, with the highest in T_3 group. Production cost per bird was similar across treatments, but gross profit increased markedly with MOLE supplementation, highest in T_3 (₹34.97) group compared to control group (₹3.98). These results indicate that MOLE supplementation at 6 mL/L in drinking water can enhance growth performance, improve feed efficiency and increase profitability in broiler production.

Keywords: *Moringa oleifera*, leaf extract, broiler performance, feed conversion ratio, profitability.

PNP-60

Effect of supplementation of *Moringa oleifera* and citric acid on feed efficiency of chicken broilers

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An experiment was conducted to study the effect of *Moringa oleifera* and Citric acid supplementation on the performance of broilers. Two hundred and twenty five day old unsexed commercial broiler chicks were subjected to five dietary treatments consisting of 15 broiler chicks in each replicate reared for a period of 6 weeks to find the effect of following treatments namely T_0 group (negative control i.e. basal ration without antibiotic), T_1 group (control i.e. basal ration with antibiotics), T_2 group (basal Ration + 1% *M. oleifera*), T_3 group (basal Ration + 0.5 % Citric acid) and T_4 group (basal Ration + 1% *M. oleifera* + 0.5% Citric acid).Temperature and humidity of the shed were recorded daily to calculate Temperature Humidity Index (THI). Standard feeding and all other managemental practices were followed during the experimental period of 42 days. Supplementation of 1% *Moringa oleifera* and 0.5% Citric acid (T_4) gave best result and statistically ($P<0.05$) improved feed efficiency. At 35 and 42 days of age, T_4 and T_2 showed significantly better ($P<0.05$) FCR than T_1 and T0 treatments groups. The corresponding mean cumulative FCR of broilers recorded on 35 and 42 days of age ranged from 1.68 (T4) to 1.82 (T0), and 1.82 (T4) to 1.98 (T0), respectively. There was no detrimental effect of 1% *Moringa oleifera* and 0.5% Citric acid on health and performance of broiler chicken. It can be concluded that addition of 1% *Moringa oleifera* and 0.5% Citric acid alone or in combination can be effectively supplemented as an alternative to antibiotic growth promoter in broiler chicken ration without any adverse effect on survivability of birds.

Keywords: *Moringa oleifera*, Citric acid, broiler performance, feed conversion ratio.

PNP-61

Effect of Vitamin C, Vitamin E and Selenium supplementation on antioxidant enzyme status in broilers under heat stress

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The present study was conducted to study the effect of dietary supplementation of Vitamin C, Vitamin E and Selenium on Antioxidant enzyme status of broiler chicken during summer season. A total of eighty broiler chickens of day old age were divided randomly into four treatment groups. Each treatment contained two replicates with ten birds each, were used for this study. Control group (C1) fed with basal diet, T1 group supplemented with Vitamin C (200 mg/ kg), T2 group supplemented with Vitamin E (150mg/kg) and T3 group supplemented with Selenium (0.3mg/kg) to the basal diet. Superoxide dismutase (SOD), glutathione peroxidase (GSH-px), catalase, reduced glutathione (GSH) and lipid peroxidation levels in plasma were measured at the end of 6 weeks of age. Dietary supplementation of Vitamin C increased SOD, GSH-px, catalase enzyme levels significantly ($p<0.05$). Whereas, supplementation of Vitamin E and Selenium effectively enhanced the levels of GSH-px, catalase, and reduced glutathione. However, lipid peroxidation levels in plasma were decreased significantly ($p<0.05$) in all treatments except control group. It is concluded that dietary supplementation of Vitamin C, Vitamin E and Selenium reduced oxidative stress caused by high environmental temperature in broilers, by enhancing antioxidant enzyme levels.

Keywords: Antioxidants, Vitamin C, Vitamin E, Selenium, lipid peroxidation, Broiler chicken.

PNP-62

Impact of Rapeseed Meal in the diet on Japanese Quail growth performance, serum biochemical profile, carcass features, and cost-effectiveness

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This study was aimedto evaluate the effect of incorporation of Rapeseed meal (RSM) at three levels in diets of Japanese quail on growth performance, serum biochemical profile, carcass traits, sensory parameters, and cost economics. A biological trial was conducted using 150 day-old Japanese quails randomly divided into five dietary treatments with three replicates of ten birds each. The treatments consisted of diets containing RSM at 0% (T_1), 10% (T_2), 15% (T_3), 17.5% (T_4), and 20% (T_5), formulated to be iso-caloric and iso-nitrogenous. Birds were reared in battery cages for five weeks with feed and water provided *ad libitum*. Chemical composition of RSM was analyzed, and parameters such as growth performance, serum biochemistry, carcass characteristics, meat quality, nutrient digestibility, and feed cost per kilogram gain were evaluated. The inclusion of RSM up to 20% had no significant effect on mean body weight, weight gain, or feed conversion ratio. Serum triglycerides and VLDL-C levels decreased significantly ($p<0.01$) with increasing RSM, while other biochemical parameters remained unaffected. Carcass yield, organ weights, meat pH, extract release volume, and water-holding capacity showed no significant changes. Sensory attributes including colour, juiciness, tenderness, and overall acceptability were unaffected. The digestibility coefficients for dry matter (DM), crude protein (CP) and ether extract (EE) did not show any significant effect up to 15% but were significantly ($p<0.05$) decreased at 20%level. The study indicated that the feed cost /kg gain were ₹ 126.31, 129.78, 122.94, 118.87 and 113.50 for T_1, T_2, T_3, T_4 and T_5, respectively, indicating significantly lower ($p<0.01$) in quails fed with 20% RSM as compared with other treatment groups. It was concluded that Rapeseed meal can be safely incorporated up to 20% in Japanese quail diets without detrimental effects on growth, health, or meat quality, while significantly reducing production costs.

Keywords: Rapeseed Meal, Japanese Quail, growth performance, serum biochemical profile, carcass features

PNP-63

Histological evaluation of Coriandrum sativum powder supplementation on intestinal villi morphometry and goblet cell density in broiler chickens

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Effect of supplementation of different levels coriander seed powder (CSP) was evaluated in broilers chicken. The experimental design consisted of 5 treatment groups (10 replications of 5 each); T1 basal diet (BD) without antibiotic, T2: BD + antibiotic (BMD at 500 gm/ton), T3: BD + CSP (0.5%), T4: BD + CSP (1.0%), T5: BD + CSP (1.5%). On 42nd day during slaughter, 2 cm long segments of duodenum, jejunum and ileum of six birds from each treatment were collected, processed for histological paraffin sections and stained with haemotoxylin and eosin stain. Histological sections were examined under 2X of light microscopy with micrometry and photographic attachment. A total of 20 intact well oriented crypt-villous units per bird were selected randomly, measured and the mean length was calculated for each sample. Villous height was measured from the tip of the villi to the base between individual villi, and crypt depth measurements were taken from the valley between individual villi to the basal membrane. The morphological measurements of duodenum revealed that supplementation of CSP at 1.5% level significantly ($P<0.05$) increased the villous height (VH), villous height: crypt depth ratio (VH:CD), villous width (VW) and goblet cell number compared to control, antibiotic and other treatments. However, among all the treatment groups, significantly higher CD was recorded in antibiotic group. The CD in CSP groups were intermediate and higher than control. Supplementation of all CSP groups significantly ($P<0.05$) increased the jejunum and ileum VH, CD, VW, VH:CD and goblet cell number compared to control and antibiotic groups. The highest goblet cell number, VH and CD was recorded in CSP 1.5% group followed by CSP 1.0% and CSP 0.5% groups. This study clearly demonstrates dietary inclusion of CSP at 1.5% may be an effective strategy for improving gut health of broilers.

Keywords: Coriandrum sativum, intestinal villi morphometry, goblet cell density, Broiler Chickens.

PNP-64

Liquorice as a phytogenic booster: Enhancing intestinal morphology in Japanese Quails

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A study was conducted to assess the impact of dietary liquorice (Glycyrrhiza glabra) supplementation on intestinal histomorphology and performance in Japanese quails. Iso-nitrogenous and iso-caloric diets, formulated per NRC (1994) standards, incorporated liquorice powder at 0% (T_1; control), 0.05% (T_2), 0.10% (T_3), 0.15% (T_4), and 0.20% (T_5) levels. A total of 150 day-old quail chicks were randomly assigned to five dietary treatments, each with three replicates of ten birds, and reared for five weeks. Statistical analysis revealed that liquorice inclusion had a positive influence on intestinal development. The mean duodenal length increased from 12.34 ± 0.45 cm (T_1) to 13.20 ± 0.36 cm (T_5), while the jejuno-ileal length increased from 25.67 ± 0.82 cm (T_1) to 26.40 ± 0.66 cm (T_5). Analysis of variance indicated significant ($p < 0.05$) treatment effects, and post-hoc Duncans test revealed that T_5 (0.20% liquorice) had significantly higher duodenal and jejuno-ileal lengths compared to the control and other groups. Histological analysis showed significant improvements in villus height and villus:crypt ratio in liquorice-supplemented groups, particularly at 0.20% (T_5), indicating enhanced mucosal architecture and nutrient absorption compared to the control. In conclusion, dietary liquorice supplementation at 0.20% enhances intestinal morphology, promoting efficient digestion and absorption in Japanese quails. These findings establish liquorice as a potent phytogenic additive for improving intestinal integrity and performance in quail production systems.

Keywords: Japanese quails, liquorice, performance, intestinal histology, villus height.

PNP-65

Influence of turmeric oil concentrate and antioxidant supplementation on carcass yield and immune-biochemical parameters in broiler chickens

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The present study was conducted with an aim to study the effect of Turmeric Oil extracted Concentrate (TOC) supplementation on performance and carcass parameters in commercial broilers. Experiment was conducted on 288 broiler chicks reared in deep litter system. Birds were randomly categorized into eight dietary treatments with six replicates for each treatment group and six birds in each replicate (8×6×6). A standard Corn-soya based diet was prepared for starter and finisher and eight experimental diets were prepared by mixing the TOC at 0, 0.1, 0.2, 0.3 and 0.4 g/kg diet, Zinc, Vitamin E and Selenium at 60, 100 and 0.2 mg/kg diet levels, respectively. The chicks were reared in deep litter system with optimum brooding conditions from day one to 42 d of age. The results of present study revealed that supplementation of TOC significantly ($P<0.001$) reduced the abdominal fat percent in all treatments compared to control. The slaughter parameters like dressing yield, percent weight of heart, gizzard, liver, immune organs (bursa, thymus and spleen) weights and shank color score were comparable among treatment groups. Serum biochemical parameters viz., total protein and cholesterol were not affected with dietary treatment groups. Significantly ($P<0.001$) higher HI and CMI response was observed in birds fed diet containing TOC at 0.2g/kg diet, vitamin E and Se. Based on findings of present study it was concluded that supplementation of TOC up to 0.4 g/kg diet did not affect the slaughter parameters. However, dietary TOC supplementation even at lower concentrations (0.1g/kg diet) reduced the abdominal fat, while higher immune response observed with TOC supplementation at 0.2g/kg diet.

Keywords: Broiler, Commercial, Slaughter, Turmeric.

PNP-66

Comparative evaluation of natural and synthetic choline sources on the performance of broiler chickens under choline-deficient diets

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The experiment was conducted on 480 day-old straight-runVencobb-430Y broiler strain for 6 weeks period. The chicks were randomly distributed into eight treatment groups viz., A, B, C, D, E, F, G and H having four replicates, each comprising of 15 birds. The control group A received a basal diet without choline chloride, treatment groups B, C and D were supplemented with Synthetic choline chloride-60% (SCC) @ 1kg/ton, Natural Choline Formula (NCF) from Carus Laboratories Pvt. Ltd.@ 0.250 kg/ton and 0.500kg/ton of feed in basal diet, respectively. Whereas, group E having Choline deficient diet (CDD) and groups F, G and H supplemented SCC @ 1kg/ton, NCF @ 0.250 kg/ton and 0.500kg/ton of feed in CDD, respectively. The results at the end of 6th week, recorded significantly (P<0.01) higher live body weights and cumulative weight gain in groups B and D compared to control group A. Also, significantly (P<0.01) higher live body weights and weight gain were recorded in treatment groups F and H as compared to group E. The feed conversion ratio (FCR) was significantly (P<0.01) better in groups B and D as compared to group A. However, significantly (P<0.01) poor FCR was noted in group E as compared to groups F, G and H. The highest mortality was recorded in group E fed CDD as compared to all other groups. The significantly (P<0.01) better EPEF was recorded in birds supplemented SCC and NCF in a basal diet and CDD as compared to groups A and E. The cost of production per kg live weight for the groups A to H were Rs. 77.78, 75.75, 76.60, 74.47, 79.09, 76.72, 77.50 and 76.29, respectively. The highest net profit per kg live body weight was observed in treatment group D followed by groups B, H, C, F, G, A and E. Hence, it is concluded that supplementation of NCF @ 0.500 kg/ton and SCC @ 1kg/ton of feed improved overall growth performance and economics of broiler production.

Keyword: Natural choline formula, Synthetic choline chloride, Growth performance, Economics, Broilers.

PNP-67

Effect of supplementation of kankrej cow urine distillate and panchgavya on performance of layer chickens

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The present experiment was conducted on BV-300layer hens for a period of 20 weeks (53–72 weeks of age) to evaluate the effect of Panchgavya and Kankrej cow urine distillate on production performance, egg weight, feed intake, and feed conversion ratio parameters. A total of two hundred birds were divided into four dietary treatments: T_1 (Control – basal diet), T_2 (basal diet + 1 ml cow urine distillate/bird/day), T_3 (basal diet + 1 ml Panchgavya/bird/day), and T_4 (basal diet + Tylosin tartrate @ 200 mg/kg feed) and each treatment contain 50 birds. The results revealed that overall hen-day egg production (%) was 85.12, 85.07, 85.20, and 87.77 in T_1, T_2, T_3, and T_4, respectively, with significantly (P<0.01) higher production in T_4 group. The mean egg weight (g) was 59.87, 59.99, 60.08, and 59.99 in T_1, T_2, T_3, and T_4 groups, respectively. Overall, there was no significant (P>0.05) difference in egg weight among the treatment groups but numerically the egg weight was higher in the T_3 group compared with other treatments. The overall feed intake (g/bird/day) was 112.02, 111.73, 110.79, and 110.05, with T_4 having significantly (P<0.01) lower feed intake compared to T_1. Feed conversion ratio was 2.22, 2.21, 2.18, and 2.11 in T_1, T_2, T_3, and T_4, respectively, with significantly better (P<0.01) values in T_4 followed by T_3. Feed cost per egg (₹) was 4.20, 4.19, 4.15, and 4.01 in T_1, T_2, T_3, and T_4 groups, respectively, indicating lowest cost in antibiotic-supplemented group. It can be concluded that supplementation of Kankrej cow urine distillate and Panchgavya had no impact on egg production, egg weight in layer chickens. Moreover, supplementation of Panchgavya significantly reduced feed intake and improved feed conversion ratio in layer chickens as compared to the control.

Keywords: panchgavya, layer chickens, performance.

PNP-68

Growth performance of Kadaknath Chicken under agro-climatic conditions of Bihar

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The present study was undertaken to investigate the growth pattern of Kadaknath chickens reared under farm conditions from hatch to 12 weeks of age. The experiment was conducted at the Poultry Research and Training Centre, Bihar Animal Sciences University, Patna, under the prevailing agro-climatic conditions of Bihar. A total of 45 Kadaknath chicks were maintained under standard managemental practices, and individual body weights were recorded at hatch (0 day) and subsequently at weekly intervals up to 12 weeks of age to assess their growth performance over time. The mean body weight (±SE) of Kadaknath chicks was 25.77 ± 0.32 g at hatch, which increased progressively to 46.14 ± 0.86 g at 1 week, 83.60 ± 1.54 g at 2 weeks, 133.21 ± 3.07 g at 3 weeks, 189.19 ± 5.16 g at 4 weeks, 254.68 ± 7.37 g at 5 weeks, 377.09 ± 10.91 g at 6 weeks, 382.75 ± 13.34 g at 7 weeks, 407.42 ± 12.42 g at 8 weeks, 480.00 ± 14.95 g at 9 weeks, 519.02 ± 16.24 g at 10 weeks, 567.02 ± 17.82 g at 11 weeks, and 615.60 ± 18.72 g at 12 weeks of age. The overall results indicated a steady and consistent increase in body weight with age, demonstrating a typical sigmoid growth trend. The highest rate of weight gain was observed between the 2nd and 6th weeks, suggesting this period as the phase of most rapid growth. Thereafter, the rate of increase declined gradually toward 12 weeks of age. The findings suggest that Kadaknath chickens exhibit a moderate growth rate characteristic of indigenous breeds, reflecting their genetic makeup and adaptability to local climatic conditions. Despite lower body weights compared to commercial broilers, their superior adaptability, disease resistance, and excellent meat quality make them highly suitable for low-input, backyard, and rural poultry production systems aimed at livelihood security and sustainable farming.

Keywords: Kadaknath, Growth performance, Body weight, Indigenous chicken, Backyard poultry.

PNP-69

Supplementation of organic acid salts on the production performance and carcass characteristics of commercial broiler chicken

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Research question: Is there any difference in production performance and carcass characteristics in commercial broiler chicken due to supplementation of organic acid salts in their feed? Materials and methods: A six-week biological experiment was carried out to study the effect of calcium propionate (CP) and sodium butyrate (SB) as an alternative to antibiotic growth promoters on production performance and meat quality of the commercial broiler chicken. The experiment was split into eight treatment groups with three replicates each (10 chicks per replicate). They were fed with corn-soybean meal based basal diet (un-supplemented control- T_1) or the basal diet with anantibiotic growth promoters [lincomycin; 4.4 ppm (T_2) and bacitracin methylene disalicylate (BMD); 50 ppm (T_3)] or organic acids (OAs) such ascalcium propionate[1000 (T_4) or 2000 ppm (T_5)] and coated sodium butyrate [500 ppm(T_6) or 1000ppm (T_7)] either alone or in combination [CP 1000 + SB 500 ppm; (T_8)].Upon completion of the feeding trial, six birds from each treatment were slaughtered to study the carcass characteristics and meat quality. Results: Supplementation of either AGPs or OAs did not influence the body weight, body weight gain, feed consumption and feed efficiency, significantly (P>0.05). Among the treatment groups, AGPs (BMD; T_3) and lower doses of OAs (T_4, T_6) supplementation reduced the cost of production (COP) than control; at higher doses of OAs and its combination group increased the COP than control. The lowest cost of production per kg live weight (Rs. 71.68) and higher European economic factor (259) were observed in the groups supplemented with sodium butyrate @ 500 ppm (T_6) among other treatment groups with the value ranged from 205 to 254. A non-significant difference was observed in live weight, blood loss, New York dressed weight, eviscerated yield, ready-to-cook yield, giblet weight and the cut-up parts. Meat quality parameters such as

physico-chemical, microbiological (total viable count), proximate composition and sensory qualities also witnessed a non-significant difference among the treatment groups. Water holding capacity was significantly reduced in the groups supplemented with organic acid owing to apparent pH reduction. Organic acid supplementation slightly increased lightness (L*) value and leads to reduction in redness (a*) and yellowness (b*) without impairing the quality of meat. Favourably, organic acid and AGPs supplementation reduces the shear force value (kgf), hardness (kgf), gumminess (N) and chewiness (kgf.mm) than control groups. Conclusion: Salts of organic acids (OAs) could be supplemented as an alternative to antibiotic growth promoters (AGPs) in the commercial broiler diet without affecting the meat quality and sensory quality.

Keywords: Organic acid, calcium propionate, sodium butyrate, carcass characteristics and meat quality.

PNP-70

Supplementation of various forms of Zinc and Selenium on the production performance and carcass yield of Japanese Quails

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A biological experiment was conducted to study the effect of supplementation of these nano forms along with inorganic and organic sources on (1) production performance for six weeks and (2) carcass characteristics in Japanese quails (n=288) with six experimental groups each with four replicates (twelve chicks per replicate). Six experimental diets (JQ brooder) were formulated based on NRC (1994) specifications except the levels of Zn and Se (mg/kg), *viz.,* non-supplemental control (T_1), 25 and 0.2 (T_2; inorganic), 50 and 0.4 (T_3; enhanced inorganic), 25 and 0.2 (T_4; organic), 12.5 and 0.1 (T_5; 50% nano) and 6.25 and 0.05 (T_6; 25% nano). Body weight, feed intake, mortality and carcass characteristics were recorded and feed conversion ratio (FCR), livability, European economic factor (35 d) and cost of production (35 d) were calculated. Fifth week body weight and body weight gain were significantly ($P<0.05$) lower in enhanced inorganic (T_3) groups when compared to negative and positive control. Significant ($P<0.05$) differences were noticed in feed consumption (four to six week) and FCR (first two weeks). In spite of non-significant ($P>0.05$) difference among the treatment groups, livability was numerically poor in nano (50% of NRC, 1994) minerals supplemented group (T_5) throughout the period. Supplementing enhanced level (2X) of inorganic Zn and Se (T_3) and 25 per cent through nano forms (T_6) reduced the COP by Rs. 12.83 and 10.12 per bird, respectively. There was no significant ($P>0.05$) difference in pre-slaughter live weight and per cent loss of blood in the bird slaughtered at sixth week of age. Per cent eviscerated yield was significantly ($P<0.05$) higher in both nano supplemented groups when compared to negative control and organic Zn and Se supplemented groups (T4). Proximate principles of meat such as, moisture, crude protein and crude fat (ether extractives) did not show any significant ($P>0.05$) differences among the treatment groups. Conclusion: Dietary supplementation of Zn and Se in enhanced (2X) level through inorganic (T_3) or 25 per cent of the requirement through nano (T_6) sources could be of beneficial for improving the overall performance (EEF), reducing the cost of production and better eviscerated yield.

Keywords: Zinc, selenium, production performance, carcass yields, Japanese quails.

PNP-71

Beyond Antibiotics: Chitosan and synbiotic edible coatings as a integrated strategy for gut health and shelf-life extension in poultry

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The worldwide chicken industry, a pillar of food security, is under increasing strain due to environmental sustainability, feed efficiency, antibiotic resistance, and post-processing food safety. The conventional use of synthetic polymers for packaging and chemical additives for preservation contributes significantly to plastic pollution and causes ongoing consumer health concerns. This paradigm is becoming increasingly untenable, prompting the urgent pursuit

of sustainable alternatives. Among these, biopolymers-natural, biodegradable macromolecules produced from renewable resources-have emerged as an important and multifaceted option. There are specific sources and functionalities of well-known biopolymers, such as chitosan from crustacean exoskeletons, alginate from brown seaweed, gelatin from connective tissues, and poly (lactic acid)-PLA from fermented plant sugars, as well as their transformative applications throughout the poultry production chain. In animal nutrition and health, biopolymers, notably chitosan, provide powerful non-nutrition advantages. Chitosan's cationic structure enables it to bind to negatively charged pathogens in the gut, hence limiting Salmonella and Campylobacter colonization. Its prebiotic qualities selectively encourage beneficial gut flora, such as Lactobacilli, resulting in increased short-chain fatty acid synthesis and improved gut integrity and nutrition absorption. Meta-analyses of feeding trials show that dietary inclusion of chitosan at 0.02-0.05% can improve feed conversion ratio (FCR) by 5-8% and lower mortality rates, making it a viable option for reducing the usage of in-feed antibiotic growth promoters. In product preservation, biopolymer-based edible coatings and films provide a sophisticated barrier system for meat and eggs. For example, a chitosan-based coating cross-linked with alginate can reduce purge loss in raw chicken breast by up to 15% when compared to controls during refrigerated storage. By adding natural antimicrobials (e.g., thyme essential oil, nisin) and antioxidants (e.g., tocopherols), these active coatings can inhibit the growth of spoilage organisms such as Pseudomonas spp. and Lactic Acid Bacteria, prolonging the shelf life of fresh poultry pieces by 3-5 days. A thin gelatin-alginate bilayer coating on shell eggs efficiently closes the cuticle pores, preserving Haugh unit quality and minimizing weight loss by more than 50% over four weeks of storage. Additionally, biopolymers are transforming environmentally friendly packaging. With mechanical qualities similar to those of petroleum-based PS and LDPE, PLA and its composites are currently effectively used to create entirely compostable trays and overwrap films. Such packaging's life cycle assessment (LCA) shows a 40–60% decrease in greenhouse gas emissions and the use of fossil fuels. By including smart indicators—like pH-sensitive anthocyanin-based sensors—into these biopolymer matrices, food safety is improved and waste is decreased. Adoption of biopolymer technology is an essential and necessary step toward a more sustainable, effective, and consumer-transparent poultry sector, despite obstacles related to cost and scalability.

Keywords: Biopolymers, Poultry industry, Gut health.

PNP-72

Effect of feeding fermented rapeseed meal with or without enzymes on growth performance in broilers

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An experiment was conducted to evaluate the effect of dietary inclusion of fermented rapeseed meal (FRSM) with or without enzyme supplementation on the growth performance of broilers. A total of 240 day-old Cobb broiler chicks were randomly assigned to eight dietary treatments with three replicates of ten birds each for six weeks period. All diets were formulated to be iso-caloric and iso-nitrogenous, as per BIS (2007) standards. The control group (T1) received a corn-soybean meal based basal diet without FRSM or enzymes, while T2 was fed the basal diet with 0.02% enzyme supplementation. The treatment groups T3, T5 and T7 were supplemented with FRSM at 2.5, 5.0 and 7.5%, respectively, without enzymes, whereas T4, T6 and T8 received 2.5, 5.0 and 7.5% of FRSM with 0.02% enzymes, respectively. The results revealed no significant differences ($p>0.05$) among treatment groups with respect to body weight, feed intake, feed conversion ratio and survivability. It was concluded that dietary inclusion of FRSM up to 7.5%, with or without enzyme supplementation, had no detrimental effect on growth performance in broilers, indicating its safe incorporation in poultry diets.

Keywords: Fermented rapeseed meal, enzymes, body weight, feed intake, feed conversion ratio, Survivability.

PNP-73

Effect of feeding fermented rapeseed meal with or without enzymes on gut health in broilers

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An experiment was conducted to evaluate the effect of dietary inclusion of fermented rapeseed meal (FRSM) with or without enzyme supplementation on the gut health of broilers. A total of 240 day-old Cobb broiler chicks were randomly assigned to eight dietary treatments with three replicates of ten birds each for six weeks period. All diets were formulated to be iso-caloric and iso-nitrogenous, as per BIS (2007) standards. The control group (T1) received a corn-soybean meal based basal diet without FRSM or enzymes, while T2 was fed the basal diet with 0.02% enzyme supplementation. The treatment groups T3, T5 and T7 were supplemented with FRSM at 2.5, 5.0 and 7.5%, respectively, without enzymes, whereas T4, T6 and T8 received 2.5, 5.0 and 7.5% of FRSM with 0.02% enzymes, respectively. The results revealed no significant differences ($p>0.05$) among treatment groups with respect to gut morphology (villus height, crypt depth of different segments of the intestine), whereas microbial load showed significant reduction in E. coli counts and increased Lactobacillus counts compared to control group. It was concluded that dietary inclusion of FRSM up to 7.5%, with or without enzyme supplementation, has no detrimental impact on gut morphology and positively modulates the gut microbial population in broilers.

Keywords: Fermented rapeseed meal, enzymes, villus height, crypt depth, E. coli, Lactobacillus.

PNP-74

Response of feeding different levels of dietary calcium and available phosphorus on serum biochemical profile in growing turkey poults

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An experiment was undertaken to study the response of feeding different dietary levels of calcium and available phosphorus on serum biochemical profile in growing turkey poults. An eight weeks (0-8wks) feeding trial was conducted involving three levels of calcium (1.0/0.80, 1.2/1.0 and 1.4/1.2%) each with three levels of available phosphorus (0.50/0.40, 0.60/0.50 and 0.70/0.60%) in a 3×3 factorial manner during the period of 0-4/5-8wks of age. Day old turkey poults (n=288) were randomly distributed in 36 groups and each of such diet was offered as mash *ad libitum* to four replicated groups of eight chicks each kept in battery brooder cages. At the end of feeding trial, blood samples from 8birds/treatment (2birds/replicate) were randomly collected and serum samples were separated by centrifugation at 3000rpm for 10minutes for the study of serum biochemical profiles. Results indicated that significantly ($P<0.01$) lower alkaline phosphatase activity was recorded at 0.70/0.60% Av.P than those recorded in other levels of Av.P in the diets during 0-4/5-8wks of age. Significant ($P<0.01$) linear increased in serum Ca concentration as increasing Ca levels in the diet from 1.0/0.80 to 1.40/1.20% during 0-4/5-8wks of age. Significantly ($P<0.01$) higher albumin and albumin/globulin ratio were recorded at 1.40/1.20% Ca than those recorded at other dietary levels of Ca in the diets during 0-4/5-8wks of age. Significantly ($P<0.01$) higher glucose value was recorded at 0.60/0.50% Av.P than those recorded at other dietary levels of Av.P in the diets during 0-4/5-8wks of age. Based on the results it was concluded that a dietary concentration of 1.0/0.80% Calcium with 0.50/0.40% available phosphorus during 0-4/ 5-8wks of age was found adequate for optimum serum biochemical profile in growing turkey poults.

Keyword: Calcium, available phosphorus, turkey poults, serum biochemical profile.

PNP-75

Effect of feeding different levels of dietary calcium and available phosphorus on growth performance and immune response of growing turkey poults

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An experiment was undertaken to study the response of feeding different dietary levels of calcium and available phosphorus on growth and immune response of growing turkey poults. An eight weeks (0-8wks) feeding trial was conducted involving three levels of calcium (1.0/0.80, 1.2/1.0 and 1.4/1.2%) each with three levels of available phosphorus (0.50/0.40, 0.60/0.50 and 0.70/0.60%) in a 3×3 factorial experiment during 0-4/5-8wks of age. Day old turkey poults (n=288) were randomly distributed in 36 groups and each of such diet was offered as mash *ad libitum* to four replicated groups of eight chicks each kept in battery brooder cages. Significantly($P \leq 0.01$) higher body weight, gain in body weight, feed intake and better efficiency of feed utilization were observed in a dietary combination of 1.0/0.80% calcium with 0.50/0.40% available phosphorus than those recorded in other dietary combinations during 0-4/5-8wks of age. Significantly ($P \leq 0.05$) higher cellular and humoral immune response were observed in a dietary combination of 1.2/1.0% calcium with0.60/0.50% available phosphorus than those recorded in other dietary combinations during different growth phases. Significantly ($P \leq 0.05$) higher immune organ weight was recorded in a dietary combination of 1.2/1.0% calcium with0.50/0.40 or 0.60/0.50% available phosphorus than those recorded in other dietary combinations during 0-4/5-8wks of age. Based on the results it was concluded that a dietary concentration of 1.0/0.80% Calcium with 0.50/0.40% available phosphorus during 0-4/ 5-8wks of age was found adequate to achieve optimum growth performance. However, better immune response was realized with a dietary concentration of 1.2/1.0% Calcium with 0.60/0.50% available phosphorus during0-4/5-8wks of age.

Keyword: Calcium, available phosphorus, turkey poults, growth performance, immune response, immune organs weight.

PNP-76

Modulation of immunity by *Moringa oleifera* in broiler chickens

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This study was carried out to determine the effects of *Moringa oleifera* ethanolic leaf extract (MOELE) on the immunity level of broiler chickens. A total of 144 day-old broiler chicks (Vencobb 430) were randomly distributed into four groups of three replicate and each replicate having twelve birds. The treatments were: T_0/ Control = no extract; T_1 = @2 ml/L MOELE in drinking water; T_2 = @4 ml/L MOELE in drinking water; and T_3 = @6 ml/L MOELE in drinking water. The average organ indices for bursa of Fabricius for groups T_2 and T_3 showed significantly ($P<0.05$) higher values compared to groups T_0 and T_1. For spleen and thymus, group T3 showed statistically higher values than all other groups. For day 42, the heterophil values of MOELE groups significantly ($P<0.05$) lower than that of control while the lymphocyte values of MOELE groups were higher ($P<0.05$) than that of control. The H/L ratio also improved ($P<0.05$) by 42 for MOELE groups compared to control. The HI titre against Newcastle virus vaccine for groups T2 and T3 were significantly higher ($P<0.05$) by day 42 as compared to other groups. From the above results we can conclude that addition of moringa extract in drinking water might lead to beneficial effects on the health of broiler chickens and could increase the immunity.

Keywords: *Moringa oleifera*, Ethanolic extract, Immunity, Broiler chicken, H/L ratio.

PNP-77

Effect of supplementation of synbiotic (β-glucans, MoS and multi-species probiotic) on growth performance and gut health in broiler chicken

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An experiment was conducted to study the effect of supplementation of synbiotic (β-glucans, MOS and multi-species probiotic) on growth performance and gut health in broiler chicken.Two hundred and fifty (250) day old broiler chicks were randomly allotted to five dietary treatments with ten replicates of five birds in each. The birds were raised in a battery brooder under uniform managemental conditions and fed with isocaloric and isonitrogenous diet from day old to 6 weeks of age. The treatments consisted of a control diet based on corn-soybean without antibiotic as negative control (NC), with antibiotic growth promoter (Lincomycin @100g/MT) as positive control (PC), three experimental diets consisted of probiotic (*Bacillus subtilis, B. coagulans, B. licheniformis and Saccharomyces boulardii)* @ 200g/ MT, prebiotic (MOS & β glucans) @ 500g/MT and synbiotic (*Bacillus subtilis, B. coagulans, B. licheniformis and Saccharomyces boulardii*, MOS & β-glucans) @ 200g/MT. The feed and water were offered ad libitum.The results revealed that supplementation of different dietary treatments did not affect (P>0.05) the body weight gain and feed intake of broilers at 42 d of age. feed conversion ratio was significantly (P<0.05) difference was observed in carcass parameters among all the dietary treatments. Supplementation of probiotic, prebiotic, synbiotic in broiler diets had significantly decreased (P<0.05) *E.coli* count and increased Lactobacilli count compared to control. Supplementation of synbiotic and AGP groups significantly (P0.05) difference was observed among synbiotic, AGP, probiotic and prebiotic. No significant (P>0.05) difference was recorded in jejunum crypt depth and VH:CD ratios at 42 d of age. Based on the results, it was concluded that, synbiotic, a synergistic combination of probiotic and prebiotic (Bacillus subtilis, B. coagulans, B. licheniformis and Saccharomyces boulardii, MOS & β-glucans) can be used as an alternative to antibiotic growth promoters to increase overall performance of broiler chicken when compared to probiotic and prebiotic alone.

Keywords: Synbiotic, growth performance, beta glucan, feed conversion ratio, gut health.

PNP-78

Effect of citric acid monohydrate on the growth performance and gut health of broiler chickens

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A biological experiment was conducted up to 5 weeks of age to investigate the effect of dietary supplementation of Citric Acid Monohydrate (CAM) on the growth performance of commercial broiler chicken. Three hundred and sixty-day old Cobb 400 broiler chickens were divided into five groups, each with six replicates of twelve birds each. The treatment groups were fed a basal diet supplemented with 0%, 0.5%, 1.0%, 1.5%, and 2.0% CAM, respectively. The data on body weight, feed intake, FCR, livability, carcass traits, total serum cholesterol, low density cholesterol, high density cholesterol, glycerides, gut pathogens and intestinal (duodenum, jejunum and ileum) histomorphometry were determined. The result indicated that supplementation of CAM at the rate of 2.0 % significantly (P<0.01) increased growth rate. However, the feed intake and feed efficiency was not altered by the CAM supplementation. Mean total cholesterol, low density cholesterol, high density cholesterol, serum tri glycerides were not affected by the CAM supplementation. *Escherichia coli*, Clostridium and salmonella count (log CFU/g digesta) counts in duodenal contents was significantly (P<0.01) lowered in the CAM fed groups compared with control. Whereas, Lactobacillus counts were significantly (p<0.05) increased in the CAM fed broiler chickens. Livability was not affected by the treatments. CAM significantly (P<0.01) improved small intestine histomorphometry traits (villi height, crypt depth, villi width, epithelial thickness, and muscularis thickness) across the treatment groups. Conclusively, dietary supplementation with CAM at

2.0% enhanced growth performance, gut health, and positively influenced health status in broiler chickens.

Keywords: Citric Acid Monohydrate, commercial broilers, serum cholesterol, serum triglycerides, pathogenic organisms and intestinal histomorphometry.

PNP-79

Effect of dietary inclusion of toasted and fermented toasted guar meal on performance, gut microbiota, intestinal morphology and serum parameters in broiler chicken

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The present study aimed to assess the scope of utilizing toasted and fermented toasted guar meal (FTGM)fermented with different cultures (C1 and C2) asprotein supplement in the diet of broilers.A total of 350 day-old broiler chicks (Vencobb 430Y) were procured and randomly assigned to 7 dietary treatments, with 10 replicates and containing 5 birds/ replicate. The dietary treatments were T1- Control diet (Maize-SBM), T2-TGM 15 %, T3-TGM 20 %, T4- FTGMC1-15 %, T5- FTGMC1-20 %, T6- FTGMC2-15 % and T7- FTGMC2-20 %. All the birds were reared in battery brooders under uniform managemental conditions. Feed and water were provided *adlibitum*. Dietary inclusion of TGM at 15 and 20% significantly ($P<0.01$) depressed the body weight gain (BWG) of broilers. The BWG in FTGMC1-15 group was comparable to the control group and significantly ($P<0.01$) higher than TGM 15 and FTGMC2-15 groups. The FTGM of both cultures at 20 % inclusion did not improve the BWG when compared to TGM 20 group. The dietary inclusion of TGM or FTGM (C1 and C2) at 15 and 20 % significantly ($P<0.01$) depressed the feed intake. Poorer FCR was observed in TGM 15 and 20 % groups. The FTGMC1-15 diet significantly ($P<0.01$) improved the FCR and was comparable to control and better than other treatments. FTGM diets of both cultures at 20 % inclusion did not improve the FCR when compared to the TGM 20 group. Gut health (increased LAB count and decreased *E. coli* count) and intestinal morphology (increased villus height and decreased crypt depth) were improved in FTGM diets fed birds. Serum parameters remain unaffected. Finally, FTGMC1 can be included at 15% in the diet of broilers without showing any adverse effects on performance, serum parameters, with improved gut health and intestinal morphology.

Keywords: Fermented toasted guar meal, performance, intestinal morphology, broilers, gut microbiota, serum parameters.

PNP-80

Influence of Nano Dicalcium Phosphate on immune response and serum mineral profile in broilers

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An experiment was conducted to evaluate the influence of replacing conventional dicalcium phosphate (DCP) with nano dicalcium phosphate (nano DCP) at lower inclusion levels on immune response in broilers. A total of 300-day-old broiler chicks (Cobb strain, straight-run) were allocated to five treatments with six replicates of ten birds each. The dietary treatments consisted of conventional rock-derived DCP or bone-derived DCP to meet 100 % of the phosphorus (P) requirement, and nano DCP incorporated to meet 75 %, 50 % and 25 % of the P requirement. All the birds were vaccinated against Newcastle Disease (ND) and Infectious Bursal Disease (IBD) as per schedule. At the end of the trial (35th day), blood samples were collected from two birds in each replicate and serum samples were evaluated for antibody titres against ND (HI test) and IBD (ELISA), along with Ca and P concentrations. The results indicated that dietary inclusion of nano DCP at reduced levels did

not significantly (P>0.05) affect the ND or IBD antibody titres. Serum Ca and P levels remained comparable (P>0.05) among treatments, indicating adequate mineral availability and homeostasis. No adverse effects on health or survivability were observed. The findings demonstrate that nano DCP can partially replace conventional DCP without compromising humoral immune response, supporting its potential as a highly bioavailable and sustainable P source in broiler nutrition.

PNP-81

Impact of supplementing natural 1, 25 - dihydroxy cholcalciferol on production performance in commercial layers during phase III production period

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Can the egg breakages in post production period in commercial layers can be minimized by supplementing natural active metabolite of Vitamin D_3? The biological trial was carried out with one hundred and ninety two, BV 300 commercial layer birds from single hatch which were weighed, leg banded and randomly assigned into four treatment groups with six replicates of eight birds each and reared from 72 to 83 weeks under standard managemental practices. The treatment group consisted of T_1 - Control (synthetic vitamin D_3), T_2 -natural 1, 25 - dihydroxy cholecalciferol (1 ppm), T_3 - natural 1, 25 - dihydroxy cholecalciferol (1.25 ppm) and T_4 - natural 1, 25 - dihydroxy cholecalciferol (1.5 ppm) supplemented in basal layer phase-III diet which was formulated according to BV 300 standard and fed to the birds throughout the study period. There was no significant difference observed across the treatments in mean body weight, hen day egg production, feed consumption, feed efficiency and livability but, numerically higher body weight and hen day egg production was found in the group supplemented with 1.5 ppm of natural 1, 25 dihydroxy cholecalciferol (T_4) followed by the group supplemented with 1.25 ppm (T_3) whereas better feed efficiency was observed in T_4 and T_3 groups. Increase in sound shelled egg production was noticed significantly in T_4 group followed by T_3 than T_2 and T_1 groups. Significant reduction in cracked and shell less eggs was noticed in T_4 group followed by T_3 group, whereas numerically lower broken eggs were produced in T_4 and T_3 groups. Based on the results of this study, it can be concluded that T_4 (1.5 ppm) is considered as effective for supplementing natural 1, 25 - dihydroxy cholecalciferol for more production of saleable eggs and reduced egg breakages resulting higher profitability.

Keywords: Commercial layers, 1, 25 - dihydroxy cholecalciferol, *Cestrum diurnum* extract, Egg breakages.

PNP-82

Ameliorative effect of *Emblica officinalis* on experimentally induced Aflatoxicosis in broiler chicken

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Can supplementation of *Emblica officinalis* in feed mitigate the adverse effects of aflatoxin on haematological, biochemical, antioxidant, organ weight and tissue residue parameters in broiler chickens? A total of 100-day-old broiler chicks were divided into five groups with two replicates of ten birds each. Group I served as control; Group II was fed aflatoxin contaminated feed (1 ppm); Group III received aflatoxin plus standard drug (UTPP); and Groups IV and V were supplemented with *E. officinalis* powder at 1 g/kg and 2 g/kg feed, respectively, along with aflatoxin for 35 days. Aflatoxin was produced by inoculating sterilized maize with *Aspergillus flavus* under controlled fermentation conditions. Haematological, serum biochemical, antioxidant, organ weight, and tissue residue analyses were carried out following standard protocols. Aflatoxinfed birds exhibited poor growth, anaemia, hypoproteinaemia, elevated liver and kidney function markers, increased lipid peroxidation, reduced antioxidant enzyme activities, hepatomegaly, splenomegaly and reduced bursal weight. Supplementation with *E. officinalis* improved haematological and biochemical parameters, enhanced antioxidant enzyme activities, normalized organ weights and significantly reduced aflatoxin residues in tissues. The higher dose (2 g/kg feed) of amla and UTPP offered superior protection compared to the lower dose of amla. *E. Officinalis* supplementation effectively ameliorated aflatoxin-induced alterations in broilers. Its antioxidant, hepatoprotective, and detoxifying effects suggest its potential as a natural, safe feed additive for improving health and performance in poultry exposed to aflatoxin.

Keywords: Aflatoxin, *E. officinalis*, Broiler chicken, Antioxidant.

PNP-83

Evaluation of hepatic pro-nutrient property of liver supplement in Aflatoxin challenged broiler chicken

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A study for 42 days was conducted to evaluate the effect of hepatic Pro-nutrient property of two polyherbal nutraceuticals (PHN1 and 2) in broiler chicken challenged with aflatoxicosis at high dose. Day-old Ross broiler chicks were randomly allotted to eight dietary treatments, viz., T1 (control), T2 (1 ppm AF B_1), T3 (AF + bentonite binder 500 g/ton), T4 (AF + PHN1 500 g/ton + binder 1000g/ton), T5 (AF + binder 750 g/ton + PHN 1 750 g/ton) and T6 (PHN 1 500 g/ton + binder 500 g/ton), T7 (AF + PHN2 500 g/ton + binder 1000g/ton) and T8 (AF + PHN2 1000 g/ton + binder 1000g/ton). Aflatoxin challenged birds showed reduced growth, feed intake and feed efficiency, significantly elevated serum AST, ALT, ALP, creatinine and blood urea nitrogen, and significant reductions in antibody titers, haemoglobin, packed cell volume, total protein and albumin. Antioxidant enzymes (SOD, CAT) were depressed and hepatic lipid peroxidation increased. Gross lesions included pale, enlarged liver and kidneys with lymphoid depletion of the bursa, spleen and thymus. Microscopically, aflatoxin treated birds revealed severe hepatic vacuolar degeneration, bile-duct hyperplasia, periportal necrosis and renal tubular degeneration. Supplementation with the PHN1 and 2 and binder (T4–T8) significantly improved growth performance and some of the serum biochemical and antioxidant parameters. Histological lesions in liver, kidney and lymphoid organs were markedly reduced. Among different treatments, T5 (AF + binder 750 g/ton + PHN 1 750 g/ton) and T8 (AF + PHN2 1000 g/ton + binder 1000g/ton) yielded better results in most of the parameters studied. The study demonstrates that dietary inclusion of a polyherbal nutraceutical, combined with a toxin binder, provides protection against aflatoxin B_1-induced hepatic toxicity in broiler chickens.

Keywords: Aflatoxin, Broilers, hepatic Pro-nutrient, polyherbal nutraceuticals.

PNP-84

Determination of standardized Ileal digestibility calcium requirement in pre-starter stage of broilers

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An experiment was conducted to determine the digestible calcium (Ca) and digestible phosphorous (P) requirements of pre-starter stage broiler chickens. Six maize-soya based diets containing 2.5, 3.0, 3.5, 4.0 ,4.5 and 5.0 g/kg standardized ileal digestible (SID)Ca and 4.5 g/kg available phosphorus maintained in all the diet were fed to broilers from d 1 to 14. Each experimental diet was randomly allocated to 10 replicate cages (5 birds per cage). Body weight and feed intake were recorded at the start and end of the experiment and the feed conversion ratio was calculated. On d 14, selected birds were slaughtered to collect the toes and tibia for the determination of Ca and P and ash concentration. Tibia were studied for breaking strength analysis. The growth performance, bone mineralization and mineral utilization of broiler pre starters were found to be optimized at 3.74 g/kg SID Ca concentration. Required SID Ca for maximum feed efficiency, weight gain and bone mineralization were determined to be 3.74, 3.47 and 3.83g/kg, respectively, at 4.5 g/kg Av.P concentration, which correspond to SID Ca to Av P ratios of 0.83,0.77 and 0.85, respectively. The estimated SID Ca requirement for feed efficiency is lower than the current Ca recommendation (9.6 g/kg total Ca or 4.9 g/kg SID Ca) for broiler pre starters, However, bone mineralization was maximized at 7.5g/kg total Ca which indicates that bone mineralization requires more Ca than growth performance.

Keywords: broiler, digestible calcium, available phosphorous, growth, bone.

PNP-85

Efficacy evaluation of some herbal hematinics in commercial broilers

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The objective of this study was to evaluate the efficacy of supplementation of herbal hematinics on growth performance of commercial broilers. The trial was conducted on 360 broiler chicks for a period of 5weeks (35days). Day old chicks (Vencobb-400) will be procured and randomly divided into 6 dietary treatments (T0, T1, T2, T3, T4, T5) each comprising of 4 replicates (15 birds per replicate). Daily maintain the record of temperature, relative humidity and total humidity index. All the chicks were reared in well ventilated, raised under deep litter system of housing with uniform management (brooding, feeding and watering) and standard hygienic conditions throughout the experiment. During the experiment, light was provided continuously by using fluorescent bulbs. Brooding temperature was maintained at 34 ± 1°C up to 7 days of age and then gradually reduced to 26 ± 1°C by 21 days of age after which chicks were maintained uniformly at room temperature. Clean and fresh drinking water was provided *ad lib* daily. The broiler pre starter (0-12days), starter (13-24days) and finisher (25-35days) diets were formulated to contain around 23, 20 and 19.50% crude protein and metabolizable energy is (ME) 3000, 3100 and 3200 K.cal/kg. The test compound T0, T1, T2, T3, T4, T5 herbal hematinics AV/HFP/21 @ 1.5, 3.0, 6.0, and 12.0 ml at different levels. The feed and water were provided *adlib* during the entire experimental period. The results revealed that During first to fifth week of age there was significant difference ($P<0.05$) in average weekly body weight and body weight gain, feed intake and feed conversion ratio of broilers fed with different dietary treatments. The average effect of broilers was significantly ($P<0.05$) higher in birds fed with T4, T3, T2, T1 compared to the birds fed with alembic product- T5 and control-T0 groups.

Keywords: Vencobb-400, Body weight, Feed intake, Feed conversion ratio, and herbal hematinics.

PNP-86

Effect of natural choline supplementation on biochemical profile, carcass characteristics and liver histoarchitecture of broilers

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The experiment was conducted on 480 Vencobb-430Y broiler strain for 6 weeks period. The chicks were randomly distributed into eight groups viz., A, B, C, D, E, F, G and H having four replicates, each comprising of 15 birds. The control group A received a basal diet without choline chloride, treatment groups B, C and Dwere supplemented with Synthetic choline chloride-60% (SCC) @ 1kg/ton, Natural Choline Formula-Carus Lab (NCF)@ 0.250 kg/ton and 0.500kg/ton of feed in basal diet, respectively. Whereas, group E was kept on Choline deficient diet (CDD) and groups F, G and H were supplemented with SCC @ 1kg/ton, NCF @ 0.250 kg/ton and 0.500kg/ton of feed in CDD, respectively. The results showed that the mean values of serum AST and ALT were significantly decreased in group Das compared to group A at 21st and 42nddays.Also, the mean ALT values were significantly decreased in the birds of groups F, G and H than group E. The cholesterol level was significantly declined in treatment groups B and D as compared to group A at 42nd day. The mean values of breast muscle cholesterol were significantly decreased in group D as compared to group A at 21st and 42nd days. At 42nd day, the breast muscle cholesterol and triglyceride levels were significantly reduced in groups F and G as compared to group E. At 21st and 42nd days, the sections of liver from groups A and E revealed mild to severe focal to diffused fatty changes in hepatic parenchyma. There was significant reduction of abdominal fat percent in groups B, C and D as compared to control group A. Whereas, the abdominal fat percent was significantly decreased in groups F, G and H as compared to group E. Hence, it could be concluded that supplementation of NCF @ 0.500 kg/ton and SCC @ 1kg/T were found to be beneficial for maintaining liver function tests, reduction of cholesterol

and triglyceride levels in breast muscle, decrease in abdominal fat percent and restoration of histoarchitecture of liver in broilers.

Keyword: Natural choline formula, Synthetic choline chloride, Biochemical of serum and breast muscle, Abdominal fat, Liver histopathology, Broilers.

PNP-87

Impact of soybean meal quality and β-Mannanase supplementation in energy-restricted diets on broiler chicken performance and nutrient digestibility

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Broiler diets are predominantly based on maize and soybean meal (SBM), but the presence of anti-nutritional factors such as β-mannans in SBM can impair nutrient absorption and reduce growth performance by increasing intestinal viscosity and triggering non-productive immune responses (Kim, et al, 2024). As poultry lack endogenous enzymes to digest β-mannans (Ryu et al., 2017), supplementation with β-mannanase has been proposed to improve nutrient utilisation and performance, particularly in diets with higher mannan (fiber) content. This study investigated the effects of β-mannanase supplementation in low-energy diets formulated with regular SBM, high-proteinSBM (HSBM), and their equal combination, on growth performance, carcass traits, and apparent ileal digestibility of nutrients in broiler chickens. A total of 2,250 male Cobb 430Y broilers were allocated to nine dietary treatments in a 3 × 3 factorial design: three protein sources (regular SBM, HSBM, and a 50:50 mix) and three calculated energy levels (standard energy, reduced energy by 200 kcal/kg, and reduced energy with β-mannanase supplementation at 800 TMU/kg feed). Each treatment was replicated ten times with 25 birds per pen, and diets were fed ad libitum from day 1 to 42. Growth performance was assessed at multiple time points, and carcass and nutrient digestibility parameters were measured at the end of the trial. Results demonstrated that β-mannanase supplementation to energy-deficient diets significantly improved feed efficiency during the pre-starter (from 1.249 to 1.232), starter (from 1.602 to 1.573), and finisher (from 2.035 to 2.021) phases, with overall feed efficiency (1–42 days) improving from 1.708 to 1.687 compared to negative control diets. The combination of SBM and HSBM as protein sources resulted in significant improvements in body weight gain and feed efficiency compared to single SBM sources. A significant interaction between β-mannanase supplementation and SBM quality was observed for feed conversion ratio during the starter phase ($P = 0.001$), with the greatest improvements seen in groups receiving both SBM and HSBM or HSBM alone. β-mannanase also enhanced energy digestibility ($P = 0.001$) and reduced abdominal fat deposition ($P = 0.010$) without affecting carcass yield. In conclusion, β-mannanase supplementation in energy-restricted diets improved feed efficiency and energy digestibility in broilers, particularly when combined with high-protein SBM in energy-restricted diets. This integrated nutritional strategy supports sustainable broiler production by optimizing nutrient utilisation and reducing feed costs.

Keywords: β-Mannanase, Soyabean mill, Energy Restriction, feed efficiency.

PNP-88

Effect of supplemental levels of dietary vitamin E and ascorbic acid on growth, immunity and serum biochemical profile in growing turkey poults

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Present study was undertaken to evaluate the response of feeding different dietary levels of supplemental vitamin E (Vit.E) and ascorbic acid on growth, immunity and serum biochemical profile in growing turkey poults. An eight weeks (0-8wks) biological trial was conducted in a completely randomized design (CRD) with five dietary treatments-D1 (Control)-11mg/kg Vit. E + nil supplemental ascorbic acid as per NRC (1994), D2-50mg/kg Vit.E + 100mg/kg ascorbic acid, D3-50mg/kg Vit.E + 200mg/kg ascorbic acid, D4-100mg/kg Vit.E + 100mg/kg ascorbic acid and D5-100mg/kg Vit.E + 200mg/kg ascorbic acid. Day old turkey poults (n=160) were randomly distributed in 20 groups of 8 chicks each and each diet was offered as mash *ad libitum* to four replicated groups kept in battery brooder cages. Significantly ($P \leq 0.05$) higher cumulative body weight gain (0-8wks) was recorded at 50mg/kg Vit.E with 100mg/kg ascorbic acid

than those observed in other dietary treatments. Significantly (P≤0.01) lower cellular immune response (foot web index to PHAP) and thymus weight were observed in D1diet than those recorded in other dietary treatments. Significantly (P≤0.01) higher total cholesterol was recorded in D5 diet than those observed in other diets. Significantly (P≤0.05) higher SGPT enzyme activity was observed in D1 diet than those recorded in other dietary treatments. Results concluded that a dietary level of 50mg/kg vitamin E with 100mg/kg ascorbic acid was found adequate for optimum growth, immunity and serum biochemical profile in growing turkey poults during 0-8wks of age.

Keyword: Vitamin E, ascorbic acid, turkey poults, growth, immunity, serum biochemical profile.

PNP-89

Comparative impact of dietary turmeric, black pepper and their combination on productivity and carcass traits in japanese quail

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The aim of this biological trial was to study the effects of supplementation of turmeric, black pepper and their combinations (turmeric and black pepper) as phytogenic feed additive in Japanese quails on growth performance, carcass traits and serum biochemical profile. 150-day- old quail chicks were distributed randomly in to five treatments with three replicates containing ten birds each and fed with five experimental diets T_1 (Basal diet), T_2 (Basal diet supplemented with 0.75% turmeric), T_3 (Basal diet supplemented with 1% black pepper), T_4 (Basal diet supplemented with0.25% turmeric and 0.5% black pepper) and T_5 (Basal diet supplemented with 0.5% turmeric and 1% black pepper).The results of present study were as follows, no significant ($p<0.01$)difference was noticed pertaining to growth performance parameters and carcass traits like dressing percentage, mean weights of liver, heart and gizzard among the treatment groups. Supplementation shown significant ($p<0.01$) increase in serum biochemical parameters like serum albumin, serum globulin, serum total protein, serum HDL cholesterol and significant ($p<0.01$) decrease in serum total cholesterol, LDL cholesterol and triglycerides.

Keywords: Japanese quails, Turmeric, Pepper, Performance, Carcass traits.

PNP-90

Chemical composition of corn distillers dried grains with soluble

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The present study investigated the compositional variability and energy potential of corn distillers dried grains with solubles (cDDGS) sourced from different ethanol plants, suppliers and feed manufacturers across India. Twenty-four cDDGS samples were categorized as light, medium and dark based on visible colour and analysed for proximate composition, calcium and phosphorus by chemical analysis. The moisture (7.57 - 13.64%) and crude fibre (7.89 -12.21%) contents revealed significant ($p<0.05$) variability, with a overall mean of 9.94 ± 0.29% and 9.77 ± 0.21%, respectively; whereas, crude protein (27.59 - 37.53%), ether extract (8.85–15.90%), total ash (2.71 – 6.47%),nitrogen free extract (34.72 – 43.68%), acid insoluble ash (0.03-1.06%), calcium (0.11-0.46%) and phosphorus (0.32-1.26%) content showed no significant difference among three colour of cDDGS, with an overall mean of 32.86 ± 0.43%, 13.15 ± 0.36%, 4.92 ± 0.18% and 39.29 ± 0.47%, 0.50 ± 0.05% 0.25 ± 0.02% and 0.83 ± 0.04%, respectively. Overall, the study underscores that colour grading, supported by analytical profiling, serves as a practical indicator of nutrient quality in cDDGS. Indian-produced cDDGS demonstrate viable alternative protein–energy ingredient for poultry feed formulation when properly evaluated for quality consistency.

Keywords: Corn DDGS, colour and proximate composition.

PNP-91

Efficacy of Mannanase supplementation in broiler diets with varying nutrient matrix values

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The present study aimed to evaluate the efficacy of Mannanase supplementation in broiler diets formulated with varying nutrient matrix values, focusing on growth performance, feed efficiency, gut morphology and economic returns. A total of 420 Vencobb 430Y broilers were randomly assigned to four dietary treatments over a six-week period: M1 (control diet), M2 (control diet with 35 Kcal/kg reduction in metabolizable energy), M3 (control diet supplemented with Mannanase @100 gm/ton and 35 Kcal/kg ME reduction) and M4 (control diet supplemented with Mannanase @100 gm/ton, 35 Kcal/kg ME and amino acid reduction). Each group consisted of 105 birds, maintained under uniform management and feeding conditions. Growth performance metrics revealed that birds in M4 achieved significantly higher live body weight and weight gain, while feed intake remained statistically comparable across all groups. M4 demonstrated a significantly improved feed conversion ratio (FCR 1.53) and corrected FCR (1.37), along with the highest European Efficiency Factor (EEF 395), indicating superior production efficiency. In contrast, M2 exhibited the poorest performance and highest FCR (1.62), suggesting that energy reduction without enzyme support negatively impacts productivity. Gut morphology analysis showed significantly increased villus length and an enhanced villus-to-crypt depth ratio (8.08) in M4, reflecting improved nutrient absorption and intestinal development. Mannanase supplementation also resulted in a significant reduction in faecal total bacterial count, indicating better gut health. Economic evaluation revealed that M4 achieved the lowest production cost per kilogram of weight gain, with savings of ₹2.21 and ₹4.37 compared to M1 and M2, respectively. These findings suggest that Mannanase supplementation at 100 gm/ton feed, combined with strategic reductions in ME and amino acids and is a sustainable approach to enhance broiler performance, gut health and profitability in commercial poultry production.

Keywords: Mannanase enzyme, broiler performance, guts health.

PNP-92

Effect of supplementation of liquid whey on egg shell thickness in layer chickens

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A study was conducted at poultry farm, LFC, Bihar Animal Sciences University, Patna with an aim to access the effect on egg shell thickness by supplementation of liquid whey with drinking water in layer chicken. A total of 120 Gramapriya layer chickens of about six months of age were divided into 4 groups of 30 bird each namelyT_5, T_6, T_7 and T_8 respectively. T_5 control group birds were supplemented with layer ration and wholesome drinking water T_6 group were fed layer ration and drinking water supplemented with 5% (v/v) liquid whey, T_7 group were fed layer ration and drinking water supplemented with 10% (v/v) liquid whey, similarly T_8 group bird were fed layer ration and drinking water supplemented with 15% (v/v) liquid whey. The egg shell thickness was found to vary between 0.28 to 0.50 mm during study period of 90 days. On first day of study T_5, T_6, and T_7 showed nearly equal value for egg shell thickness and T8 showed lowest value for egg shell thickness, but there after up to 30th day irregular trend of increase in egg shell thickness was observed among different treatment groups, but was lowest in control (T_5). From forty fifth day onwards, a non-significant but progressive increase in egg shell thickness was observed up to 90th day as the level of whey supplementation increased among treatment groups. The highest value for egg shell thickens was observed in T_7 group. The control group (T_5) showed lowest value for egg shell thickness. Hence liquid whey supplementation @ 10% (v/v) along with drinking water to layer bird has a positive effect on egg shell thickness.

Keywords: Layer, egg shell thickness, liquid whey supplementation

PNP-93

Evaluation of herbal feed additives (Giloy, Harad and Kalmegh) supplementation on performance and density of gut pathogens in commercial broiler chicken

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Although in-feed antibiotics are widely used in broiler production to promote growth and prevent disease, their extensive use has contributed to antimicrobial resistance (AMR). Hence, identifying natural and sustainable alternatives is essential. The present study evaluated the effect of Giloy, Harad and Kalmegh powders in broiler diets on performance, serum oxidative stress and gut microbiota. A total of 760 day-old commercial broiler chicks were randomly allotted to five dietary treatments with eight replications of 19 birds each and reared in floor cage system up to 42 days of age. The treatments included: T1-basal diet without antibiotic (negative control, NC); T2-basal diet with antibiotic (positive control, PC); T3 Giloy stem powder @2.5kg/ton; T4 Harad powder @1kg/ton; and T5 Kalmegh powder @2kg/ton. At 42 days, birds supplemented with Giloy, Harad and Kalmegh showed higher BWG 2548g, 2570g, and 2516g, respectively than T1(2472g) and T2(2438g) with numerically better FCR. Herbal supplementation resulted in significant ($P<0.05$) reduction in E. coli counts, with the lowest in Harad (T4), which was statistically similar to T3 and T5 but lower than T1 and T2 based on plate count method. Real-Time qPCR showed similar ($P>0.05$) in caecal E. coli load among treatments. Total bacterial count (log10cfu/g) differed significantly ($P<0.05$) among treatments, except T5 which was similar to T1. Herbal additives significantly ($P<0.05$) influenced NDV antibody titers and enhanced antioxidant enzyme activity (glutathione reductase) especially in T4 and T5, without negative effects ($P>0.05$) on liver enzymes (ALT, AST) or cell-mediated immunity. Therefore, our results shows that the tested herbal powders are safe, affordable, efficient substitute for antibiotics in broiler feed, supporting increased productivity, lowering gut pathogen load, and lowering the worries of AMR in chicken production and harad had the best performance enhancing effects among the tested additives.

Keywords: Giloy, harad, kalmegh, herbal feed additives, gut pathogen, commercial boilers.

PNP-94

Nutritional strategies to mitigate carbon footprint in broiler production systems through Life cycle assessment

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Carbon dioxide (carbon equivalent) emissions from poultry production are increasingly focused by both environmentalists and poultry nutritionists. Feed contributes more than 80% of total carbon footprint (CFP) attributed to broiler meat production. This study assessed the impact of selected nutraceutical combinations on growth performance, carcass parameters, and CFP in commercial broilers. A total of 1008 Cobb 430 broilers were allocated to six dietary treatments with nine replicates of 18 birds each, following a completely randomised design from day 1 to 42. Treatments are control and five nutraceutical combinations i.e. butyric acid (250 g/ton) with either an emulsifier (250 g/ton) (BOE), phytase (200 g/ton) (BOP), NSP enzyme (200 g/ton) (BOS), protease (25 g/ton) (BOPr), or betaine (350 g/ton) (BOB)Dietary treatments significantly influenced body weight gain during Week 1 ($P< 0.05$) and Week 2 ($P<0.05$) in (BOP). Feed efficiency (FI/BWG) improved significantly during Week 1 in BOP, in Week (3–4th), (5–6th) and overall (1-42 days), both BOP) and BOS were significantly influenced compared to control, while treatments BOE, BOPr, BOB showed intermediate differences. Among carcass traits, abdominal fat ($P < 0.05$) was significantly lower in BOP and BOB; BOBr group showed highest fat. Giblet weight ($P < 0.05$) was significantly greater in BOP and BOS groups compared to control: breast weight, dressing yield, liver weight, gizzard, spleen, heart and bursa were not significantly influenced. Overall CFP estimated by life cycle assessment also significantly ($P<0.05$) differed, with BOP CFP (4.924 kg CO2/kg meat), followed by BOS (4.937 kg CO2/kg meat), which were lower ($P<0.05$) than control (5.103 kg CO2/kg meat).

These results indicate that enzyme-based nutraceutical combinations at recommended doses enhance feed efficiency, certain carcass characteristics, and reduce carbon footprint offering a scalable strategy to enhance performance and environmental sustainability of broiler production systems.

Keywords: Broiler, Carbon footprint, Carbon equivalent emissions, Nutraceuticals, Carcass traits.

PNP-95

Effect of dietary inclusion of fermented amla supplementation on growth performance in broiler chicken

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Amla (Indian gooseberry), is exceptionally rich in vitamin C and nutrients, but its strong acidity and astringent flavor make it unsuitable for eating raw or direct consumption. Fermentation of amla reduces antinutritional factors like tannins, phytates, and oxalates, while simultaneously boosting antioxidants and polyphenols. The present study was conducted to study the effects of fermented amla (FA) supplementation on broiler growth performance. Experiment was conducted on 240 broiler chicks reared in cage system and were randomly categorized into six dietary treatments with five replicates and eight birds in each replicate. Six experimental diets were prepared T1 (Negative control), T2 (positive control), T3 (0.5g/kg FA), T4 (1g/kg FA), T5 (2.5g/kg FA), and T6 (5g/kg dried amla powder). The result of the present study revealed the body weight gain (BWG), feed intake (FI), and feed conversion ratio (FCR) over the starter (0-3 weeks) and finisher (4-6 weeks) phases. Results showed no significant differences in BWG during the starter phase among treatments, but BWG during the finisher phase and cumulative 0-6 weeks period varied significantly. The highest BWG was observed in the T3 group. Feed intake was statistically similar across treatments in all phases, indicating voluntary feed consumption was not affected by supplementation. FCR differed significantly between groups, with T3 and T4 showing improved feed efficiency. These findings suggest that 0.5 g/kg fermented amla inclusion enhances growth performance and feed efficiency in broiler chickens without detrimental effects on feed intake, aligning with prior evidence on the antioxidant and growth-promoting properties of amla supplementation in poultry production.

PNP-96

Effect of Different Sources of Lipids in Diets on Growth Performance and Carcass Traits in Broilers

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The aim of the experiment was to study influence of different sources of dietary lipids on growth, and carcass traits in broiler chickens. Three hundred and twenty broiler chicks of Vencobb 430 strain (straight run) were randomly distributed among four treatment groups such as soybean oil (T0), palm oil (T1), lard (T2) and their combination in equal proportion (T3). The experimental diets were prepared by adding these lipid sources and nutrient levels were maintained as per BIS (2024). Each experimental had 4 replicates with 20 chicks. The live weight and gain in body weight in groups fed soybean oil, lard and a blend of soybean oil, palm oil and lard were comparable but higher ($P<0.05$) than group fed crude palm oil-based diet. The feed intakes remain unchanged between treatment groups. The comparable FCR was observed in birds given soybean oil, lard, or a combination of lipids though it was increased in palm oil group. The abdominal fat pad index was higher in birds fed lard either alone or in combination with other. No significant impact of treatments was observed on carcass traits, MDA level and ND titers. There was reduction in LDL cholesterol and triglycerides in birds fed diets with soybean or palm oil than in birds fed lard or combination of differed lipid sources. The ether extract digestibility was marginally better in birds fed diet with lard followed by a diet with a combination of lipids and the diet with soybean oil fed birds and lowered in palm oil fed birds. Therefore, it can be concluded that including crude soybean oil and lard, either alone or in combination with crude palm oil, in the diet is beneficial for improving performance, lipid profile, and profitability in broiler production.

Keywords: Broiler chickens, Lard, FCR, lipid profile.

PNP-97

Effect of feeding fermented raw guar meal (FRGM) on the performance, nutrient retention, carcass traits, serum biochemical constituents, immune response, and gut health of commercial broiler chicken

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A biological trial was conducted in commercial male broiler chicken to assess the impact of incorporating varying levels of fermented raw guar meal (FRGM) on the performance, nutrient retention, carcass traits, serum biochemical constituents, immune response and gut health in commercial broiler chicken. 300 day-old commercial male broiler chicks (Vencobb 430Y) were procured and randomly distributed into 5 dietary treatment with 12 replicates for each treatment group and 5 birds in each replicate. Dietary treatments were *iso-nitrogenous* and *iso-caloric* diets containing 0 % RGM (control), 10%RGM (RGM 10), 15%RGM (RGM 15),10% FRGM (FRGM 10) and 15% FRGM (FRGM 15) respectively. The results showed that BWG in 10 and 15% FRGM incorporated group was comparable to control and significantly ($P<0.05$) higher than 15% RGM inclusion. Feeding of 10% FRGM diet showed FCR comparable with control and significantly better ($P<0.05$) when compared to 15% RGM diet. There was no significant effect of inclusion of fermented raw guar meal at any level on feed intake. The carcass (dressing percentage, giblet weight, breast weight and abdominal fat) and nutrient retention (dry matter, crude protein, crude fibre, ether extract and nitrogen free extract) remained unaffected ($P>0.05$) by incorporation of FRGM at graded level (10 and 15%). The *Lactobacillus* count was significantly higher ($P<0.05$) in FRGM groups (10 and 15%) and the *E.coli*was significantly lower ($P<0.05$) when compared to control and RGM diet groups. Significantly ($P<0.05$) higher duodenal villus height (VH) and VH/CD ratio was noticed with 10 and 15% FRGM and crypt depth with 15% FRGM compared to control. Significantly ($P<0.05$) higher jejunal VH and VH/CD ratio was noticed with 15% FRGM and crypt depth with 10 and 15% FRGM compared to control groups. FRGM groups showed significantly ($P<0.05$) higher ileal VH, CD and VH/CD ratio compared to control groups. Serum globulin, A/G ratio, HDL and LDL were not affected by inclusion of RGM and FRGM at 10 and 15 % while serum total protein was higher ($P<0.05$) in FRGM groups (10 and 15%) compared to control and RGM groups. Significantly reduced ($P<0.05$) triglycerides and very low-density lipoprotein (VLDL) was observed with FRGM (10 and 15%) groups and 10% FRGM significantly reduced total cholesterol compared to control. Incorporation of FRGM at different level resulted in significantly higher ($P<0.05$) antibody (log2) titres against ND vaccine and CMI response when compared to control groups. From the results it is evident that fermented raw guar meal upto15% can be included in diets without any adverse effects on performance, nutrient retention, carcass traits and with improvement in gut health and immunity.

PNP-98

Effect of curry leaves (*Murraya koenigii*) powder supplementation on the growth and intestinal morphology of broiler chicken.

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A study was conducted on Cobb 430 broiler chicken to ascertain the effect of addition of dietary inclusion of curry leaves powder (*Murraya koenigii*) on the gross and microscopic intestinal morphology of broiler chicken. Four treatment groups were formed including Control group namely T1, T2 and T3 incorporated with 0.25%, 0.50% and 0.75% Curry leaves powder (CLP) respectively in the basal diet formulated as per BIS standard. It was observed that the treatment groups T2 and T3 showed significantly increase in growth parameters such as live body weight and improved FCR. At the end of the research experiment, representatives birds were humane slaughtered following all standard protocols to study gross and microscopic morphology of intestinal tract and it revealed that the experimental groups treated with curry leaves powder T1, T2 and T3 showed significantly difference in gross and microscopic morphometric parameters like presence of Payer's patches, increase in villi lengths, crypt depths when compared with Control group. Thus, use of curry leaves powder at the rate of 0.5% and 0.75% can safely be use in broiler diet as feed additive without causing any detrimental effect.

Keywords: Broiler, curry leaves, dietary, significant, treatment.

PNP-99

Effect of bentonite based binder on performance and health of broiler chicken fed Aflatoxin contaminated diet

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252 commercial layer birds of 18 weeks age were procured and distributed randomly to 3 different treatment groups. Each treatment had 7 replicates with 12 birds per replicate (84 per treatment). Group 1 birds were fed control diet with AGP, Group 2 with AGP+ microencapsulated butyrate @ 500 g/T feed (MEB)and group 3 with microencapsulated butyrate @ 500 g/T feed without AGP. Birds were reared in cages with standard managemental practicesup to 12 weeks experimental period. Egg production, feed efficiency, egg quality parameters, gut microbial load and gut morphology were studied to know the effect of MEB in layer birds. Egg production and feed efficiency significantly improved in MEB supplemented groups. Body weight and flock uniformity improved with butyrate supplementation, but, no effect on serum biochemistry was noticed. Egg weight was significantly higher in butyrate supplemented groups on both 24th and 28th week with definite improvement in egg internal parameters on 28th week. An apparent gut health promoting effect of microencapsulated butyrate was evident in this trial with significant reduction in gut pathogens, *E. coli* and *Clostridium perfringens* load as well as increased counts of beneficial bacteria, *Lactobacillus* species. Butyrate supplementation also proved to be beneficial in improving gut health by increasing the villi length in all three segments of small intestine. Hence, in the current trial, it was clearly established that supplementation of microencapsulated butyrate in young layer chicken was beneficial in improving production performance, egg quality and gut health.

Keywords: Layer, Microencapsulated butyrate, Egg quality, Gut health.

PNP-100

Organic Selenium-enriched *Nannochloropsis oceanica* CASA CC201 as functional feed supplement in layer chicken

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The present study was conducted to study the effect of organic selenium enriched *Nannochloropsis oceanica* CASA CC201 microalga as functional feed supplement in layer chicken on production performance. Three hundred commercial (BV 300 strain) layer birds of 17 weeks of age were purchased from a commercial layer farm and were weighed, randomly assigned into six treatment groups with five replicates of ten in each replicate. All the birds were reared in cages under uniform managemental conditions throughout the experimental period up to 32 weeks of age. Feed formulation was formulated for pre layer and layer diets as per the BV300 standards. From 21 to 32 weeks of age, the layer birds were fed with the experimental rations such as control-basal diet (T1) without selenium supplementation, micro alga was supplemented at 0.3 ppm level with basal diet (T2). Sodium selenite (SS) with basal diet (T3) supplemented at 0.3 ppm as inorganic source of selenium. The other treatment groups were T4, T5 and T6 comprises of Selenium enriched algae (SA) *Nannochloropsis oceanica* CASA CC201 supplemented as organic source of selenium at the levels of 0.1, 0.2 and 0.3 ppm, respectively along with the basal diet. The data on production performance was recorded from 21 to 32 weeks of age. It was found that hen housed egg production was significantly ($P \leq 0.01$) higher in hens fed with organic selenium enriched microalgae fed T6 group (94.64±0.52) as compared to T1 group (88.43±1.62). Feed efficiency per dozen of eggs and feed efficiency per kg egg mass revealed that dietary supplementation of selenium enriched algal biomass had significant ($P \leq 0.01$) effect on the Se enriched algae fed groups in comparison to other treatment groups. Among the Se enriched microalgae fed groups, 0.3 ppm group had better feed efficiency per dozen of eggs (1.49) and feed efficiency per kg egg mass (2.41) as compared to basal diet fed group (1.66 and 2.76). Thus, it may be concluded that Se enriched algae supplementation has resulted in better egg production, feed efficiency and livability in layer chicken.

Keywords: Organic Selenium, microalga, feed efficiency, layer chicken.

PNP- 101

Effect of supplementation of peppermint and eucalyptus essential oils on the carcass traits of Japanese quails

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Antimicrobial resistance (AMR) has become more common in humans for which one of the reason considered was theusage of antibiotics as feed additives for farm animals. Therefore, national and international organisations started to work towards prevention of abuse of antibiotics in livestock, and still continue to conduct researches to find the possible alternatives. Essential oils which are the volatile aromatic compounds that have antimicrobial, anti-inflammatory, and antioxidant properties can be one such good replacement. This study was undertaken to investigate the effects of dietary inclusion of peppermint (PEO) and eucalyptus essential oils (EEO) on the carcass traits of the Japanese quails. 180 Japanese quail chicks of six day old were randomly grouped into 5 treatments which were further divided into 3 replicates having 12 chicks each. The experimental treatments were T0 (Basal diet), T1 (Basal diet+0.2% of PEO), T2 (Basal diet+0.2% of EEO), T3 (Basal diet+0.1% each of PEO+EEO) and T4 (Basal diet+0.05% each of PEO+EEO). The trial was carried out for 35 days, after which 2 birds from each replicate were slaughtered and their carcass traits were determined. The study revealed that the dressing weight and the cut-up part yield like thigh, breast, and drumstick and wing weight were significantly higher in the groups supplemented with PEO and EEO. The CP content of thigh and breast meat was significantly higher while the EE content was significantly reduced in group T3 supplemented with 0.1% of PEO and EEO in combination. Thus, it can be concluded that the supplementation of 0.1% of PEO and EEO in combination in the Japanese quails improved the carcass traits. Therefore, it can be recommended to include 0.1% of peppermint and eucalyptus essential oils in combination in the feed of Japanese quails to improve nutrient composition of meat making it beneficial for human consumption.

Keywords: Japanese quails, carcass traits, peppermint essential oil, eucalyptus essential oil.

PNP-102

Effect of banana peel meal on performance of broiler chicken

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A biological experiment was conducted to evaluate the effect of banana peel meal (BPM) inclusion on the production performance of commercial broiler chickens. The study was carried out at the Poultry Farm Complex, Department of Poultry Science, Veterinary College and Research Institute, Namakkal. A total of two hundred and forty, day-old commercial Vencobb 430 Y broiler chicks from a single hatch were individually weighed, wing banded and randomly distributed into five dietary treatment groups, each having six replicates with eight birds per replicate, and reared up to 35 days of age under standard managemental practices in deep litter system. The treatment groups consisted of T_1 - Control (0%BPM), T_2 - 2.5% BPM, T_3 - 5% BPM, T_4 - 7.5% BPM and T_5 - 10% BPM inclusion levels in isocaloric and isonitrogenous diets formulated as per strain specification. Our finding revealed a significant ($P<0.01$) differences were observed in body weight and body weight gain from the second week onwards. Broilers fed diets containing 5% BPM (T_3) recorded the highest final body weight (1817.73 ± 34.28 g) and cumulative body weight gain (1769.91 ± 34.16 g), followed by 7.5% BPM (T_4), which were significantly higher than those in control (1543.39 ± 23.57 g) and other treatments. Feed intake differed significantly ($P<0.01$) among treatments groups throughout the experimental period, with higher intake observed at 7.5% (2835 ±70 24.26 g) and 10% (2865.65 ± 22.59 inclusion levels. The best feed conversion ratio (1.57 ± 0.02) was recorded in 5% BPM group (T_3), indicating improved feed efficiency and nutrient utilization. Livability remained 100% across all treatment groups, confirming that BPM inclusion up to 10% had no adverse effect on bird health or survival. Overall, the inclusion of banana peel meal (BPM) up to 7.5% in broiler diets markedly improved body weight gain, feed intake, and feed conversion ratio without any adverse effects. The best

performance was observed at 5–7.5% inclusion, which may be attributed to enhanced nutrient absorption, antioxidant activity, and improved intestinal function resulting from the bioactive compounds and dietary fiberpresent in banana peel.

Keywords: Banana peel meal, Broiler, Body weight.

PNP-103

Effect of supplementation of combination of phenolic aromatic polymer and modified lignin on gut health in broilers

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An experiment was conducted to study the effect of phenolic aromatic polymer and modified lignin on gut health in broilers. Six treatment groups with three replicates of ten birds each for 42 days. T1 was fed with control diet based on BIS (2007) [3], T2 fed with reformulated diet with 2% reduction in metabolizable energy and crude protein of control diet, T3 and T4 supplemented with 0.2% phenolic aromatic polymer and modified lignin in control and reformulated diets, respectively and T5 and T6 supplemented with 0.3% phenolic aromatic polymer and modified lignin in control and reformulated diets, respectively. The results showed, birds supplemented with 0.2 and 0.3% phenolic aromatic polymer and modified lignin in control diet showed significant improvement in gut health compared to control and reformulated diets fed groups. It was concluded that supplementing phenolic aromatic polymer and modified lignin improved gut health in broilers.

Keywords: Phenolic aromatic polymer, Modified lignin, gut morphology, gut microbial load, broilers.

PNP-104

Effect of supplementation of combination of phenolic aromatic polymer and modified lignin on growth performance in broilers

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An experiment was conducted to study the effect of phenolic aromatic polymer and modified lignin on growth performance in broilers. Six treatment groups with three replicates of ten birds each for 42 days. T1 was fed with control diet based on BIS (2007) [4] standards, T2 fed with reformulated diet with 2% reduction in metabolizable energy and crude protein of control diet, T3 and T4 supplemented with 0.2% phenolic aromatic polymer and modified lignin in both control and reformulated diets, respectively and T5 and T6 supplemented with 0.3% phenolic aromatic polymer and modified lignin in both control and reformulated diets, respectively. The results showed that birds supplemented with 0.2 and 0.3% phenolic aromatic polymer and modified lignin in control showed significantly improved body weight and feed conversion ratio compared to both the control and reformulated diets fed groups and no significant difference was noticed in feed intake and survivability among all the groups. It was concluded that supplementing phenolic aromatic polymer and modified lignin improved growth performance in broilers.

Keywords: Phenolic aromatic polymer, modified lignin, growth performance, broilers**.**

PNP-105

Preparation and Characterization of Nano-Calcium from Chicken Eggshells by Hydration-Dehydration Method

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Chicken Eggshells, a common by-product of egg layer industry rich in calcium carbonate, offer a sustainable source for nano-calcium generation. Nano-calcium oxide (CaO, nanoparticles) exhibit multifaceted applications across

pharmaceuticals and biomedicine. In catalytic and industrial applications, nano-CaO functions as a heterogeneous catalyst for biodiesel synthesis, esterification reactions, and acts as a dehydrating agent in steel production and water softening. This study aimed to synthesize nano-CaO (nCaO) particles from eggshell powder using two thermal methods: direct ashing and a combined hydration-dehydration method. The ashing method involved calcination of dried eggshell powder at 900°C for 3 hours to convert calcium carbonate into CaO. The hydration-dehydration method included ashing followed by hydration with water at 60°C for 6 hours, drying, and a second ashing cycle at 870°C for 3 hours to transform calcium hydroxide back to CaO. The synthesized nCaO particles were characterized using dynamic light scattering (DLS) to determine average particle size, which was found to be 38.28 nm for the hydration-dehydration method. Scanning electron microscopy (SEM) imaging provided morphometric evidence confirming the uniformity and nanoscale size of the particles. The hydration-dehydration method demonstrated improved particle size distribution and uniformity, making it a preferred synthesis route for applications requiring consistent nCa. These findings suggest that adopting multi-step hydration – dehydration processes can optimize nano-calcium production from chicken eggshell, enhancing its potential utility in pharmaceutical formulations and catalytic processes.

Keywords: Nano calcium, Eggshells, Calcination, Calcium oxide.

PNP-106

Effect of Supplementation of Mixture of *Moringa Oleifera* Leaf and Arjuna Bark Powder on the Productive Performance and Economics of Egg Production of Kadaknath Chicken

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Alternatives are needed due to the public health risks of subtherapeutic antibiotic use in chicken feed. Moringa oleifera is a phytobiotic with antibacterial and immunomodulatory effects. *Terminalia arjuna* in Ayurvedic medication is used as a heart tonic to keep the heart healthy, blood pressure normal and cholesterol levels low. The goal of the study was to see how *Moringa oleifera* leaf and Arjuna (*Terminalia arjuna*) bark powder administration affected the productive performance of Kadaknath fowl. Day old chick (n=72) were distributed into six treatment groups, having three replicates of four birds each. The study was conducted from day old to 52 weeks of age. Chicks were fed T_0 (control) basal diet and 5 treatment groups as T_1, T_2, T_3, T_4, T_5 supplemented with 1, 2, 3, 4, 5% *Moringa oleifera* leaf powder respectively and 1% Arjuna bark powder in each group respectively. The age at first egg laying in T_3 was found to be less (174 day) as compared to control (177 day) groups. No significant difference in average feed consumption. The average egg production in supplemented group was significantly ($P<0.05$) higher than control group from 25-52 week of age. The average eggmass(g) was found to be significantly higher($P<0.01$) in T3 than T0, T4 and T5 groups. Average feed conversion ratio per egg mass basis was significantly ($P<0.05$) better in T_3 group than control group from 25-52 wk of age. T3 had significantly lower ($P<0.05$) feed cost per dozen eggs thanT0, T4and T5. Thus, it may be concluded that dietary supplementation of mixture of *Moringa oleifera* leaf @3% and Arjuna bark powder @1% resulted in better productive performance and low feed cost of Kadaknath chicken.

Keywords: Feed conversion, Laying, Arjuna, Moringa, Kadaknath.

PNP-107

Influence of different levels of serratiopeptidase on the production performance of commercial broiler chicken

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Due to the growing concern over antibiotic resistance, the poultry industry is moving towards safe, natural alternatives to antibiotic growth promoters. Serratiopeptidase, a proteolytic enzymes with anti-inflammatory and fibrinolytic

properties has shown promise in enhancing nutrient digestion and growth performance in broilers. A biological trial was conducted using 240 day-old broiler chicks divided into six groups: control (T_1), control + Antibiotic growth promoters (T_2) and serratiopeptidase at 10, 20, 30 and 40 mg/kg feed (T3 to T6). Each treatment had five replicates of eight chicks. The birds were reared for 35 days under standard management and data on body weight, weight gain, feed intake and feed conversion ratio (FCR) were analyzed statistically. Supplementation of serratiopeptidase significantly improved growth performance and feed efficiency compared to the control and antibiotic-fed groups. Birds fed with 30 mg/kg levels showed higher body weight gain and better FCR, while feed intake remained similar across treatments, indicating improved nutrient utilization rather than increased consumption, suggesting its potential as a safe, non-antibiotic alternative to traditional growth promoters. Supplementation of serratiopeptidase, particularly at 30 mg/kg feed, enhances growth performance and FCR in broiler chickens.

Keywords: Broiler chicken, feed additives, non-antibiotic growth promoters, Body weight, Body weight gain, Feed conversion ratio and serratiopeptidase.

PNP-108

Intelligent designing of nano-Selenium composites over pure nano Selenium: able to positively stimulate survival and immunocompetence in Pekin ducks

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Nano-minerals represent a pioneering trend in poultry research, offering improved bioavailability and potential gains in growth and immunity. The current study examines an intelligently designed Nano-Selenium composite, combining Nano-Selenium and Nano-Ferrous via a nano-carrier system, compared to pure Nano-Selenium, by in-ovo injection in White Pekin duck embryos at day 23 of incubation. Using 450 fertile eggs, five treatment groups were arranged: Nano-Ferrous, Nano-Selenium, Nano-Fe-Se, Nano Fe-Se-Titanium composite, sham, and untreated controls. Each group received 25 µg of the respective nano-compound. Ducklings were monitored post-hatch for growth, survival, and immune competence, with some groups supplemented with 0.2 ppm dietary nano-minerals for three weeks. Immune responses were evaluated by anti-Sheep RBC titre at week five and cell-mediated immunity (CMI) by PHAP injection at week six. Results indicated that viable hatchability occurred only in Nano-Se and Titanium-Fe-Se composite groups, achieving nearly 60%, while Fe-Se treatment resulted in near-total embryonic mortality. The Nano-Se group reached the highest six-week body weight (1840g), followed by the nano-composite (1698.8g), surpassing sham controls by 21.3%. Survival rate was highest in the nano-composite group (1% mortality) vs. Nano-Se (7%). Ducklings receiving both in-ovo and dietary nano-composite showed superior humoral immunity, while those with only in-ovoNano-composite exhibited the highest CMI. The findings demonstrate that the specially designed Nano-Se-Fe-Ti composite enhances internal defense mechanisms in ducklings beyond pure Nano-Selenium, although Nano-Se alone most benefits the growth. These results highlight the promise of nano-mineral composites and underscore the need for further research to clarify their impact for poultry production improvement.

Keywords: Ducks, Pekins, Nano-composite, Nano-selenium, Sheep-RBC antibody titre.

PNP-109

Evaluation of lipid metabolism and carcass quality in quail fed diets supplemented with varying amounts of peppermint leaf powder

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A study was conducted to evaluate the effects of dietary peppermint leaf powder (PLP) supplementation on the lipid profile and carcass characteristics of Japanese quails (*Coturnix japonica*). A total of 150 day-old quails were randomly allotted to five dietary treatments, each with three replicates of 10 birds. Experimental diets were formulated by incorporating PLP at 0% (T1: control), 0.75% (T2), 1.5% (T3), 2.25% (T4), and 3.0% (T5), with marginal adjustments in feed ingredients to ensure iso-caloric and iso-nitrogenous rations. Feed and water were provided *ad libitum*, and

birds were maintained in battery cages from hatch to 5 weeks of age. At the end of the trial, two birds per replicate (six birds per treatment) were slaughtered to evaluate serum biochemical parameters and carcass traits. Results revealed that serum total cholesterol, LDL-C, VLDL-C, triglycerides ($p<0.05$), and creatinine ($p<0.01$) significantly decreased with increasing dietary PLP levels, whereas HDL-C values increased significantly ($p<0.05$). Live body weight, carcass weight, and dressing percentage were also significantly improved ($p<0.05$) in quails receiving higher levels of PLP. Sensory attributes of meat, including color, flavor, juiciness, tenderness, and overall acceptability, were significantly enhanced ($p<0.05$) at 3.0% PLP inclusion compared to other treatments. It is concluded that peppermint leaf powder can be safely incorporated up to a level of 3.0% in quail diets, resulting in improved serum lipid profile, carcass yield, and meat sensory quality without any adverse effects.

Keywords: J.Quail, Meat quality, Pepper mint, Serum cholesterol, Sensory attributes.

PNP-110

Effect of supplementation of modified lignin on gut health in broilers

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An experiment was conducted with 180-day-old Cobb broiler chicks to evaluate the effect of modified lignin on gut health. The chicks were randomly allotted into six dietary treatment groups with three replicates of ten birds each for 42 days. The treatments included a control diet as per BIS (2007) (T1), reformulated diet with 2% reduction in metabolizable energy and crude protein (T2), and experimental diets supplemented with 0.2% (T3, T4) and 0.3% (T5, T6) modified lignin in both control and reformulated diets, respectively. The results showed that supplementation of modified lignin at 0.2 and 0.3% significantly enhanced villus height and crypt depth in duodenum, jejunum and ileocecal junction, and also reduced E. coli counts, and increased Lactobacillus counts compared to control and reformulated groups. It was concluded that dietary inclusion of modified lignin effectively improved gut health in broilers.

Key words: E. coli, Lactobacillus, villus height, crypt depth, duodenum, jejunum, ileocecal junction.

PNP-111

Effect of supplementation of modified lignin on growth performance in broilers

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An experiment was conducted using 180 day-old Cobb broiler chicks to study the effect of modified lignin on growth performance. The chicks were randomly divided into six treatment groups with three replicates of ten birds each for 42 days. Treatment groups included a control diet (T1) as per BIS (2007), a reformulated diet with 2% reduction in metabolizable energy and crude protein of control diet (T2), and experimental diets T3 and T4 supplemented with 0.2% modified lignin in both control and reformulated diets, respectively and similarly, the treatments T5 and T6 supplemented with 0.3% modified lignin in both control and reformulated diets, respectively. The results showed that birds supplemented with 0.2 and 0.3% modified lignin in both control and reformulated diets showed significantly improved body weight, feed intake and better feed conversion ratio compared to both the control and reformulated diets fed groups and no significant difference was noticed in survivability among all the groups. It was concluded that supplementing modified lignin improved growth performance in broilers.

Keywords: Modified lignin, reformulated diet, body weight, feed intake, feed conversion ratio, survivability.

PNP-112

Effect of copper and zinc on growth performance, carcass and meat quality traits in Aseel chicken

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The present study was conducted to evaluate the dietary requirements of copper (Cu) and zinc (Zn) for optimal growth performance and carcass characteristics in Aseel chickens. A total of 192 day-old sexed chicks were allotted to four treatments in a 2 × 2 factorial design for 16 weeks, with two levels each of Cu (12 and 24 mg/kg) and Zn (80 and 160 mg/kg). Weekly body weight, feed intake and feed conversion ratio (FCR) were recorded. At 16 weeks, two birds per replicate were slaughtered for carcass assessment. Data were analyzed using the General Linear Model in SPSS 20, with mean separation by Duncan's multiple range test. The dietary Cu and Zn had neither interactive effects nor individual effects of Cu on body weight (1661.63 - 1709.81 g) throughout the 16 weeks trial period. Similarly, individual Zn levels did not affect body weight up to 6 weeks of age. However, from 7 to 16 weeks of age, body weight (1704.97 vs 1672.15g) were significantly ($P<0.05$) higher with 160 ppm Zn compared to 80 ppm fed groups. The weekly cumulative feed intake (6089.48 - 6263.19 g) of Aseel chicken was not affected ($P>0.05$) by different levels of Cu and Zn throughout trial period. The cumulative feed conversion ratio (3.65 - 3.78) was unaffected by the interaction between Cu and Zn or by the Cu levels at 16 weeks of age. Similarly, Zn supplementation at 80 and 160 ppm had no effect on the feed conversion ratio from 0 to 8 weeks. However, from 9 to 16 weeks of age, 160 ppm Zn fed group had significantly ($P<0.05$) enhanced (3.65 vs 3.77) the feed conversion ratio compared to 80 ppm Zn fed group. The present study also revealed that varying dietary levels of Cu and Zn, independently or in combination, did not significantly influence ($P>0.05$) any of the examined carcass traits, such as dressing percentage or the relative weight of various organs, cut up parts and meat quality parameters such as meat pH, WHC and TBA among the different treatment groups. The study revealed that dietary supplementation with 12 ppm Cu and 160 ppm Zn is adequate to optimal growth performance in Aseel chickens without adversely affecting carcass or meat quality traits.

Keywords: Aseel chicken, Growth performance, carcass characteristics, copper and zinc.

PNP-113

Gut morphology of commercial layer chicken fed with silk worm pupae meal

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The biological experiment was conducted for finding silk worm pupae meal as an alternative protein source in commercial layer feed by using fifty-four commercial layer chicken (White Leghorn) at the age of 25th week, belonging to single hatch after providing two weeks adaptation period. These birds were randomly grouped into three treatment groups with three replicates of six birds each and fed with experimental feed; T_1 (Control - Basal diet), T_2 (Basal diet + 2% Silk worm pupae meal) and T_3 (Basal diet + 4% Silk worm pupae meal), up to 33rd week. Segments from the ileum, jejunum, and duodenum were taken during slaughter at the end of the trial and fixed in 10 per cent neutral buffered formalin and later embedded in paraffin wax for evaluating the gut morphology. Significantly ($P\leq0.05$) higher villi length was observed in the T^3 (Basal diet + 4% Silkworm pupae meal) group birds when compared to T_1 (Control - Basal diet) and T_2 (Basal diet + 2% Silk worm pupae meal) group. Based on this experiment, inclusion of silkworm pupae meal at 4 per cent level in commercial layer feed performed better with respect to gut morphology traits. Hence, the silkworm pupae meal up to 4 per cent level could be included as an alternate protein source in commercial layer feed.

Keywords: Commercial layer chicken, Silk worm pupae meal, Gut morphology.

PNP-114

Comparative efficacy and performance of antimicrobial gut health additives fed to broiler chicken

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A six-week biological experiment was conducted to evaluate the comparative efficacy and performance of different antimicrobial gut health additives in commercial broiler chickens. A total of 640, day-old male commercial broiler chicks of the Cobb-430Y strain were randomly divided into four groups (A to D), containing 160 chicks per group with eight replicates of 20 chicks in each. Group A was the control without any antimicrobial gut health additive. Broilers from groups B, C, and D were fed with Enramycin 8% @ 100g/ton, Virginiamycin 50% @ 40 g/ton, and Phytogenic Feed Additive (PFA) @100g/ton, as per manufacturers' recommendations, respectively. The broilers were fed with iso-caloric and iso-nitrogenous pre-starter, starter, and finisher diets from 0-10, 11-21, and 22-42 days, respectively. The different antimicrobial feed additives significantly ($P<0.05$) improved the finisher phase BW, cumulative BWG, ADG, and overall FCR in broilers, achieving the best with PFA @ 100 g/ton among antimicrobial feed additives. The addition of PFA and other antimicrobial feed additives significantly decreased Clostridium spp. count of caecal digesta and Total Bacterial Enteritis Scoring (TBE) on the 35th day, leading to better gut health. The PFA significantly decreased serum BUN and ammonia levels compared to other antimicrobial feed additives and the control group on the 35th day of age, indicating a positive effect on protein metabolism by decreasing the protein catabolism rate. The PFA significantly decreased oxidative stress-induced serum lipid peroxidation levels as well as serum total nitrite levels compared to other antimicrobial feed additives and the control group on the 35th day of age, while the values of SOD antioxidant enzyme levels were highest in the PFA group. It was concluded that the PFA was found to be promising for the replacement of antibiotic growth promoters in commercial broilers for improving gut health and growth performance.

Keywords: Broilers, Phytogenic feed additive, Gut Health.

Poultry Physiology and Management: Oral Presentations

PMO-01

Comparative gross anatomy, histology and ultrastructural features of the liver, magnum, testes, and spermatozoa in Kamrupa chickens under farm and field conditions

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The present study investigated the gross anatomical, histological, and ultrastructural characteristics of the liver, magnum, testes, and spermatozoa in Kamrupa chickens (*Gallus domesticus*) reared under farm and field conditions. The liver was bilobed, with the right lobe larger than the left, the left lobe was further divided into dorsal and ventral parts, and the gall bladder was located within the right lobe. Mean liver length was 40.6 0.39 mm (farm) and 42.6 2.49 mm (field). The magnum was the longest oviduct segment, averaging 33.31 ± 0.73 mm (farm) and 32.27 ± 1.39 mm (field). Testes were bean-shaped, averaging 72.0 1.52 mm (farm) and 71.6 1.96 mm (field). Histologically, the liver exhibited typical hexagonal lobules, hepatocytes, endothelial cells, and Kupffer cells. Magnum mucosa displayed primary, secondary, and occasional tertiary folds lined by pseudostratified ciliated columnar epithelium, with abundant tubular glands. Testes showed tunica vaginalis, tunica albuginea, and tunica vasculosa, with active spermatogenesis. Spermatozoa were sickle-shaped, with distinct head, midpiece, and tail. Ultrastructural examination revealed more prominent hepatic cords in field birds, more complex secondary folds in field magnum, and larger gland openings in farm magnum. Mitochondria were more prominent in farm spermatozoa. These findings provide a detailed morphological and ultrastructural baseline for Kamrupa chickens, aiding future breeding and reproductive biology studies.

Keywords: Kamrupa chicken, gross anatomy, histology, ultrastructure.

PMO-02

Effect of short periods of incubation during egg storage on hatchery performances of broiler chicken

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An experiment was conducted to evaluate the effect short periods of incubation during egg storage (SPIDES) with or without turning on hatchery performances of long term stored eggs. A total of 750 broiler hatching eggs from 33.5 weeks old parent stock were divided into five groups: T1 (Control without SPIDES), T2 (3 SPIDES without turning), T3 (3 SPIDES and 3 turning during each SPIDES), T4(4 SPIDES without turning), and T5 (4 SPIDES and 3 turning during each SPIDES). Eggs were stored at 17 °C with 75% relative humidity and SPIDES treated eggs were periodically exposed to 37.7 °C for 3 hours at 5 days interval. The SPIDES with turning treatment group eggs were turned by 45º angle on either side of an hourly interval. All eggs were stored for 21 days and incubated at 22nd day. The results showed significant differences between treatment groups in storage loss, moisture loss, hatchability of total egg set and fertile egg set, hatch time, hatch window, early, mid, late and total embryonic mortality as well as dead-in-shell. SPIDES effectively mitigated the negative impacts of prolonged storage, suggesting its potential for improving hatchability of commercial broiler hatching eggs stored for long period. In conclusion, SPIDES treatment, particularly with 3 SPIDES and 3 turning during each SPIDES at every 5 days interval significantly ($p<0.01$) enhanced hatchability and reduced embryonic mortality in long term stored eggs.

Keywords: SPIDES, hatchability, hatch time, hatch window, break open study.

PMO-03

Cryopreservation and post-thaw characterization of Kadaknath chicken bone marrow-derived mesenchymal stem cells

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Bone marrow derived mesenchymal stem cells (BM-MSCs) are multipotent progenitor cells capable of self-renewal and differentiation into multiple lineages, making them indispensable for regenerative medicine, cellular therapy, and conservation of genetic resources. Cryopreservation of MSCs provides an effective strategy for long-term storage of

germplasm without compromising stem cell properties. Standardized protocols for avian MSC cryopreservation are limited. Bone marrow–derived MSCs (BM-MSCs) from Kadaknath chickens were cryopreserved using a slow-freezing method with cryomedia containing 10% DMSO and stored in liquid nitrogen. Cells were revived using prewarmed high-glucose DMEM with 20% FBS and repeated centrifugation to remove DMSO. Post-thaw characterization involved assessment of cell viability, morphology, attachment, clonogenic potential, and passage stability. Molecular characterization was performed by RT-PCR for MSC surface markers (CD29, CD44, CD73, CD90, CD105), stemness markers (Sox2, Nanog, Oct4), and absence of hematopoietic markers (CD34, CD45). Trilineage differentiation into osteogenic, adipogenic, and myogenic lineages was confirmed by histochemical staining (Alizarin Red S and Oil Red O) and expression of lineage-specific genes (Osteopontin, BSP, BMP2; C/EBPα, C/EBPβ; MyoD, Myf5, Pax7) using RT-PCR. RT-qPCR was used to compare gene expression levels between fresh and cryopreserved–revived cultures. Revived cells exhibited 80–90% viability, retained characteristic spindle-shaped morphology, attachment, and clonogenicity. MSC-specific and pluripotency markers were consistently expressed after revival. The results indicated that the functional multipotency after revival was preserved in the cells. RT-qPCR analysis revealed robust expression of osteogenic, adipogenic, and myogenic lineage genes, with higher levels in fresh cultures but substantial expression retained in revived cells, confirming preserved multipotency. A cryopreservation and revival protocol for Kadaknath BM-MSCs was standardized, ensuring high post-thaw viability, molecular stability, and trilineage differentiation potential. This provides a valuable tool for avian germplasm banking, conservation of native breeds, and future stem cell research.

Keywords: bm-mscs, cryopreservation, trilineage differentiation, kadaknath chicken.

PMO-04

Effect of egg shape index on hatchability and post-hatch performance of commercial layer chickens under Kashmir agro-climatic conditions

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The present study was conducted to assess the impact of egg shape index (SI) on hatchability and post-hatch performance of commercial layer chick under the agro-climate conditions of Kashmir valley, and to recommend the best egg SI for optimum chick quality and growth performance. A total of 600 hatching eggs were segregated into three SI groups: G1: elongated (<72%) G2: standard (72–76%) and G3: rounded (>76%). All eggs were incubated under standard conditions, and hatchability on total egg set (HTES) and fertile egg set (HFES), embryonic mortality, chick quality, and post-hatch performance up to 8 weeks of age were studied. External and internal egg quality characteristics were also measured. Overall hatchability was the highest in the eggs of standard SI (72–76%) group (HTES: 76.00%; HFES: 86.36%) with the least dead-in-shell mortality (3.98%). Eggs that were elongated had lower hatchability (HTES: 64.5%; HFES: 76.84%) and increased dead-in-shell mortality (14.86%). Chicks from the standard SI eggs (G2) performed better than other groups from 3 weeks onwards, attained significantly ($P<0.05$) highest body weights (686.08 g) at 8 weeks followed by 679.88g in G3 and 653.56 g, in G1 groups. The Cumulative feed conversion ratio was also significantly ($P<0.05$) better in G2 (2.967) than G1 (3.128) and G3 group (3.091). Most of the external and internal egg quality characteristics differed significantly ($P<0.05$) among different egg SI groups. It could be concluded that 72–76% is the best egg SI for maximizing hatchability, less late embryonic mortality, and improve early growth performance in commercial layer chicken.

Keywords: commercial layer, egg shape index, hatchability, post-hatch performance.

PMO-05

Effect of different cryoprotectants on post-thaw seminal parameters and fertility of cryopreserved Tellicherry chicken semen

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A study was conducted to evaluate the effect of different cryoprotectants-glycerol, dimethylacetamide (DMA) and dimethylformamide (DMF) on post-thaw seminal parameters and fertility of cryopreserved Tellicherry chicken semen for the conservation of Tellicherry chicken breed. Semen was collected from 20 healthy Tellicherry roosters maintained at the All India Co-ordinated Research Project on Poultry Breeding, Mannuthy. Pooled ejaculates with more than 70% motility and concentration of 4000 × 10^6 sperm/mL were extended with Lake and Ravie diluent containing 6% of each cryoprotectant, filled in 0.5 mL straws, frozen manually in liquid nitrogen vapour and stored in –196°C liquid nitrogen. Thawed samples were evaluated for progressive motility, viability, sperm morphological abnormalities, plasma membrane integrity (HOST) and lipid peroxidation (MDA). Fertility and hatchability were determined by inseminating hens with cryopreserved semen containing 200 × 10^6 sperm/hen. Post-thaw progressive motility and viability decreased significantly ($p<0.05$) compared to fresh semen. Among treatments, glycerol recorded the highest motility (43.77%) and viability (46.59%), followed by DMA (36.55% and 41.79%) and DMF (31.10% and 42.15%), respectively. HOST response was highest in DMA (46.15%) and MDA concentration was lowest, indicating better membrane stability and reduced oxidative stress. Fertility and hatchability on fertile egg set were highest in glycerol (45.43% and 57.21%) followed by DMA (42.96% and 46.62%) and DMF (24.06% and 45.43%). Glycerol provided superior post-thaw seminal quality and fertility but requires removal before insemination. DMA yielded comparable fertility with simpler handling, suggesting its potential as an effective alternative cryoprotectant for routine cryopreservation of Tellicherry chicken semen in genetic resource conservation programmes.

Keywords: Tellicherry chicken, semen cryopreservation, glycerol, dma, dmf, fertility, oxidative stress.

PMO-06

Comparative analysis of seminal attributes and their association with fertility in PB1, PB2 and Punjab Brown

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The present study was planned to evaluate semen attributes and their association with fertility in PB1, PB2 and Punjab Brown maintained at Poultry Research Farms, GADVASU, Ludhiana. A total of 60 roosters (20 per group), aged 32–38 weeks, were used and three ejaculates from each bird were analysed. There was no significant difference in color, pH, and membrane integrity among all the groups. Significant differences ($p<0.05$) were observed among the genetic groups for seminal parameters. PB1 and PB2 recorded significantly higher semen volume (0.55 ± 0.02 ml and 0.56 ± 0.02 ml, respectively) and sperm concentration (5273.65 ± 149.64 ×10^6/ml and 5150.82 ± 172.68 ×10^6/ml) than Punjab Brown (0.40 ± 0.02 ml; 4225.00 ± 190.90 ×10^6/ml). PB1 also exhibited superior sperm motility (79.87 ± 0.40%), live sperm

percentage (80.17 ± 0.46%) and membrane integrity (HOST: 69.87 ± 1.73%). Punjab Brown, showed the least sperm abnormalities (13.72 ± 1.03%), indicating better sperm morphology. Fertility was comparable among PB1 (81.73%), PB2 (81.45%) and Punjab Brown (80.84%). Seminal attributes, including progressive motility, sperm viability, HOST responsiveness, and acrosomal integrity, showed positive associations with fertility, revealing membrane integrity (HOST) had the strongest positive association with fertility whereas sperm abnormalities were negatively correlated. It is concluded that PB1 is the most suitable line for artificial insemination based on semen quality, while Punjab Brown demonstrates strong genetic resilience. Functional semen traits, particularly HOST and motility, should be prioritized during sire selection in poultry breeding programmes.

Keywords: PB1, PB2, Punjab Brown, semen attributes, fertility.

PMO-07

Effect of hatching-eggs turning duration during incubation on embryonic growth and embryonic stress at transfer

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An experiment was conducted to evaluate the effect of hatching-eggs turning duration during incubation on embryonic growth and stress at transfer on 18.5 days of incubation. A total of 840 hatching eggs from 33.5week aged broiler breeder birds were divided into seven treatment groups of 120 eggs per treatment with three replicates of 40 eggs each. Each treatment group were turned at hourly interval in setter compartment of forced-draft type incubator from 0 day up to different turning durations as follows: T_1 (0–18.5 days - control), T_2 (0–17.5 days), T_3 (0–16.5 days), T_4 (0–15.5 days), T_5 (0–14.5 days), T_6 (0–13.5 days) and T_7 (0–12.5 days). On 18.5 days of incubation during transfer of eggs, moisture loss was assessed and six live embryos from each treatment were sacrificed for assessing embryonic growth and stress by assessing heterophil, lymphocyte and their ratio. The result on embryo weight at transfer revealed a significantly ($p<0.01$) higher embryo weight (per cent of egg weight) at 18.5 days of incubation in T_3, T_4, T_5 and T_2 than control, while T_6 and T_7 recorded intermediary results indicating increase in the weight as turning duration increases from 14.5 days to 17.5 days of incubation. No significant differences were observed among treatment group at transfer on moisture loss (per cent), yolk weight (per cent of egg weight), embryo length, organs weight of liver, heart and intestine (per cent of embryo).The result also revealed that the heterophil count at 18.5 days of incubation was significantly ($p<0.01$) higher in control group, T_2 and T_3 than other treatment groups (T_4, T_5, T_6 and T_7) with lowest count in T_7 among all the treatment groups and the count had found to decrease in turning duration-dependent fashion. Lymphocyte count and Heterophil: Lymphocyte ratio at 18.5 days of incubation showed an opposite trend, which were significantly ($p<0.01$) highest in T_4, T_5, T_6 and T_7 and lowest in control group with T_2 and T_3 showing intermediary results, indicating lower stress responses in these groups. Based on the result, it may reasonably be concluded that hatching-egg turning duration from 14.5 days to 17.5 days of incubation significantly improved the embryo weight at transfer with highest weight in eggs turned up to 16.5 days of incubation and the stress response of embryo at transfer was significantly decreased in a duration-dependant fashion as the hatching-egg turning duration decreased from 18.5 day to 12.5 days of incubation.

Key words: hatching-eggs, embryonic growth, embryonic stress.

PMO-08

Deep learning driven microcontroller-based automatic feed dispenser for sustainable poultry production

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Poultry rearing in a deep litter system is one of the most drudgery-prone, labour-intensive and time-consuming operation with manual method. To reduce the drudgery involved in manual feeding systems, an automatic feed dispenser (AFD) using deep learning-based microcontroller system was developed and tested. The system leveraged the ergonomics database of Indian agricultural farm workers for the design and its application. The AFD consists of a hopper, augur-type

feed dispenser, stepper motor, and programmable logic controller (PLC). The feed dispenser used here is a volumetric-based augur type which is operated with a stepper motor. An intelligent computer vision-based bird detection model was coupled with the existing microcontroller system to count the birds and adjust the feed rate to be dispensed. The object detection models Faster RCNN, YOLOv5 and YOLOv7 were developed and evaluated on 960 poultry images and YOLOv7 was found superior in detecting the birds from actual poultry environments with a mean average precision of 95.7% and F1 score of 93.9%. The model output was fed into the controller and was able to dispense the feed at an accuracy upto 97.85% with a response time of 19.07 s. With this system, we can adjust the feed rate to be dispensed as per the number of birds as well as the age of the birds in weeks. The developed AFD reduces the drudgery, labour cost, time as well as any risk of disease infestation to the workers through contamination.

Keywords: Deep learning; Object detection; Automatic feed dispenser; Microcontroller; Ergonomics.

Poultry Physiology and Management: Poster Presentations

PMP-1

Influence of management system on growth and egg production performance of Kamrupa chickens in Assam

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Kamrupa chicken, a dual-purpose variety developed for Assam's agro-climatic conditions, is widely reared under both intensive farm and traditional backyard systems. This study evaluated the growth, body conformation, age at sexual maturity (ASM), egg production, egg weight, egg quality, and reproductive performance of Kamrupa chickens under these two management conditions. A total of 1,020 birds were monitored from February 2021 to July 2022. Body weight was recorded at hatch, 5, 20, 40, and 52 weeks; conformation traits (shank length, keel length, breast angle) were measured at 5 weeks; and ASM was determined when 50% of hens commenced laying. Egg production and egg weight were recorded at 32, 40, 52, and 72 weeks, while egg quality traits (shape index, albumen index, yolk index, Haugh unit, and shell thickness) and reproductive traits (fertility, hatchability on total eggs set, and hatchability on fertile eggs set) were assessed during the production period. Farm-reared birds exhibited significantly ($P \leq 0.01$) higher body weights, longer keel lengths, greater breast angles, earlier ASM (147.36 vs. 167.23 days), higher hen-housed egg production (154.44 vs. 127.50 eggs at 72 weeks), and heavier eggs (61.17 g vs. 46.16 g at 72 weeks) compared to field-reared birds. Haugh unit values were also higher under farm conditions, while most other egg quality and reproductive parameters were comparable between systems. Field birds showed longer shanks, reflecting enhanced locomotor adaptation. Overall, Kamrupa chickens demonstrated excellent adaptability to both management systems, with intensive rearing yielding superior growth and production performance. Targeted nutritional and environmental improvements in backyard systems could help bridge the productivity gap and support sustainable rural poultry development in Assam.

Keywords: Kamrupa chicken, growth performance, egg production, egg quality, reproductive traits, backyard poultry.

PMP-2

Effect of application of poultry litter compost on crop yield

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One of the major issues the poultry industry is currently facing is the accumulation of large amount of wastes, especially manure and litter, generated by intensive production, which is causing major environmental problems. The problem could be resolved by converting poultry litter (Waste) to compost (Wealth). The bio-fertilizer, thus formed was applied to the field to see the effect on growth and production of the crop. Poultry litter with dry leaves compost having Carbon to Nitrogen ratio 30:1 was applied to the land to grow the crop of green gram variety WGG-45. The total duration of the crop was 65 days and spacing between the plants was 45x10 cm. The plant population was 22 per m^2. Along with the control, recycled derived fertilizer, met from 18 kg urea and 125 kg SSP, was also applied to the field for crop production. Different parameters like plant height, number of branches per plant, age to 50% maturity, pod characteristics (average number of pods per plant, pod length, number of seeds per pod), seed index, stover yield and average seed yield were recorded. The plant heights were found to be 9.36 and 27.54 cm on 30^{th} and 45^{th} days, respectively. It was observed that the height of plants in Control and RDF groups were 36.16 and 38.91cm, respectively. The number of branches per plant was found to be 4.60 which was significantly higher than control group which was 3.66 cm at the time harvest. Avg. age to 50% maturity (days) was 38.14, however, in control it was 40.23. The pod characteristics which include the avg. no. of pods per plant, pod length (cm) and no. of seeds per pod were 9.30, 5.80 and 7.80 and in control group 7.45, 4.2 and 5.69, respectively. The Seed index or 100 grain wt. (g) was 3.70. The Average stover yield (q ha-1) was 36.50. The Avg. seed yield (q ha-1) was 9.20 which were significantly different from the control group which was 6.94. It can therefore, be concluded that the application of poultry litter compost with dry leaves can enhance the green gram productivity significantly.

Keywords: poultry litter, compost, crop yield.

PMP-3

Influence of poultry litter bio-fertilizer on growth and yield of field crop

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The poultry industry is currently facing the problems of large amount of wastes, especially manure and litter, generated by intensive production causing environmental issues. The problem could be resolved by converting poultry litter into bio-fertilizer, the vermi compost. The poultry litter with dry leaves vermi compost was prepared having Carbon to Nitrogen ratio 30:1. It was applied to the field to grow green gram variety WGG-45. The total duration of the crop was 65 days and spacing between the plants was 45x10 cm. The plant population was 22 per m2. Along with the control, recycled derived fertilizer, met from 18 kg urea and 125 kg SSP, was also applied to the field. Different parameters like plant height, number of branches per plant, age to 50% maturity, pod characteristics (average number of pods per plant, pod length, number of seeds per pod), seed index, stover yield and average seed yield were recorded. It plant height in Control and RDF groups were 36.16 and 38.91cm, respectively and the height of the plants was 44.36 cm where vermi compost was applied. The number of branches per plant was found to be 5.10 which was significantly higher than control group which was 3.66 cm at the time harvest. The plants height was found to be 44.36 cm at maturity in case of poultry litter with dry leaves vermi compost and compost having C/N ratios 30:1. Avg. age to 50% maturity (days) was 39.12, however, in control it was 40.23. The pod characteristics which include the avg. no. of pods per plant, pod length (cm) and no. of seeds per pod were 10.10, 6.20 and 8.10 and in control group 7.45, 4.2 and 5.69, respectively. The Seed index or 100 grain wt. (g) was 3.80 and in control group it was 2.56. The Average stover yield (q ha-1) was 22.69 and in control group it was 36.80. The Avg. seed yield (q ha-1) was 9.30 which were significantly different from the control group which was 6.94. It can therefore, be concluded that the application of poultry litter vermi compost with dry leaves can significantly enhance the green gram productivity.

Keywords: poultry litter, vermi compost, crop yield.

PMP-4

Study of the performance of the White Pekin layer ducks on quantitative reduction of feed

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An experiment was conducted to study the performance of White Pekin layer ducks on quantitative feed restriction. For this experiment 126 Nos (90 Female and 36 Male) of 20 weeks White Pekin layer ducks were selected. They were randomly divided into three groups having six replicates each with five females and two males in each replicate. All the birds were offered with diet containing 18% CP and 2650 k cal ME/kg feed. The group one birds were offered with 100 % of recommended feed (250g), the Group-2 birds were offered 90 % of recommendation (10% Reduction) i.e. 225g and the Group-3 birds were provided with 80 % of recommendation (20% Reduction) i.e. 200g/d. All the birds were reared under deep litter system. Half or the measured quantity of feed was provided in the morning and half the feed in the evening. Clean drinking water was provided round the clock, Daily feed offered, residue left, egg production, egg weight and bi-weekly were recorded from 20 to 40 weeks of age. Metabolic trial was conducted at the end of 40 weeks of age. From this experiment it was observed that the duck house egg production from 20-40 weeks of age was 60 48+4.19, 60.29+4.29 and 60.09+4.40 in Gr-1, Gr-2 and Gr-3, respectively. However, no significant differences between the groups were observed. The egg quality parameters were studied at 20th and 40th weeks of age. The Haugh unit values at 20th week were 89.92+1.27, 86.89+1.12 and 86.83+1.40 and at 20th weeks were 86.90+1.53, 84.12+1.59 and 84.70+1.72 in Gr-1, Gr-2 and Gr-3, respectively. The fertility percentage was 70.34+1.65, 70.28+2.08 and 71.06+1.86 in Gr-1, Gr-2 and Gr-3, respectively. No significant difference between the groups was observed. However, hatchability % on total egg set was significantly ($P<0.05$) higher in group-2 (59.60+6.13), than Group -1 (51.90+5.62) and group-3 (52.91+7.97). Similarly, the hatchability % on fertile egg set basis was significantly ($P<0.05$) in group-2 (76.98+2.71) than Group-2 (67.7+2.34) and Group-3 (71.01+2.14).

Keywords: White pekin, layer, quantitative feed restriction.

PMP-5

Standardization of organic agricultural wastes and lime powder for moisture reduction in poultry feces to enhance farm hygiene and suppress house fly breeding

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The rapid expansion of intensive poultry farming has led to the accumulation of large amounts of poultry waste, creating favorable conditions for housefly breeding around farms. To develop effective litter moisture-reducing strategies, a six-week pilot study was conducted at the Poultry Research Farm, Department of Livestock Production Management, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. The study was divided into two phases. In the first phase (three weeks, May), organic agricultural residues such as paddy straw and rice husk, along with calcium oxide (lime powder), were tested individually and in combinations at 4%, 8%, and 12% application rates. Among all treatments, 8% applications produced the greatest reduction in litter moisture. Based on these results, the second phase (late May to early June) evaluated weekly lime dusting at 4%, 6%, 8%, 10%, and 12%. Litter samples were collected on Day 0, Day 2 (post-application), and periodically throughout the six-week period to monitor moisture changes. Results revealed a clear inverse relationship between lime concentration and litter moisture content. The 8% lime application significantly reduced litter moisture to 36.64%, a level considered unsuitable for fly breeding and cost-effective for routine use. In contrast, the untreated control group showed a 63% moisture level, highly conducive to fly development. Overall, lime dusting at an 8% rate was found to be an efficient, economical, and environmentally safe method for reducing litter moisture and suppressing fly breeding potential in intensive poultry production systems.

Keywords: dusting, Housefly, Lime, Litter Moisture.

PMP-6

Effect of different stocking densities on growth performance, litter quality and stress parameters in broilers

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The current experiment was conducted to study the influence of different stocking densities on the growth performance, litter quality and stress parameters in broilers. The experiment was conducted on 300 Vencobb 430Y commercial broilers for six weeks. The day-old chicks were randomly divided into five equal groups and each group was further divided into six replicates of ten birds each. For a period of 0 to 2 weeks stocking densities provided for groups A, B, C, D, and E were 0.5, 0.5, 0.6, 0.6, and 0.7 sq. ft. per bird, respectively. Whereas for a period of 3 to 6 weeks stocking densities for groups A, B, C, D, and E were 1, 1.2, 1.2, 1.3, and 1.4 sq. ft. per bird, respectively. The parameters studied in this experiment were live weights, gain in weights, feed consumption, FCR, Mortality, EPEF, litter moisture, litter pH, H:L ratio, and corticosterone levels of the birds. From the results, it was recorded that at the end of the sixth week, the birds from group A had numerically higher live weights, gain in weights, and EPEF as compared to all other groups. The litter moisture and litter pH were found to be numerically higher in group A, compared to other groups. The H:L ratio and corticosterone level were found to be significantly ($P \leq 0.05$) higher in group A as compared to other groups. The overall performance of the birds suggested that different stocking densities in this experiment are suitable for broiler production. Furthermore, it can be concluded that a stocking density of 0.5 sq. ft. per bird for 0-2 weeks and 1 sq. ft. per bird for 3-6 weeks is most suitable for commercial broiler farming as it resulted in the highest net profit per bird.

Keywords: stocking density, broilers, litter quality, stress.

PMP-7

Machine learning approaches for predicting hatchability in commercial layer chicken eggs

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The present study was undertaken to assess the effect of egg shape index (SI) and storage period of eggs on the hatchability of commercial layer chicken eggs, and to construct machine learning (ML) models for prediction of hatchability results. Two trials were conducted with a total of 1,200 eggs. In the first trial, 600 eggs were categorized according to SI: elongated (<72%), normal (72%–76%), and rounded (>76%). In the second trial, 600 eggs were placed in storage for 5, 10, 15, or 20 days respectively, prior to incubation. Total hatchability on egg set (HTES), hatchability on fertile egg set (HFES), embryonic mortality, chick weight was recorded. Two datasets were generated (SI dataset: 517 eggs; storage dataset: 528 eggs) and processed with six different ML algorithms: Logistic Regression, Support Vector Machine, Random Forest, Balanced Random Forest, Gradient Boosting, and XGBoost. Feature engineering comprised morphometric characteristics of eggs, weight loss patterns, and interaction terms. Optimization of models was undertaken with stratified cross-validation, imbalance management (SMOTE, ADASYN, class weights), and probability calibration. Although biologically, eggs with standard SI (72–76) and storage of ≤5 days gave the best hatchability, the ML treatment gave the greatest improvement. Ensemble methods, especially Random Forest and XGBoost, performed better than traditional methods consistently, with balanced accuracy (>90%), F1-scores (>0.88) and ROC-AUC (>0.93). Feature importance analysis identified egg SI, storage time, and rate of daily moisture loss as the most significant predictors, with interaction terms (shape-weight, storage-moisture) contributing to greater predictive strength. Threshold optimization and isotonic calibration enhanced probability reliability, evidencing the strength of ML frameworks for predicting hatchability. The results confirm SI (72%–76%) and storage period of ≤5 days as biological hatchability maximization thresholds. Predictive frameworks based on ML deliver data-driven hatchery management tools that allow for optimization of incubation methods and enhanced production efficiency.

Keywords: commercial layers, hatchability prediction, machine learning (ML), feature engineering, predictive modeling.

PMP-8

Characterization of embryonic death stages and causes of dead-in-shell embryos in hatchery conditions

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Dead-in-shell (DIS) embryos represent a significant cause of reduced hatchability in poultry production, with mortality peaking during the early and late stages of incubation. Determination of the chick embryonic developmental period at which embryonic mortalities occur could help in establishing the cause of such mortalities and take appropriate corrective measure. The late stage of embryonic development has particular importance due to its dramatic effect on life after hatching. This study was conducted to investigate the stage of embryonic death in dead-in-shell chick embryos. A total of 1,000 unhatched eggs were collected at hatching day at six different days from hatchery located in AICRP poultry, Bengaluru. Out of 1,000 unhatched eggs, 15,7% (157) showed embryo formation indicating early embryonic death. Approximately 84.3% of the dead embryos displayed DIS chicks at late stage of embryonic development. Multifactorial causes of embryonic death including genetic, environmental, nutritional, infectious, and management-related factors. Late-stage deaths often occur during critical respiratory transitions, particularly internal and external pipping, improper ventilation, dehydration, or inadequate egg weight loss may result in embryo suffocation. Overall, dead-in-shell embryos arise from complex interactions of biological and management factors, highlighting the importance of integrated flock health, nutrition, hatchery practices, and hygiene is needed to maximize hatchability and chick viability.

Keywords: dead in shell, hatchability, incubation, ventilation, infection.

PMP-9

Effect of different housing systems under low cost bamboo cages and deep litter housing systems on growth traits in Japanese quails

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The research was pinpointed to evaluate layer Japanese quail for production traits under low-cost bamboo cages and deep litter housing systems. Investigation was based on Completely Randomized Design and was conducted from 9 weeks old layer Japanese quail up to the completion of 14 weeks of age (6 weeks). A total 144 (108 females and 36 adult males) Japanese quails of similar age were randomly allocated in three treatments (T_1, T_2 and T_3) of 3 replicates each, based on deep litter, single tier and double tier cages. T1 and T2 was having 36 bird (27 females and 9 males), and treatment T3 was having 72 birds (54 females and 18 males) with adaption period of one week. The overall weekly feed intake (g) per bird was 211.7±0.76, 209.7±0.49 and 209.8±0.37 in T_1, T_2 and T_3 respectively and data revealed significant ($P<0.05$) difference among the treatments and less feed was consumed by bird of group T_2 and T_3 as compared to T_1. The overall weekly FCR and FER was 4.28±0.13, 4.46±0.28, 4.40±0.2 and 0.237±0.00, 0.238±0.01, 0.238±0.01 respectively in three subsequent group with no significant ($p>0.05$) difference among the birds either reared in deep litter system and cage housing system i.e., T_2 and T_3. The heavier size eggs were produced by deep litter birds than cages, and also in deep litter bird, feed intake, feed conversion ratio were significantly higher than cage birds. In this study, there was no adverse effect on production and other parameters in low-cost bamboo cage system as compared to birds reared in deep litter.

Keywords: low cost bamboo cage, FCR, Japanese quail, FER.

PMP-10

Outcome of different housing system on the reproductive traits in Japanese quails

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The study was carried out to assess the influence of different housing systems low-cost bamboo cages (single and double tier) and deep litter housing-on the reproductive performance of layer Japanese quails. A total of 144 quails (108 females and 36 males) of similar age were randomly distributed into three treatment groups: T1 (deep litter), T2 (single-tier bamboo cage), and T3 (double-tier bamboo cage), each with three replicates. All groups were maintained under identical management, feeding, and environmental conditions throughout the six-week experimental period. Reproductive parameters such as fertility percentage, hatchability on total egg set basis (HTESB), and hatchability on fertile egg set basis (HFESB) were recorded and analyzed. The fertility (%) was highest in double-tier cage (T3: 82.00±0.98), followed by single-tier cage (T2: 81.16±2.71), and lowest in deep litter (T1: 78.00±1.82), though differences were statistically non-significant ($P>0.05$). Similarly, hatchability on total egg set basis was marginally higher in cage systems (T3: 70.66±1.63; T2: 70.00±3.97) than in the deep litter system (T1: 68.5±4.18), suggesting that eggs produced in cages were generally cleaner and more viable for incubation. In contrast, hatchability on fertile egg set basis was greater in the deep litter system (T1: 90.5±1.64) than in single-tier (T2: 85.1±1.40) and double-tier (T3: 85.5±1.38) cages, possibly due to enhanced mating opportunities and reduced stress under more natural floor conditions. The study concluded that housing systems influence reproductive efficiency in Japanese quails. Cage housing particularly low-cost bamboo cages improved fertility and hatchability on total egg set basis, while deep litter housing favoured better hatchability on fertile egg basis. Thus, bamboo cage housing offers a sustainable and cost-effective alternative for optimizing reproductive performance in quail production under tropical conditions.

Keywords: Japanese quail, housing system, bamboo cage, deep litter, fertility, hatchability, reproductive traits.

PMP-11

Impact of cage and floor housing systems on the egg production traits of Japanese quail

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This investigation was designed to assess the effect of cage and floor housing systems on the egg production performance of Japanese quails, with an emphasis on identifying the more economical and efficient rearing method. A total of 180

birds of 6 weeks of age were equally divided in two different housing systems of rearing, 90 birds were kept in floor housing system and rest were in cage housing system, maintaining the sex ratio of 3:1 f i.e. (67 females +23 males) in floor housing as well as in cage housing system. The result showed that the overall hen day egg production was non-significant (P≥0.05) with numerically higher in floor system 56.73±23.04 % as compared to 55.67±27.22 % in cage system of rearing. But the average hen housed egg production was varied higher in floor system (10.95±1.34) than cage (10.52±0.17) System of rearing which may be associated with better comfort of birds in this housing along with availability of some nutrients from litter and better expression of bird's natural behavior in floor rearing as compared to cage system.

Keywords: Japanese quail, egg production, cage housing system.

PMP-12

Effect of cage and floor housing systems on the egg quality trait of Japanese quails

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Neetu Sonkar, Rishabh Sinha, Neelam Banjaree, Sangeeta Singh and Kiran Kashyap**

This study was conducted to evaluate the effect of cage and floor housing systems on the egg quality traits of Japanese quails, aiming to determine the more economical and efficient rearing system. A total of 180 quails, aged six weeks, were evenly divided into two housing system 90 birds reared in the floor housing system, and the remaining 90 kept in the cage system. In both systems, a mating ratio of 3:1 was maintained, consisting of 67 females and 23 males in each housing system. Eggs were collected and analysed for external traits such as egg weight, length, width, shape index, shell thickness, and shell weight, and for internal traits including yolk and albumen weight, height, width, index, and Haugh unit. The mean egg weight was 10.89±0.66 g and 10.72±1.02 g in floor and cage systems, respectively, showing no significant (P>0.05) difference. Egg length, width, and shape index were also reported non-significant between housing systems. However, shell thickness was significantly higher (P<0.05) in cage-reared quails (0.23±0.03 mm) compared to floor-reared birds (0.21±0.03 mm), indicating improved shell quality in cage housing. Among internal parameters yolk width, yolk index, albumen index, and albumen ratio differed significantly (P<0.05) between systems, with floor-housed birds exhibiting higher internal quality indices. The Haugh unit value was found to be non significant in both systems. In conclusion, most external egg traits were unaffected by housing system, though cage housing improved shell thickness characteristics. Internal egg traits, particularly yolk and albumen indices were marginally superior in floor housing. Overall, both systems maintained satisfactory egg quality, with cage housing offering better shell strength and floor housing favoring superior internal composition.

Keywords: Japanese quail, housing system, internal and external egg quality, yolk index, albumen index, shell thickness.

PMP-13

Eco-innovative approaches employing organic agricultural wastes and lime powder for sustainable housefly management in poultry farm

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The intensification of poultry farming has resulted in the accumulation of large volumes of poultry waste, which creates favorable conditions for housefly (*Musca domestica*) proliferation and poses risks to farm hygiene and public health. Faeces moisture is a key factor influencing fly breeding, and identifying practical strategies for moisture reduction is critical. This study evaluated the effectiveness of organic agricultural residues and lime powder in lowering poultry feces moisture and suppressing housefly development. Controlled experiments were conducted at the Poultry Research Farm, Department of Livestock Production Management, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. A preliminary three-week trial tested paddy straw, rice husk, lime powder, a blend of all three in equal proportions, and a combination of paddy straw with rice husk at application rates of 4%, 8%, and 12%. Based on preliminary outcomes, 8% applications were selected for a four-week trial (late May to June), followed by one week of post-treatment monitoring. Faeces moisture, temperature, adult fly counts, and in vitro larval counts were recorded on Day 0 (pre-treatment), Day 1 (application), Day 2, Day 5, and Days 8, 11, and 14 after the final treatment. The 8% lime powder dusting produced the most significant effect, reducing faeces moisture to 36.38% by the fourth week compared

with 62.51% in the untreated control. A rapid decline to 29.48% was observed within one day of lime application. Faeces temperature was only marginally influenced, with a slight decrease to 32.93°C in lime-treated groups. In vitro larval counts showed inconsistent reductions across most treatments; however, lime powder caused a pronounced decline beginning one day post-application, which persisted up to Day 14 without reapplication. Dusting of lime powder at 8% of fecal weight is an effective, economical, and locally available method for reducing poultry feces moisture, thereby creating unfavorable conditions for housefly breeding. The findings highlight lime powder as a practical component of integrated housefly management strategies in intensive poultry farming systems.

Keywords: dusting, feces moisture, *Musca domestica.*

PMP-14

Innovative strategies using organic agricultural waste and lime for control of housefly at poultry farm

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The intensification of poultry farming has resulted in the accumulation of large volumes of poultry waste, which creates favorable conditions for housefly (*Musca domestica*) proliferation and poses risks to farm hygiene and public health. Faeces moisture is a key factor influencing fly breeding, and identifying practical strategies for moisture reduction is critical. This study evaluated the effectiveness of organic agricultural residues and lime powder in lowering poultry feces moisture and suppressing housefly development. Controlled experiments were conducted at the Poultry Research Farm, Department of Livestock Production Management, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. A preliminary three-week trial tested paddy straw, rice husk, lime powder, a blend of all three in equal proportions, and a combination of paddy straw with rice husk at application rates of 4%, 8%, and 12%. Based on preliminary outcomes, 8% applications were selected for a four-week trial (late May to June), followed by one week of post-treatment monitoring. Faeces moisture, temperature, adult fly counts, and in vitro larval counts were recorded on Day 0 (pre-treatment), Day 1 (application), Day 2, Day 5, and Days 8, 11, and 14 after the final treatment. The 8% lime powder dusting produced the most significant effect, reducing faeces moisture to 36.38% by the fourth week compared with 62.51% in the untreated control. A rapid decline to 29.48% was observed within one day of lime application. Faeces temperature was only marginally influenced, with a slight decrease to 32.93°C in lime-treated groups. In vitro larval counts showed inconsistent reductions across most treatments; however, lime powder caused a pronounced decline beginning one day post-application, which persisted up to Day 14 without reapplication. Dusting of lime powder at 8% of fecal weight is an effective, economical, and locally available method for reducing poultry faeces moisture, thereby creating unfavorable conditions for housefly breeding. The findings highlight lime powder as a practical component of integrated housefly management strategies in intensive poultry farming systems.

Keywords: dusting, feces moisture, *Musca domestica.*

PMP-15

Influence of light restriction on serum biochemistry of broiler chicken

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A biological experiment was conducted in broiler chicken to assess the influence of light restriction on serum biochemistry of broiler chicken. Two hundred and fifty-two sex separated day old broiler chicks were randomly grouped into seven treatments with three replicates per treatment and containing twelve chicks per replicate. The treatment groups were provided with experimental lighting programme as follows: The control group (T_1) was given continuous photoperiod of 23 hours (hours of light) and scotoperiod of 1 hour (hours of dark) i.e., 23L:1D from 0 to 42 days; The treatment groups T_2, T_3 and T_4 were given lighting programme of 23L:1D from 0 to 21 days followed by 22L:2D (T_2), 20L:4D (T_3) and 18L:6D (T_4) from 22 to 42 days of age, respectively. The treatment groups T_5, T_6 and T_7 were given lighting programme of 23L:1D from 0 to 7 days (during brooding) and lighting programme of 22L:2D (T_5), 20L:4D (T_6) and 18L:6D (T_7) from 08 to 35 days of age, respectively followed by 23L:1D from 36 to 42 days of age in T_5, T_6 and T_7.

The chicks were reared in deep litter system in a gable roofed, open sided house under standard management conditions. All the birds were provided with uniform light intensity of 5-10 lux during the photoperiod at night with natural day light during day hours. The result revealed no significant difference among different treatment groups due to light restriction programme on serum glucose, total protein and triglycerides. However, the result on serum total cholesterol revealed that the T_6 group had significantly ($p<0.01$) higher total cholesterol (155.42 mg/mL ± 13.67) than the control group (108.47 mg/mL ± 11.89), whereas other treatment groups (T_2, T_3, T_7, T_4 and T_5) showed intermediary results. Similarly, the group T_6 had significantly ($p<0.01$) higher serum HDL (150.78 mg/mL ± 11.22) than the control group (79.07 mg/mL ± 7.09), whereas the treatment groups (T_7, T_5, T_2, T_3 and T_4) did not differ significantly either with the control (T_1) or the higher serum HDL cholesterol group (T_6). The result indicates that the light restriction programme in broiler chicken had increased serum total cholesterol primarily through increase in serum HDL, which might be due to improved health status of the broiler chicken. Light restriction by 2, 4 and 6 hours from 22nd to 42nd day of age (T_2, T_3, T_4) had decreased the serum uric acid concentration in a dose-dependent fashion with significantly ($p<0.01$) lowest uric acid in T_4 (3.19 mg/mL ± 0.81). The treatments T_5, T_6 and T_7 recorded lower concentration than T_1 (7.64 mg/mL ± 0.70), however higher uric acid concentration than T_2, T_3 and T_4, which might be due to sudden increase of photoperiod from 22, 20 and 18 hours to 23 hours that the change itself might have induced a stress and ultimately would have increased the uric acid concentration in T_5, T_6 and T_7. Hence, it is concluded that lighting restriction increases the serum HDL cholesterol and decreases the serum uric acid concentration in broiler chicken.

PMP-16

Comparative performance of Daothigir and indigenous chicken of Assam under intensive management system

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Productive and reproductive traits in terms of body weight at different ages, age at first egg, egg production, egg weight (g) and conformation traits of *Daothigir* and Indigenous chicken of Assam were studied under intensive rearing system and their respective values were compared. A total of 200 day-old chicks with uniform body weights, 100 each from *Daothigir* and indigenous varieties were reared in deep litter system under the project ICAR-AICRP on Poultry Breeding, Khanapara, Guwahati for the above study. The birds were offered layer chick, grower and layer feed under similar management conditions. The mean body weight was significantly ($P\leq0.05$) higher in *Daothigir* than indigenous chickens at 5th weeks of age. The mean body weights of male chickens at 20th and 40th week were also significantly ($P\leq0.05$) higher in *Daothigir* than indigenous chickens, however in females no significant differences were recorded between two verities at similar ages. The mean age at first egg was significantly ($P\leq0.05$) higher in *Daothigir* than indigenous chickens. The mean hen-day and hen-housed egg production up to 40, 52 and 72 weeks of did not vary significantly ($P\leq0.05$) in both the varieties. The mean egg weights of *Daothigir* chickens at 32 weeks of age was significantly ($P\leq0.05$) higher than that of indigenous chickens, However, egg weights at 42, 52 and 72 weeks did not show any significant ($P\leq0.05$) difference between two varieties. The shank length and keel length did not show any significant ($P\leq0.05$) difference between *Daothigir* and indigenous chickens, however, the breast angle in *Daothigir* was significantly ($P\leq0.05$) wider than indigenous chickens. It may be concluded that male *Daothigir* chicken showed some of the promising growth traits than indigenous chickens of Assam.

Keywords: Daothigir chicken, indigenous chicken, body weights, age at first egg.

PMP-17

Comparative performance of Kamrupa chicken under different management system

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A total of 400 day-old *Kamrupa* chicks with uniform body weights were equally divided and were reared under farm and field conditions under the project ICAR-AICRP on Poultry Breeding at Guwahati centre. Half of the chicks were

reared in intensive system in deep litter and remaining chicks were reared in semi-intensive system at farmers' field. Productive and reproductive traits in terms of body weight at different ages, age at first egg, egg production, egg weight (g) and conformation traits of *Kamrupa* chicken under farm and field conditions were studied and their respective values were compared between two systems. The mean body weights of *Kamrupa* chickens were significantly (P≤0.05) higher in farm conditions at 5th, 20th and 40th weeks of age than field condition in both sexes. The birds under farm conditions attained sexual maturity earlier (148.18 days) than field condition (168.96 days). The mean hen-day and hen-housed egg productions up to 32, 40, 52 and 72 weeks of age were also significantly (P≤0.05) higher in farm condition than field condition. Similarly, the mean egg weights at different ages varied significantly (P≤0.05) between two systems of rearing and higher in farm than field condition. The shank length and keel length did not show any significant (P≤0.05) difference between farm and field condition, however, the breast angle in farm condition (70.14°) was significantly (P≤0.05) wider than field condition (55.74°). It may be concluded that *Kamrupa* chicken under farm condition showed better performance than field condition might be due to balance nutrition, better management etc.

Keywords: Kamrupa chicken, body weights, age at first egg, egg production, farm and field condition.

PMP-18

Studies on embryonic mortality in native chicken of Chhattisgarh under backyard rearing system

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To increase reproductive efficiency, it is necessary to assess the infertility and embryonic mortality that leads to hatching failure. Hatching failure results from two main causes: ova failed to be fertilized or fertilized egg failed to hatch in addition to embryonic mortalities occurred at any stage of development. The purpose of the recent study was to characterize the incidence of embryo mortality in native chicken eggs of Chhattisgarh. A prospective cohort study was performed, through breaking of egg and embryo diagnosis in native chicken eggs of Chhattisgarh reared under backyard system. Other data such as hatchability on total egg basis and fertile egg basis, percentage of infertility were reported. Total 02 numbers of hatching and 277 numbers of eggs were observed collected from two villages of Rajnandgaon district of Chhattisgarh. Eggs were uniform in shape, colour with good sound shell quality were selected for hatching. Mortile embryo was categorized into three early, mid and late stage according to the age of the embryo. Hatchability on total egg basis and fertile egg basis was 38.86% and 84.76%, respectively. Fertility recorded was 45.84%. General embryo mortality reached 16.59%. In the first week of incubation 4.54% of the embryos died; in the second week embryo mortality was 6.06% died and in third week the mortality was 9.09%. This may be concluded that the hatchability was low due to low fertility. The fertility may be low as the villagers have more hens as compare to cock in their herd. Hatchability was low as the collected eggs were stored for different duration by the villagers. Embryo mortality is low in all the stages and is acceptable.

Keywords: hatchability, fertility, embryo mortality.

PMP-19

Mitigating photoperiod variability in commercial farms through smart light control systems

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Optimal photoperiod of 16 hours with adequate light intensity is essential in laying hens to regulate reproductive hormone secretion and maintain egg productivity. Insufficient light or irregular lighting schedules can lead to reduced egg

production. To ensure adequate photoperiod, artificial illumination is generally provided in addition to natural daylight, and most commercial farms use timer based on–off lighting systems to avoid manual adjustments. However, fluctuations in natural day length across seasons often affect the effectiveness of this system, causing inconsistent light exposure and production instability. This study was undertaken to assess the available light intensity and determine corrective measures in a commercial layer farm at Erode, Tamil Nadu, housing 50,000 birds in a 4M three-tier cage system, wherein a fixed timer-controlled lighting schedule (5:00–6:30 AM and 6:00–9:00 PM) was implemented. Light intensity observations were recorded over a 25-day period in December 2024, with measurements taken at three locations on the lower tier of each M (eight rows total) using a Sigma Lux Meter (Model LX-1010B) at six time points: 6:30 AM, 7:00 AM, 7:30 AM, 5:00 PM, 5:30 PM, and 6:00 PM. The results showed that outer rows consistently received higher light intensity, while inner rows remained below the recommended minimum of 20 lux during early morning and evening periods, reaching only 26 lux at 7:30 AM. These inadequate intensities during transition periods indicate that timer-based lighting combined with natural light does not maintain sufficient photostimulation, potentially affecting reproductive performance and egg production. To overcome this issue, a smart light automation prototype was developed using a photo sensor, microcontroller, and RTC module to automatically regulate illumination based on ambient light levels. The system has two operational modes: automatic mode, which adjusts lighting according to detected daylight, and scheduled mode, which follows preset timing. This approach ensures consistent illumination, accommodates seasonal light variation, reduces energy waste, and supports improved production efficiency in commercial layer farms.

Key words: Photo stimulation, Seasonal fluctuation and Smart light automation.

PMP-20

Effect of beak trimming on various stages in Kadaknath chicken production

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A biological experiment was conducted to study the effect of beak trimming on growth performance and cost economics in Kadaknath chickens at various age groups. The study was conducted at Poultry Demonstration and Experimental Unit of the College of Veterinary Science & A.H., Anjora, Durg (Chhattisgarh). Corn-soya meal based basal diets to meet ICAR (2013) standard for Kadaknath chickens were formulated. A total of 300 Kadaknath chicks were allocated to 5 equal groups with 3 replicates in each treatment *viz.* control group (T0) with no beak treatment, T1 beak trimmed at 1 day, T2 at 7 days and T3, T4 beak trimmed at 49 days and 84 days, respectively from day 0 to 20 weeks of age. With the overall mean body on weight gains being non-significant between groups T0 (793), T1 (707), T2 (722), T3 (735) and T4 (714) g. The overall feed intake of T0, T1, T2, T3 and T4 were 4042, 3677, 3574, 3572, and 3736 g respectively, which were found non-significant (P>0.05) during the experimental trial. The overall FCR of T0 and T1 were 5.09 and 5.20 in T2, T3 and T4 it was 4.95, 4.85 and 5.23, respectively which was found statistically non-significant (P>0.05) but numerically lower in T2 and T3 groups. The mortality during the entire experimental period from 0 to 20 weeks remained 4.8 % which is well within the normal range in Kadaknath birds. The percentages of total mortality and birds dying or culled due to cannibalism were higher for the control treatment than all treatments. Differences in mortality due to cannibalism approached significance and were high for the control treatment (1.4%) and not present or found at low levels for the T1, T2 (0.7%), T2 (0.7%), T3 (1.0%), T4 (1.0%) in all other treatments. Cumulative feed cost@ Rs.34 per kg was calculated in T0 (Control) T1, T2, T3 and T4 group were 172, 176, 167, 164 and 178 rupees, respectively per kg live weight of Kadaknath chicken. Thus, it was concluded that beak trimming at 49 days of age is effective management tool for economic Kadaknath chicken production which improves feed conversion ratio and minimized cannibalism.

Keywords: Kadaknath, beak trimming, growth, economics.

PMP-21

Studies on the welfare of poultry under different housing systems and its effect on production

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The present study was carried out at the Poultry Research and Training Centre (PR&TC), Bihar Animal Sciences University, Patna, to evaluate the effects of different housing systems on the performance and welfare of Rhode Island Red (RIR) hens. A total of 120 RIR hens were procured at 16 weeks of age and randomly allotted to three housing systems—Individual Cages, Colony Cages and Deep Litter—each comprising 40 birds. The birds were maintained under these systems for 24 weeks, up to 40 weeks of age, in separate buildings within the PR&TC facility. The results revealed that housing systems exerted a significant influence on body weight, with hens in Individual Cages exhibiting the highest weight, followed by those in Colony Cages and the Deep Litter system. Total egg production was also highest in Individual Cages, while both Deep Litter and Colony Cage systems supported more natural laying behavior, with most eggs deposited in nests though with slightly reduced production efficiency. Egg cleanliness varied across systems, with Colony Cages and Individual Cages showing superior cleanliness compared to Deep Litter. Feather condition was initially good across all systems but progressively deteriorated, especially in cage-based systems. Incidence of foot lesions and keel bone deformities was higher in Individual and Colony Cages due to restricted movement, harder flooring and increased aggression, whereas birds in the Deep Litter system showed fewer lesions, reflecting the benefits of softer bedding and greater environmental enrichment. Claw length was shorter and gait performance better in the Deep Litter system, highlighting the positive effects of natural mobility, while longer claws in Individual Cages contributed to gait issues. Tonic immobility duration was longest in Individual Cages, indicating higher fear and stress levels compared to the other systems. Overall performance scores ranked Colony Cages highest, followed by Deep Litter and Individual Cages. The study concludes that each housing system presents distinct advantages and limitations, and the choice should be guided by production goals, welfare priorities and available resources.

Keywords: RIR, deep litter, cage system, gait, keel bone deformity.

PMP-22

Effect of hatching-eggs turning duration during incubation on post-hatch performance and embryonic mortality of broiler chicks

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An experiment was conducted to evaluate the effect of hatching-eggs turning duration during incubation on post-hatch performanceand embryonic mortality of broiler chicks. A total of 840 hatching eggs from 33.5week aged broiler breeder birds were divided into seven treatment groups of 120 eggs per treatment with three replicates of 40 eggs each. Each treatment group were turned at hourly interval in setter compartment of forced-draft type incubator from 0 day up to different turning durations as follows: T_1 (0–18.5 days - control), T_2 (0–17.5 days), T_3 (0–16.5 days), T_4 (0–15.5 days), T_5 (0–14.5 days), T_6 (0–13.5 days) and T_7 (0–12.5 days). The eggs were then transferred to hatcher compartment and maintained at standard and uniform temperature. Upon hatching, the post-hatch performance *viz* hatchability (TES, FES), hatch window and hatch time were assessed. Similarly, embryonic mortality pattern was studied by candling eggs on 10^{th} day to assess infertile and Period II mortality (0-7days) as well as after hatching to assess Period III mortality (8-18d), Period IV mortality (19-21d), pipped and contamination. The result of post-hatch performance revealed that all the treatment groups had significantly higher hatchability (per cent) on total egg set ($p<0.01$) and fertile egg set ($p<0.05$) than control (TES-87.30±1.03; FES-94.77±0.39) among which, T_3 group had the highest hatchability (percent) on total egg set (92.85±0.21) as well as on fertile egg set (97.52±0.28). The hatch window (hours) was significantly ($p<0.01$)

shorter in T3, T4, T_2 and T_1 with shortest hatch window (18.00±0.57 hours) in T_3 followed closely by T_4, and longest hatch window (27.00±0.57hours) in T_7. The result on hatch time (hours) showed T3 with significantly ($p<0.01$) shortest hatch time(479.00±1.52) followed by T_4andlongest hatch time in T7, followed by T6 with intermediate values observed in other treatment groups (T5, T2 and T_1).The Period III embryonic mortality (per cent)was found to significantly ($p<0.05$) increase (from zero in T_6 with 13.5 days of turning duration) as the hatching-egg turning duration increased with highest mortality per cent (3.96±0.79) in T_1. The total embryonic mortality (per cent) was found to be significantly ($p<0.05$) lesser in all the treatment groups (T_2 to T_7) ranged from 7.14 to 8.73 per cent than control group which recorded highest total embryonic mortality per cent (12.69±1.58). Based on the result, it may reasonably be concluded that hatching-egg turning duration up to 12.5 days to 17.5 days of incubation significantly increased hatchability (Total egg set, fertile egg set), shorten hatch window and hatch time than present-day practice of 18.5 days of incubation, with highest hatchability, lowest embryonic mortality, shortest hatch window and shortest hatch time in hatching-eggs turned up to 16.5 days of incubation.

Key words: hatching-eggs, incubation, embryonic mortality, broiler chicks.

PMP-23

Effect of hatching-eggs turning duration during incubation on quality and stress response of chicks at hatch

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An experiment was conducted to evaluate the effect of hatching-eggs turning duration during incubation on chick quality and stress response of chicks at hatch. A total of 840 hatching eggs from 33.5week aged broiler breeder birds were divided into seven treatment groups of 120 eggs per treatment with three replicates of 40 eggs each. Each treatment group were turned at hourly interval in setter compartment of forced-draft type incubator from 0 day up to different turning durations as follows: T1 (0–18.5 days - control), T2 (0–17.5 days), T3 (0–16.5 days), T4 (0–15.5 days), T5 (0–14.5 days), T6 (0–13.5 days) and T7 (0–12.5 days). The eggs were then transferred to hatcher compartment and maintained at standard and uniform temperature. On the day of hatch, chick weight was calculated by dividing total chick weight by no. of chicks hatched in each replicate. Then, nine chicks per treatment (three chicks per replicate) were randomly selected and quantitative chick quality parameters (chick yield, chick length) and qualitative chick quality parameters (Pasgar Score) were assessed. The chicks were then sacrificed and the following parameters were studied *viz*. Yolk free body mass, chick organs weight (liver, heart, intestine), stress response of chicks at hatch by assessing corticosterone level, heterophil, lymphocyte and their ratio. The result revealed that all the treatment groups (T_2-T_7) had significantly higher chick weight($p<0.01$), hick yield($p<0.01$) and yolk-free body mass ($p<0.05$) at hatch than control group, however there existed no significant difference among the groups between T_2 and T_7in the above parameters No significant differences were observed among the treatment groups in chick length, chick quality (as Pasgar Score), chick organs (liver, heart and intestine) weight and plasma corticosterone level at hatch, due to different hatching-eggs turning duration. The heterophil count as well as heterophil: lymphocyte ratio of chicks at hatch were significantly ($p<0.01$) higher in control group than all other treatment groups (T_2 to T7) and there existed no significant difference between the groups from T_2 to T7 in heterophil count and H: L ratio. The lymphocyte count showed an opposite trend, which were significantly ($p<0.01$) lower in control group than all other treatment groups (T_2 to T7) and there existed no significant difference between the groups from T_2 to T7. Based on the result, it may reasonably be concluded that hatching-egg turning duration up to 12.5 days to 17.5 days of incubation significantly increased chick weight, chick yield and yolk-free body mass than present-day practice of 18.5 days of incubation, with highest result in hatching-eggs turned up to 17.5 and 16.5 days of incubation. The stress to chicks at hatch was found to significantly ($p<0.01$) decrease in a duration-dependant fashion as the hatching-egg turning duration decreased from 18.5 day to 12.5 days of incubation.

Key words: hatching-eggs, incubation, Chick quality, stress response.

PMP-24

Short periods of incubation during egg storage on production performances of broiler chicken

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This study investigated the effect short periods of incubation during egg storage (SPIDES) with or without turning on long-term storage on chick quality parameters of long stored hatching eggs. A total of 750 broiler hatching eggs from 33.5 weeks old parent stock were divided into five groups: T1 (Control without SPIDES), T2 (3 SPIDES without turning), T3 (3 SPIDES and 3 turning during each SPIDES), T4(4 SPIDES without turning) and T5 (4 SPIDES and 3 turning during each SPIDES). Eggs were stored at 17 °C with 75% relative humidity and SPIDES treated eggs were periodically exposed to 37.7 °C for 3 hours at five days interval. All eggs were stored for 21 days and incubated at 22nd day. The SPIDES with turning treatment group eggs were turned by 45º angle on either side of an hourly interval. The results showed significant differences between treatment groups in body weight, body weight gain, feed consumption, feed conversion ratio and livability. In conclusion, the SPIDES treatment, particularly with 4 SPIDES with 3 turning during each SPIDES at every five day intervals during a 21 days storage period, enhanced overall production performances of broiler chicken.

Keywords: SPIDES, body weight, body weight gain, feed consumption, feed conversion ratio, livability, broiler.

PMP-25

Duck production in cage houses

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With an aim to encourage commercial duck farming through cage rearing, 150 Khaki Campbell ducks (6 weeks) were randomly divided into two groups and reared in deep litter system (75 numbers: 25 each in three pans) as well as cage management system (75 numbers: 5 ducks in one cage) up to 40 weeks of age. The floor space, feed and water were same for both the groups. The floor of the cages was fitted with plastic coated wire net so that there was no injury to the web of the birds. Feed and water provision were made inside the cages. Further ducks in the pen were maintained with dry sand as litter material and standard feeding and watering and run-way facility. It is observed that at growth of birds were significantly ($P<0.05$) higher in cages at 12 and 32 weeks of age. Further, no mortality was observed in cages up to 40 weeks of age against 3 percent in the pens during same period. The age at first egg, egg production up to 40 weeks of age and egg weight (32 and 40 weeks) are significantly ($p<0.05$) higher in cage reared ducks whereas, age at 50 percent egg production is significantly ($p<0.05$) higher in floor management ducks. Also, more egg production with higher egg weight observed in cage reared ducks are indicative of better feed utilization in cages than pens.

Keywords: Khaki Campbell duck, Cages, Deep litter management, Growth, Egg production.

PMP-26

Comparative evaluation of growth performance on cage and floor housing systems in Japanese quail layers

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The study was framed to estimate the growth performance of Japanese quail to reduce housing cost and to achieve efficiency. A total of 180 birds of 6 weeks of age were equally divided in two different housing systems of rearing,

90 birds were kept in floor housing system and rest were in cage housing system, maintaining the sex ratio of 3:1 (67 females +23 males) in floor housing as well as in cage housing system. The results revealed that overall mean value of weekly feed intake was 18.73±0.78kg and 18.41±0.84kg in floor housing and cage housing systems respectively and was found to be non-significant (p≥0.05). The result indicates that there was an improvement in FCR at progressively higher age groups. However, FCR was also found to be non-significant(P≥0.05). Similarly, weekly body weight and body weight gain were also statistically nonsignificant (P≥0.05) in both systems of rearing. But the average daily weight gain and total body weight gain had significant effect of housing system(p≤0.05) due to better availability of animal protein factor, riboflavin, certain trace minerals and unidentified growth promoters available in bedding material of litter. The overall feed intake cost per dozens of eggs revealed that there was no significant difference in cost economics of reared birds in floor and cage housing system which may be due to greater number of birds reared by unit area warranting reduced expenses towards housing cost.

Keywords: Japanese quail, FCR, litter system, Body weight gain, Cage housing system.

PMP-27

Growth performance of Kadaknath chicken under agro-climatic condition of Bihar

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A study was carried out to evaluate the growth performance of Kadaknath chickens under agro-climatic condition of Bihar. A total of 45 Kadaknath chicks were reared under standard managemental conditions. Individual body weights were recorded at hatch (0 day) and subsequently at weekly intervals up to 12 weeks of age. The data were analyzed to assess growth trends across different age intervals. The mean body weights (±SE) were 25.77 ± 0.32 g at hatch, 46.14 ± 0.86 g at 1 week, 83.60 ± 1.54 g at 2 weeks, 133.21 ± 3.07 g at 3 weeks, 189.19 ± 5.16 g at 4 weeks, 254.68 ± 7.37 g at 5 weeks, 377.09 ± 10.91 g at 6 weeks, 382.75 ± 13.34 g at 7 weeks, 407.42 ± 12.42 g at 8 weeks, 480.00 ± 14.95 g at 9 weeks, 519.02 ± 16.24 g at 10 weeks, 567.02 ± 17.82 g at 11 weeks, and 615.60 ± 18.72 g at 12 weeks. The results revealed a steady and consistent increase in body weight with advancing age and with the highest growth rate observed between the 2nd and 6th weeks. Kadaknath chickens exhibited a moderate but consistent growth rate typical of indigenous breeds. Although their growth performance is lower than that of commercial broilers, their adaptability, hardiness, and superior meat quality make them suitable for low-input and backyard poultry production systems.

Keywords: Kadaknath, body weight, growth performance, indigenous chicken.

PMP-28

"*In ovo* delivery of aromatase inhibitors in broiler chickens: Effects on embryonic development and hatchability"

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Sex is one of the major determinant of broiler performance, with male chicks exhibiting faster growth, superior feed efficiency, and higher carcass yield than females. In birds, sex differentiation follows the ZZ/ZW chromosomal system, where genetic females (ZW) rely on aromatase, a cytochrome P450 enzyme, for estrogen synthesis and ovarian development. Inhibition of aromatase during the critical period of sexual differentiation around 5 to 6 days of incubation can redirect gonadal development toward a male feature. With this background a study was carried out to evaluate the effects of *in ovo* delivery of aromatase inhibitors on embryonic development and hatchability in broiler chickens. A total of 630 fertile broiler eggs were randomly allocated into six treatment groups; namely, T_1 - Untreated, T_2 - Distilled water, T_3 - Tamoxifen, T_4 - Letrozole. T_5 - Garlic extract and T_6 - Mushroom extract. In each treatment group there was three replicates of 35 eggs in each replicate. On the 5th day of incubation, 0.1 ml of respective aromatase inhibitor agents (@1 mg/ml) were injected into the albumen using tuberculin syringe *in ovo*. The point of drilling on the egg shell was sealed immediately after injection using wax and the eggs were replaced in the incubator. The parameters like egg weight, embryonic weight, albumen weight, yolk weight, hatching time, hatchability percentage, sex ratio and day-old chick weight were recorded. At day 10 of incubation period, the mean egg weight did not differ among all the groups.

At day 17 of incubation period, the egg weight of natural aromatase inhibitors treated group (T_5 and T_6) was higher ($P<0.01$) than T_1 and T_3. By break open, the embryo was isolated from attachments and weighed. at day 10 of incubation, T_6 group was comparable with T_1 group. But it was higher ($P<0.05$) than T_3 and T_4 group. Similar trend was observed in day 17 of incubation as well. In albumen and yolk weight, no differences were observed among all the groups both at day 10 and 17 of incubation period. Hatching time was uniform across all the treatment groups. It suggested that aromatase inhibitors treatment did not influence hatching time. The hatching percentage recorded in control groups was 94.00 % (T_1) and 81.15 %. (T2) Among treatment groups T_3 exhibited lowest hatchability (55.07%), whereas, T_4 group exhibited highest hatchability (73.90 %). In T_5 and T_6 groups, hatchability percentage recorded was 65.21% and 62.31% respectively. Feather sexing was carried out on the day of hatching. The female: male sex ratio in groups T_1 to T_6 were found to be 1 : 1.08, 1 : 1.06, 1 : 1.38, 1 : 1.44, 1 : 1.38 and 1 : 1.13 respectively. There was no significant difference noticed in sex ratio between groups. The day old chick weight was ranged between 46.83 ± 0.22 and 48.03 ± 0.19 g. The aromatase inhibitors treatment did not influence the hatch weight in all the groups.

Keywords: Aromatase inhibitor, Broiler chicken, Embryonic characteristics.

PMP-29

Comparative manure composition analysis in environmentally controlled and elevated cage layer houses

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This study assessed the manure quality of poultry flocks reared in Environmentally Controlled (EC) houses versus Elevated Cage houses, using samples collected from chicks, growers, and layers. Manure parameters evaluated included moisture, crude protein, crude fibre, ash, calcium and ammonia levels. Samples were analysed in both dry and wet forms to evaluate nutrient concentration and waste-management efficiency under two housing systems.Results showed that EC houses consistently produced manure with lower moisture levels in layers (e.g., 34.16% dry manure vs. 25.23% in Elevated Cage), more stable nutrient composition, and comparatively lower ammonia emissions (10–20 ppm). In chicks and growers, EC manure exhibited more uniform protein (9.41–12.38%) and fibre levels (5.3–4.61%), while Elevated Cage manure showed higher fluctuations and increased moisture retention due to exposure to open ventilation and climatic variations. Across all categories, EC houses maintained better manure consistency, improved nutrient retention and reduced wetness, indicating superior environmental control.The study concludes that EC houses support more efficient manure digestion, better nutrient preservation, reduced ammonia accumulation, and enhanced waste-management outcomes compared to Elevated Cage houses. These results suggest that EC housing promotes improved manure quality, contributing to more sustainable, hygienic and environmentally responsible poultry production systems.

PMP-30

Comparison of production efficiency and external egg quality traits between moulted and non-moulted Kuroiler parent flocks

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This study evaluated the differences in production performance and external egg quality parameters between moulted and non-moulted Kuroiler parent flocks. Moulting was induced at 57–62 weeks using feed and light restriction, and post-moult performance was assessed from 65–80 weeks. Production traits analysed included hen-day egg production (HDEP), mortality, feed cost per egg, net cost per egg, and total cost per egg. External egg characteristics assessed were

egg weight, volume, specific gravity, surface area, and shape index. Results showed that the moulted flock exhibited significantly higher egg production (65.9% HDEP) compared to the non-moulted flock (53.5%), yielding 47,973 more eggs during the study period. Feed cost per egg was lower in the moulted flock (₹5.81) than in the non-moulted flock (₹7.14), resulting in reduced total and net cost per egg. However, mortality was slightly higher in the moulted flock. External egg quality improved post-moult, with moulted eggs showing greater egg volume (+1–3 ml), higher egg weight (+0.79–2.2 g), increased surface area (+1.89–4.62 cm²), but slightly lower specific gravity (−0.02 to −0.06) and shape index values. Based on study, forced moulting proved beneficial in enhancing production efficiency and external egg quality, despite minor welfare concerns. The study supports the use of controlled moulting to extend flock productivity and improve economic returns in Kuroiler parent operations.

PMP-31

Development of a IoT enabled smart sensor-based system for continuous water quality monitoring in poultry farms

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Ensuring optimal drinking-water quality is essential for maintaining poultry performance. This study designed and implemented a IoT enabled sensor-based Smart Watering System that continuously monitors water pH and temperature in real time. The system uses a Raspberry Pi controller linked with pH and temperature sensors, Wi-Fi connectivity and a display module. Data is logged and visualised through a mobile or laptop web page connected to a common Wi-Fi network.The prototype was installed in the VAL nipple watering line of a commercial brooding shed. Hourly readings were recorded as pH values between 6.5–7.2 and temperatures between 20.5–24°C. Comparison with standard instruments showed 97% measurement accuracy, validating the system's reliability. The automated monitoring ensured early identification of deviations from ideal water quality, reducing risks of digestive issues, microbial growth and compromised flock performance.By minimising manual intervention and providing continuous water-parameter display, the system enhances management efficiency and supports better bird health. The design is cost-effective, easy to deploy and scalable for all poultry farm sizes.The Smart Watering System demonstrates strong potential as a precision-farming tool for maintaining consistent water quality in modern poultry operations.

Keywords: IoT water monitoring, pH and temperature sensing, Smart watering system, Poultry water quality.

PMP-32

Effect of egg storage duration on hatchability, fertility and chick yield in broiler breeder eggs

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This study evaluated the influence of different egg storage periods on hatchability, fertility, weight loss, and chick yield in broiler breeder eggs. A total of 924 hatching eggs from a 45-week-old GP626K flock were divided into three treatments based on storage duration: T1 (7 days), T2 (5 days), and T3 (3 days), with 308 eggs per treatment. The eggs were collected, fumigated, and stored under controlled conditions (16–17°C; 75–80% RH). Storage loss, weight loss during incubation, hatchability, fertile hatchability, and chick yield were recorded using standard hatchery procedures. Storage loss increased with longer holding times, with T1 showing the highest loss (1.5%) and T3 the lowest (0.45%). Weight loss during incubation ranged from 10.39% (T3) to 11.54% (T1), remaining within acceptable standards. Hatchability improved as storage duration decreased: 87.98% in both T1 and T2, rising to 91.23% in T3. Fertile hatchability also peaked in T3 (91.53%). Chick yield exceeded the standard 66–68% across all groups, with the highest yield recorded in

T2 (75.1%). Overall, shorter egg storage duration significantly improved hatchability and fertile hatchability, likely due to reduced moisture loss and better maintenance of internal egg quality. The study concludes that a 3-day storage period is optimal for maximizing hatchery performance and economic efficiency in broiler breeder operations.

Keywords: Egg Storage Duration, Hatchability, Weight Loss and Chick Yield.

PMP-33

Effect of egg weight categories on hatchery performance and chick quality in 31-week VENCOBB 430 breeder flock

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This experiment evaluated how different egg weight categories influence hatchability, moisture loss, embryonic mortality, and chick quality in a commercial VENCOBB 430 parent flock aged 31.3 weeks. A total of 360 eggs were grouped into three weight classes: T_1 (50–55 g), T_2 (56–60 g), and T_3 (61–65 g). After standard fumigation and storage, eggs were incubated uniformly, candled at day 10, and later transferred to the hatcher on day 19 for final evaluation. Hatchability was highest in the standard-weight group T_2 (90%), followed by T_1 (84.16%) and T_3 (76.66%). Embryonic mortality analysis revealed that T_3 eggs had the highest early mortality (5.83%) and pipped-live losses, while T_2 consistently showed the lowest losses across all stages. Chick weight increased with egg size, ranging from 39.67 g (T_1) to 44.57 g (T_3). Chick yield showed slight variation but was highest for T_1 (73.77%). Chick length also increased with egg weight, measuring 18.6 cm, 18.9 cm, and 19.16 cm respectively. Based on the study demonstrates that selecting standard-weight eggs (56–60 g) maximizes hatchability and reduces embryonic mortality while maintaining desirable chick weight and length. Although heavier eggs produce larger chicks, they exhibit reduced hatchability. These results emphasize the importance of optimal egg weight selection in hatchery management for improved broiler breeder efficiency.

PMP-34

Effect of induced moulting on egg production, cost efficiency and external egg characteristics in Kuroiler layers

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This project investigated the impact of induced moulting on production performance and external egg quality in Kuroiler parent flocks. Moulting was initiated at 57–62 weeks, and comparative data for moulted and non-moulted flocks were collected during 65–80 weeks. Key parameters evaluated included hen-day egg production (HDEP), feed cost per egg, mortality, net cost per egg, and total cost per egg. External quality traits assessed were egg weight, volume, shape index, specific gravity and surface area. The moulted flock demonstrated a substantial improvement in HDEP (65.9%) compared with the non-moulted flock (53.5%), resulting in an additional 47,973 eggs. Economic analysis revealed lower feed cost per egg for the moulted flock (₹5.81) than for the non-moulted flock (₹7.14), contributing to reduced total cost per egg. Although mortality was marginally higher in moulted hens, overall flock economics favoured moulting. External egg quality improved post-moult, with moulted eggs exhibiting higher weight (average +1.51 g), larger volume (+1–3 ml), greater surface area (+3.24 cm^2), and acceptable shape index values. Specific gravity was slightly lower but remained within functional quality limits. Based on these findings confirm that induced moulting enhances both productivity and egg quality, making it a viable strategy for extending laying cycles and improving profitability in Kuroiler breeder farms, provided welfare considerations are managed appropriately.

PMP-35

Influence of egg weight on hatchability, embryonic mortality and chick quality in VENCOBB 430 parent flock

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This study investigated the effect of egg weight on hatchability, embryonic mortality patterns, chick weight, chick yield, and chick length in a 31.3-week-old VENCOBB 430 broiler breeder flock. A total of 360 eggs were classified into three weight groups: T_1 (50–55 g), T_2 (56–60 g; standard), and T_3 (61–65 g). Each treatment contained 120 eggs, which were incubated under uniform conditions after storage at 20°C and 75% RH. Candling on day 10 was performed to eliminate infertile and early dead embryos. Weight loss during incubation was recorded at days 3, 10, and 17. Results showed that egg weight significantly affected hatchability and chick quality traits. Hatchability of set eggs was highest in T_2 (90%), followed by T_1 (84.16%) and T_3 (76.66%). Standard-weight eggs (T_2) also recorded the lowest embryonic mortality and optimal moisture loss (10.84%). Chick weights increased with egg weight, with averages of 39.67 g (T_1), 40.69 g (T_2), and 44.57 g (T_3). Chick length followed a similar trend. Chick yield was highest in T_1 (73.77%), followed by T_3 (71.43%) and T_2 (70.42%). Based on findings indicate that standard-weight eggs (56–60 g) provide the best balance between hatchability, embryo survival, and post-hatch chick quality. Extremely light or heavy eggs result in lower hatchability or variable chick yield. This study highlights the importance of selecting optimal egg weight ranges for maximizing hatchery performance in broiler breeders.

PMP-36

Prototype design and evaluation of a semi-automatic dry-cleaning system for poultry eggs

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Maintaining eggshell hygiene without compromising shell integrity is essential for safe and high-quality egg production. This study focuses on developing a semi-automatic egg dry cleaner that eliminates contaminants through mechanical brushing rather than water-based washing. The system integrates a 12V wiper motor, food-grade conveyor belt, variable speed controller, IR sensor, nylon-based cleaning materials, and an XC410 control/display unit. The prototype operates by conveying eggs through a series of dry-cleaning brushes that remove dirt while preventing cuticle damage. The IR sensor accurately counts eggs at the exit point, ensuring automated monitoring. Multiple cleaning materials were tested to determine their effect on cleaning efficiency, shell thickness, and cuticle preservation. Nylon brushes and nylon fibre bars consistently cleaned eggs effectively without affecting shell quality, whereas sandpaper, metal brushes, and steel wool showed abrasive action that compromised both shell thickness and cuticle integrity. Dry cleaning trials confirmed that the prototype maintains the natural protective bloom layer, thereby reducing bacterial penetration and improving shelf life. Additional advantages include reduced handling damage, elimination of chemical and water usage, and compliance with hygiene standards. The system also demonstrated low operational cost and minimal maintenance requirements. Overall, the semi-automatic dry egg cleaner prototype provides an eco-friendly, safe, and practical solution for poultry farms, offering improved egg hygiene and sustainability compared to conventional wet cleaning methods.

Keywords: Dry egg cleaning, Cuticle preservation, Mechanical brushing, Egg hygiene.

PMP-37

Prototype design of an energy-efficient thermoelectric egg storage cooling unit using peltier technology

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Eggs are highly perishable and require controlled temperature conditions to maintain freshness and prevent microbial deterioration. This project presents the design and evaluation of a thermoelectric egg storage cooling system utilizing a Peltier module (TEC1-12706) to provide precise and automated cooling for egg storage. The system incorporates a semiconductor refrigeration unit, cooling fan, radiator, thermal insulation gasket, silicon grease, and a digital temperature sensor, all supported by a stable 12V SMPS power supply. The Peltier module generates a cooling effect on one surface while expelling heat from the opposite side via the radiator and fan. Continuous temperature monitoring ensures automatic adjustment of cooling intensity and maintaining stable storage conditions. The compact design, absence of refrigerants, and minimal mechanical components contribute to its low maintenance and environmental benefits. Performance evaluation confirmed that the prototype effectively lowers egg storage temperatures, reduces spoilage, and improves shelf life. The system is cost-efficient, portable, quiet in operation, and ideal for small and medium egg producers. Although limited by moderate cooling capacity and dependence on uninterrupted power, it remains a practical solution for decentralized and rural poultry setups.This Peltier-based cooling model provides a sustainable and scalable alternative to traditional refrigeration, supporting improved egg quality management across various poultry operations.

Keywords: Thermoelectric cooling, Peltier module, Egg storage, Temperature control.

PMP-38

Hammer mill blade design on power consumption and grinding rate for preparing commercial broiler feed

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An experiment was conducted to study the hammer mill blade design on power consumption (KWh/100Kg) and grinding rate (Kg/Sec) while preparing commercial broiler feed for different stages. In this experiment, 5 different blade designs were used *viz.* Plain (T_1), Single stepped (T_2), Double stepped (T_3), Extended tip (T_4) and Tapered tip (T_5). For preparing broiler pre-starter feed the sieve opening of 3mm is used. For preparing broiler starterfeed the sieve opening of 4.5mm is used. For preparing broiler finisher feed the sieve with opening of 6mm was used. Thehorizontal type hammer mill is used for preparing the feed in this experiment. The power consumption is measured with the help of energy meter and the grinding rate is measured with the help of timer. The result on power consumption (KWh/100Kg) revealed that T_4- Extended tip hammer mill blade design had recorded the lowest power consumption for grinding broiler pre-starter feed (0.61 KWh/100Kg) and broiler finisher feed (0.33 KWh/100Kg) among all the treatment groups, whereas, T_5 had the lower power consumption (0.38 KWh/100Kg) for preparing broiler starter feed. The result on grinding rate (Kg/Sec) revealed that the group T_4 had highest grinding rate for broiler pre-starter, broiler starter and broiler finisher feed, which were recorded to be 0.37, 0.50 and 0.69 Kg/Sec respectively. The result of thestudy concluded that the Extended tip hammer mill blade design could be used to produce commercial broiler feed with significantly lower power consumption and higher grinding rate.

Keywords: Hammer mill blade design, power consumption, grinding rate and commercial broiler feed.

PMP-39

Impact of single-male versus mixed-male semen use on fertility and hatch performance in artificial insemination of layer breeders

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This study evaluated the comparative effects of single-male semen and mixed semen from multiple males on fertility and hatchability in artificially inseminated BV300 layer parent stock. A total of 240 hens (35 weeks old) were assigned to four treatments: T_1 (single male), T_2 (two males), T_3 (three males), and T_4 (four males), with 60 birds per treatment. Artificial insemination was performed three times per week using 0.05 ml of semen per hen, and 84 eggs from each treatment (336 in total) were collected, incubated, and analyzed. Results showed a clear decline in reproductive performance as the number of males contributing to the semen increased. Fertility was highest in the single-male treatment (T_1: 100%), followed by T_2 (97.6%), T_3 (94.0%), and T_4 (91.6%). Hatchability followed the same trend, with T1 achieving the highest hatchability (95.2%), compared to T_2 (92.8%), T_3 (89.2%), and T_4 (86.9%). Moisture loss and chick yield percentages showed minimal variation among treatments, indicating that semen source primarily influenced fertility and hatch outcomes rather than embryonic development. Break-open analysis further confirmed increasing embryonic mortality with mixed-male semen. The study concludes that using semen from a single male significantly enhances fertility and hatchability under artificial insemination in layer breeders. These findings support the preference for single-male semen collection to maximize reproductive efficiency and hatch performance in commercial breeding programs.

Keywords: Single-Male Semen, Mixed-Male Semen, Fertility & Hatchability and Artificial Insemination.

PMP-40

IoT-based real-time water flow monitoring system for poultry sheds using YF-S201 sensor and Raspberry Pi Pico W

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The project demonstrates that IoT technology can enhance precision water management, reduce wastage and improve flock productivity and sustainability in modern poultry farming. Efficient water management is essential for maintaining bird health, nutrient delivery and overall productivity in poultry farms. This study developed an IoT-enabled water flow monitoring system using a YF-S201 Hall-Effect flow sensor integrated with a Raspberry Pi Pico W microcontroller to measure real-time water flow in poultry water lines. The system captures flow rate and total water volume and transmits live data to the ThingSpeak cloud platform for remote visualization through mobile or computer devices. The YF-S201 sensor detects flow through pulse frequency, which is processed by the microcontroller to calculate instantaneous flow rate (L/min) and cumulative usage. The prototype was tested under field conditions and demonstrated reliable performance with ±10% accuracy. Real-time data logging enabled early detection of issues such as pipeline blockages, leakage and abnormal water usage patterns, helping prevent dehydration, production drops and medication inefficiency in breeder birds.The system supports remote monitoring, automated data storage, alerts and consumption analysis per bird, contributing significantly to improved water management. With a low fabrication cost, easy installation and user-friendly cloud access, this IoT-based flow meter provides a cost-effective and scalable solution for both open-sided and environmentally controlled poultry sheds.

PMP-41

Development of an arduino-based temperature monitoring and control system for poultry debeaking machines

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Debeaking is a widely practiced procedure in commercial poultry farms to reduce injurious pecking, but its safety and welfare outcomes depend strongly on maintaining the correct blade temperature. Overheating causes tissue burns and granuloma formation, while low temperature leads to incomplete trimming and repeated handling stress. This study developed an automated temperature monitoring and control system for a debeaking machine using an Arduino microcontroller, K-type thermocouple, MAX6675 amplifier, relay module, LCD display and buzzer alert. The system continuously monitors blade temperature in real time and maintains it within a safe range (approximately 600°C) through automatic switching of the heating element via a relay. The LCD displays the current temperature, while the buzzer alerts operators during overheating. This ensures greater consistency, rapid operator response, reduced manual monitoring and improved safety. Field assessment was conducted on 100-bird samples comparing conventional debeaking to sensor-assisted debeaking. Results showed that the sensor system achieved 100% livability, zero bleeding, faster wound healing (2 days), no granuloma formation and improved trimming quality. In contrast, conventional methods resulted in 95% livability, 2% bleeding and 2% granuloma formation. The automated system proved to be cost-effective, scalable and operator-friendly, while significantly improving animal welfare outcomes. This technology offers a reliable solution to enhance precision, reduce human error and modernize debeaking operations in poultry production systems.

Keywords: Debeaking, Automated temperature monitoring and Enhanced precision.

PMP-42

Effect of breeder age on quantitative and qualitative chick quality traits in BV300 layer parents

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This study investigated the influence of breeder age on chick quality in BV300 layer breeders by comparing two age groups: 35 weeks (younger flock) and 46 weeks (older flock). A total of 50 chicks per age group were assessed using quantitative parameters—egg weight, chick weight, chick length, and chick yield-and qualitative traits including leg strength, beak appearance, eye brightness, navel quality, and activity level. Results showed that egg and chick weights were higher in the 46-week flock (58.9 g and 40.2 g) compared to the 35-week flock (56.4 g and 38.5 g). Chick length also increased with age, measuring 17.9 cm for older breeders versus 17.3 cm for younger breeders. Chick yield showed a marginal improvement in the older flock (67.5%) compared to the younger flock (66.7%). Qualitative assessments demonstrated superior leg strength (84%), beak appearance (92%), navel quality (92%), and overall vitality in chicks from 46-week breeders, while eye brightness was slightly higher in the younger flock. Overall, breeder age significantly affected both quantitative and qualitative chick characteristics, with older breeders producing larger, longer and more vigorous chicks. The study concludes that chick quality performance is higher at 46 weeks of breeder age, supporting the importance of age-based breeder management strategies in commercial layer hatcheries.

Keywords: Breeder age, chick quality, chick weight, navel quality and activity level.

PMP-43

Effect of different normal saline dilution levels on fertility, embryonic development and hatchability in BV300 layer breeders

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This study evaluated the impact of normal saline–based semen dilutions on fertility, embryonic development and hatchability in BV300 layer breeders. A total of 300 hens (51 weeks) were inseminated thrice weekly with 0.05 ml semen. Five treatments were used: T1–undiluted semen (control), T2–0.1 ml saline, T3–0.2 ml saline, T4–0.3 ml saline and T5–0.4 ml saline. For each treatment, 84 eggs (420 total) were incubated under standard setter and hatcher conditions. Fertility, hatchability, moisture loss, chick yield and embryonic mortality were analysed. Results showed a progressive decline in fertility as dilution increased. T1 recorded 100% fertility, followed by T2 (98.8%), T3 (97.6%), T4 (96.4%) and T5 (96.4%). Hatchability was highest in the control group (96.4%), decreasing with dilution: T2 (94.0%), T3 (92.8%), T4 (89.2%) and T5 (88.0%). Embryonic mortality increased in higher-dilution treatments as indicated by break-open results. Chick yield ranged from 66.6% to 67.8%, remaining within acceptable hatchery standards. The study concludes that undiluted semen yields optimal fertility and hatchability, while mild dilution up to 0.3 ml saline can be used when male availability is limited without drastically affecting outcomes. Higher dilution (>0.3 ml) negatively influences fertilization and embryonic development. The findings support judicious use of semen diluents to maximize male utilization while maintaining acceptable hatchery performance.

PMP-44

Improving hatchability of hairline-cracked eggs using paper and transpore surgical tapes

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Hairline-cracked eggs are normally rejected in hatcheries due to excessive moisture loss, microbial contamination and reduced embryo survival. This study evaluated the effectiveness of sealing hairline cracks with two types of surgical tapes-paper surgical tape and transpore surgical tape-on improving hatchability and chick quality in Hyline W80 breeder eggs. A total of 360 eggs (35-week flock) were divided into four treatments: T1 – normal eggs, T2 – hairline-cracked eggs sealed with paper surgical tape, T3 – sealed with transpore tape and T4 – unsealed hairline-cracked eggs (control). Eggs were stored at 18°C and 75% RH for 2–3 days, incubated under standard setter and hatcher conditions and assessed for fertility, moisture loss, hatchability, chick yield and embryonic mortality. Moisture loss was lowest in T1 (10.7%) and highest in T4 (18.5%). Hatchability decreased sharply in unsealed cracked eggs (78%) but improved significantly when sealed, with paper tape achieving the highest hatchability among cracked-egg treatments (88%). Chick yield was also highest in T1 (68.3%) and T2 (67.1%), followed by T3 (66.2%) and T4 (63.5%). Break-open analysis revealed increased early and late embryonic mortality in T4, largely due to dehydration and microbial contamination. Paper surgical tape showed superior sealing efficiency, reducing contamination and mortality while maintaining embryo viability. The results indicate that sealing hairline cracks - particularly with paper surgical tape - is a simple, low-cost and effective method to recover hatchable eggs and improve economic returns in commercial hatcheries.

PMP-45

Productive and reproductive parameters of *Siruvidai* chicken in Tamil Nadu under extensive management system

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An investigation was conducted to document the production and reproduction performance of Siruvidai chickens of Tamil Nadu under an extensive management system. The study was carried out across three agro-climatic zones of the state: Tiruvannamalai district (North-Eastern zone), Dharmapuri district (North-Western zone), and Ariyalur and Perambalur districts (Cauvery Delta zone). A total of 3,000 native Siruvidai chickens were selected for the study, with 1,000 birds from each district following the guidelines of ICAR–NBAGR (2016). Data on production and reproduction traits of female Siruvidai chickens were collected from 300 farmers, including 100 farmers from each district, using a simple random sampling method. The data were collected using a semi-structured interview schedule and self-observation. Information was recorded on key production parameters, including age at sexual maturity, body weight at sexual maturity, egg weight, clutch size, inter-clutch interval, number of clutches per laying cycle, average pause period, laying cycle length, number of laying cycles per year, eggs produced per laying cycle, egg production percentage, annual egg production per hen, and age at culling. Siruvidai chickens attained sexual maturity at 156.34 ± 1.40 days, with an average body weight of 858.15 ± 7.90 g. Annual egg production was 79.33 ± 0.84 eggs under semi-intensive management and 56.63 ± 0.87 eggs under extensive management. The average egg weight, clutch size, inter-clutch interval, number of clutches per laying cycle, average pause period, laying cycle length, number of laying cycles per year, eggs produced per laying cycle, and culling age in females were 34.79 ± 0.35 g, 6.27 ± 0.08 days, 1.99 ± 0.03 days, 2.30 ± 0.03, 87.06 ± 1.20 days, 104.54 ± 1.23 days, 3.61 ± 0.03 cycles, 15.81 ± 0.29 eggs, and 2.61 ± 0.04 years, respectively. A significant difference ($P \leq 0.05$) was observed among the districts for several production parameters, including age at sexual maturity, body weight at sexual maturity, egg weight, annual egg production, and culling age.

Keywords: *Siruvidai* chicken, Production, reproduction parameters, age at sexual maturity and culling.

PMP-46

Effect of stocking density on performance, health, and economics of Vanaraja birds reared

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This study aimed to evaluate the effects of different stocking densities on the growth performance, feed efficiency, blood biochemical parameters, stress physiology and economic viability of Vanaraja birds reared under deep litter system. A total of 120 Vanaraja chicks of 1-week age were distributed randomly into 4 treatment groups having 3 replicates each containing 10 chicks. The floor space @ 0.75 sq.ft , 1.00 sq.ft, 1.25 sq.ft. and 1.50 sq.ft per bird was provided for T1, T2, T3 and T4 groups respectively. T1 group was kept as control. The birds were fed uniform commercial diet and managed under deep litter system of management. Body weight, feed consumption, feed conversion ratio and blood biochemical parameters were studied. The experiment was conducted for a period of 6 weeks. The results indicated that birds in the T3 group (1.25 ft²/bird) exhibited significantly ($P < 0.05$) higher body weight (690.84±5.18g) compared to other groups, with the lowest body weight (581.44±6.23g) observed in T1 (0.75 ft²/bird). The FCR was also significantly ($P < 0.05$) better in T3 (2.72±0.03), demonstrating improved feed efficiency and lowest in T1(2.99a±0.03). Blood biochemical analysis revealed significant differences in serum parameters such as SGOT and SGPT with lower values observed in T3 and T4 groups compared to T1 and T2 group. Heterophils, lymphocytes, and H/L ratio differed significantly among

various treatments, with lower stress indicators i.e., heterophils and H/L ratio observed in T3 and T4 compared to T1 and T2 group. Economic analysis revealed the highest profit per bird in T3 group (Rs. 36.53) and lowest in T1 group (Rs. 21.57). The benefit-cost (B:C) ratio was highest in the T3 group (1.36), indicating better profitability compared to other stocking densities. In conclusion, rearing of vanaraja birds with SD of 1.25 ft² per bird provides optimal growth performance, welfare and better economic returns.

Keywords: Vanaraja, Stocking density, performance, serum biochemicals, stress, economics.

Poultry Health: Oral Presentations

PHO-01

Molecular features of fowl adenovirus and its pathological characterization in specific pathogen free (SPF) chicks

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Inclusion Body Hepatitis (IBH) is an acute, immunosuppressive condition of poultry c aused by fowl adenoviruses (FAdVs), characterized by high mortality and severe anemia, posing a significant threat to global poultry health. This study aimed to investigate the molecular characteristics and pathological features of FAdV associated with IBH outbreaks in SPF broiler chicks in the Kashmir Valley. Out of 25 suspected outbreaks, 18 were confirmed FAdV positive by PCR amplification of the Fiber (1184 bp), Polymerase (564 bp), and Hexon (897 bp) genes. The disease was observed to primarily affect broiler chicks between 15 and 35 days of age, with recorded mortality rates ranging from 10% to 21%, and an overall average mortality of 12.91%. Gross pathological examination revealed hepatomegaly, petechial hemorrhages, hepatic pallor and friability, hydropericardium, renal cortical hemorrhages, and splenomegaly. Histopathological analysis showed hepatocellular degeneration with basophilic intranuclear inclusion bodies, sinusoidal congestion, heterophilic infiltration, splenic lymphoid depletion, glomerular atrophy, and myocardial fibre disruption. BLASTn analysis of the isolates showed high sequence identity with FAdV-D strains: 99.91% for the Fiber gene (MK572868.1), 95.52% for the Hexon gene (MK816405.1), and 99.78% for the Polymerase gene (OP688511.1), confirming circulation of FAdV serotype 11 (species D) in the region. Virus isolation in chicken embryo fibroblast (CEF) cultures yielded a titer of 10^5 $TCID_{50}$/ml. In experimental studies, 45 SPF chicks were divided into three groups: Group I (control), Group II (intraperitoneal inoculation with 0.2 mL of 10^5 $TCID_{50}$), and Group III (intramuscular inoculation). Groups I and II were sacrificed at defined intervals, while mortality in Group III reached 100% by 6 dpi. Clinical signs included lethargy, anorexia, respiratory distress, and stunted growth. Hematological and biochemical analyses revealed anemia (reduced hemoglobin, PCV, ESR) and elevated markers of renal and hepatic injury (creatinine, BUN, ALT, AST, ALP). Gross lesions in experimentally infected birds were same as those seen in natural infections. Histopathology confirmed classic basophilic intranuclear inclusion bodies, hepatocyte necrosis, karyolysis and karyorhexis, myocardial inflammation, glomerular atrophy, splenic lymphoid depletion, and gizzard pellicle loss. Page green staining highlighted characteristic red inclusion bodies within hepatocytes. Disease severity peaked between 3 and 5 dpi, with clinical recovery observed by day 7. This study confirms the predominance of FAdV serotype 11 (species D) in recent IBH outbreaks in Kashmir Valley. Further molecular and pathogenic studies are essential to inform the development of effective IBH vaccines.

Keywords: FAdV-11, Inclusion Body Hepatitis, SPF broiler chicks, Virus isolation**.**

PHO-02

Prevalence and association of avian metapneumovirus (aMPV) in commercial layer pullets with respiratory signs

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Avian Metapneumovirus (aMPV) is a significant respiratory pathogen in poultry, frequently associated with upper respiratory tract inflammation, facial swelling, and secondary bacterial infections. The present study aimed to determine the prevalence of aMPV infection and evaluate its potential role as a predisposing factor for other respiratory pathogens in commercial layer pullets exhibiting eye and head swelling. A total of 239 serum samples were collected from 16 commercial layer farms with flocks aged 8–17 weeks showing respiratory distress and facial edema. Serological screening for aMPV antibodies was performed using the IDEXX ELISA kit, and molecular detection for aMPV, *Avibacterium paragallinarum* (Infectious Coryza), and *Ornithobacterium rhinotracheale* (ORT) was carried out using PCR assays. Out of the 239 samples, 132 (55.2%) were seropositive for aMPV, with a mean ELISA titer of 870, indicating moderate field exposure. However, all samples were negative for aMPV by PCR, suggesting past infection with antibody persistence but absence of active viral shedding. Nine flocks were positive for Infectious Coryza and four for ORT by PCR, indicating co-infection with bacterial respiratory pathogens among aMPV-seropositive flocks.

Clinically, affected birds exhibited periocular swelling, nasal discharge, and mild respiratory distress, with low mortality. The findings indicate that subclinical or transient aMPV infection may predispose birds to secondary bacterial infections such as Coryza and ORT, contributing to the respiratory disease complex in commercial layers. This study provides serological evidence of aMPV circulation in layer pullets and highlights the importance of routine monitoring and strategic vaccination to mitigate the impact of aMPV-associated respiratory disorders.

Keywords: Avian Metapneumovirus, Commercial Layers, Infectious Coryza, ORT, Respiratory Complex, Seroprevalence.

PHO-03

Cholesterol 25-hydroxylase inhibits Newcastle disease virus replication by its architectural damage and blocking the HN protein

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Newcastle disease is a severe viral disease that affects poultry globally. The causative agent is the Newcastle disease virus (NDV). Many human interferon-stimulated genes (ISGs) have been identified, with some clarified for their antiviral functions. However, chicken ISGs identified with antiviral properties are still rare. Cholesterol 25-hydroxylase (CH25H) is a membrane-bound endoplasmic reticulum protein that converts cholesterol into 25-hydroxycholesterol (25HC). Recent studies have demonstrated that CH25H is an interferon-stimulated gene (ISG) that aids in combating various viruses and exhibits broad antiviral effects. However, the role of chicken CH25H (chCH25H) in controlling Newcastle disease virus (NDV) infection and replication remains unexplored. This study examined the impact of chCH25H on NDV infection in chicken embryo fibroblast cells. DF1 and BHK21 cells are used for *in vivo* studies. We used the lentogenic (B1), mesogenic (R2B), velogenic (Bareilly), and rNDV-GFP (C30) strains of NDV for viral studies. Chicken RBCs and chicken PBMC were also used for these studies. Chicken CH25H (chCH25H) expressing plasmid (pcDNA 3.1 (+) Zeo) was used for overexpression. Moreover, siRNA against this gene was also used for knockout studies. NDV HN protein was also used to demonstrate interaction with 25HC, an active metabolite of the chCH25H gene. Moreover, Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM) were done to validate the interaction results. Calcein-Loaded Large Unilamellar Vesicles (LUVs) were prepared to see the interaction with 25HC. This study investigated the effect of chCH25H on NDV infection in chicken embryo fibroblast cells. The results showed that cells try to upregulate the chCH25H expression temporally upon viral infection. Moreover, the overexpression of chCH25H reduced NDV infection in cells, while reducing endogenous chCH25H levels increased its replication. Additionally, treating cells and viruses with 25HC, an active metabolic intermediate of chCH25H, significantly reduced NDV replication by blocking the virus from entering cells while causing significant structural damage to the virus architecture. In addition, *in ovo* results also exhibited that the eggs treated with lipopolysaccharides (LPS), a positive regulator of chCH25H and 25HC, resulted in extensive viral reduction. These findings suggest that chCH25H and 25HC inhibit NDV replication in chicken fibroblast cells and are promising candidates for the development of therapeutics against NDV.

Keywords: NDV, ISGs, CH25H, 25HC, Pathogenicity.

PHO-04

Detection, isolation and characterization of a fourth NDV panzootic genotype VIIj of Newcastle disease virus in poultry farm in Srinagar- Jammu and Kashmir

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Newcastle disease (ND) remains a major threat to global poultry production due to its high virulence and economic impact. In Jammu and Kashmir, repeated outbreaks of virulent Newcastle disease virus (NDV) have been documented in both

commercial and backyard poultry, emphasizing the need for continued molecular surveillance.

During an outbreak investigation on a chicken farm in Srinagar, tissue samples from dead birds exhibiting torticollis, incoordination, diarrhea, and depression were collected following OIE biosafety standards. RNA extracted from the tissues was reverse transcribed, and NDV detection was performed by SYBR Green-based real-time PCR targeting the matrix gene. Virus isolation was carried out in 11-day old embryonated chicken eggs followed by serial passages in chicken embryo fibroblasts (CEF). NDV-positive samples were subjected to Sanger sequencing of the Fusion (F) gene.

Phylogenetic analysis revealed that the outbreak strain belonged to Genotype VIIj, sub-genotype VII.1.1, closely related to previously reported strains of this lineage. The deduced amino acid sequence at the fusion cleavage site (113K-R-Q-K-R ↓ F117) contained multiple basic residues, confirming the virulent nature of the isolate as per OIE criteria. One isolate, FVSC-864, was successfully propagated through serial passage in CEF and preserved for further studies.

These findings confirm the circulation of a virulent NDV sub-genotype VII.1.1 strain in Srinagar, underscoring the importance of enhanced genomic monitoring and preventive measures to control future outbreaks.

Keywords: Newcastle disease virus, Genotype VII.1.1, Fusion gene, Virus isolation, Phylogenetic analysis.

PHO-05

Molecular tracking of antimicrobial resistance in *Ornithobacterium rhinotracheale* isolates across ducks, chickens, and their environment

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Antimicrobial resistance (AMR), especially multidrug resistance (MDR), has become a global challenge, threatening human and animal health, food, and environment safety. The evolution of MDR in bacteria occurs through Horizontal gene transfer (HGT) mechanisms. The dissemination of Antibiotic Resistance Genes (ARGs) also occurs between clinical isolates of commercial chickens, ducks and environment. The *Mycoplasma*, *Ornithobacterium* and *E. coli* are the common pathogens that poses significant challenges to commercial poultry production due to respiratory and systemic infections. Among them, the *Ornithobacterium rhinotracheale (ORT)* is one of the emerging gram-negative bacteria causing economical losses to poultry and duck industry. The AMR is also common in poultry due to over usage of antibiotics and carry of ARGs occurs in clinical isolates, including those potentially related to *ORT*, through mechanisms like conjugation, transformation, and transduction, mediated by mobile genetic elements such as R plasmids which allow bacteria to acquire and spread resistance genes, contributing to the rapid emergence of multidrug-resistant pathogens in both clinical and environmental settings. 662 samples including 79 nasal swabs, 104 oral swabs, 113 tracheal swabs, 91 exudates from infra orbital sinuses, 63 lungs, 63 liver, 34 trachea, 34 air sacs and52 heart blood were collected from 28 poultry farms in Andhra Pradesh. 312 samples including 65 nasal swabs, 100 oral swabs, 75 tracheal swabs and 72 exudates from infra orbital sinuses were collected from 12 duck farms that are very nearer and mixed farms. 12 water samples were also collected from the mixed farms. Phenotypically showed ampicillin and cefotaxime resistance of 12 isolates from commercial chickens, ducks and environment. Genotypically confirmed all clinical ORT isolates by targeting 16Sr RNA gene and rpoB gene. Genotypically also detected (TSO-T) blaTEM, (TSO-S) blaSHV and (TSO-O) blaOXA genes by Multiplex PCR1 and BlaCTX-M group1&2 genes by Multiplex PCR2. Concluded that AMR dissemination occurs through shared water sources, large population of bacteria increasing the encounters between different strains, the presence of environmental selective pressure and the interactions of birds in a mixed setting can also facilitates the spread of bacteria and their associated ARGs.

Keywords: ARGs, MDR, ORT, Chickens, Ducks, Environment,16SrRNAgene, rpoBgene, SYBR Green Real Time PCR, Multiplex PCR.

PHO-06

Molecular characterization of vitreous humour proteins as potential biomarkers for early diagnosis of ocular diseases in broiler chickens

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Can vitreous humour protein profiling and molecular characterization in broiler chickens reveal potential biomarkers useful for the early diagnosis of ocular diseases?. Vitreous humour (VH) samples were aseptically collected from freshly enucleated eyeballs of broiler chickens belonging to three age groups: chicks (2-4 weeks), growers (8–10 weeks) and adults (>20 weeks) from a local processing facility (n=10 per group). Samples were diluted in phosphate-buffered saline (0.025 mM, pH 7.4), homogenized and centrifuged at 10,000 × g for 15 min at 4°C. The supernatant was analyzed using SDS-PAGE for electrophoretic separation and gel filtration chromatography for protein fractionation. Prominent protein bands were subjected to in-silico analysis (UniProt and BLASTp) for identification and functional annotation. Protein profiles revealed molecular weight ranges between 10–70 kDa with consistent expression of bands at 66, 45, 25, and 18 kDa. Notably, the 18 kDa and 25 kDa proteins were expressed across all age groups, whereas low-molecular-weight proteins (15–20 kDa) were more prominent in early-age birds. In-silico annotation indicated these bands corresponded to albumin, α-crystallin, transferrin and carbonic anhydrase, which are involved in oxidative stress defense and lens transparency regulation. Age-associated shifts in VH protein patterns suggest alterations preceding visible ocular pathology. The study identifies key vitreous humour proteins as candidate molecular biomarkers for early ocular disease detection in broiler chickens. Integration of biochemical and bioinformatic tools demonstrates their potential for developing molecular or biosensor-based diagnostic assays, advancing ocular health surveillance and preventive management in commercial poultry.

Keywords: Vitreous humour, Proteins, Biomarkers, Ocular diseases, Broiler chickens.

PHO-07

A case report of inclusion body hepatitis in backyard poultry

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Adenoviruses cause a wide range of diseases among all avian species. Even though most of them cause mild disease, some are associated with considerable mortality in the flock. Fowl adenoviruses (FAdVs) are the etiological agents of important diseases like Inclusion body hepatitis (IBH), Hepatitis hydropericardium syndrome (HHS) and Egg drop syndrome (EDS-76) in poultry along with. Four dead birds of 2 months old were brought for necropsy to the Department of Veterinary Pathology, Rajendranagar, Hyderabad. Approximately 10 to 15 per cent mortality was noticed and affected birds showed dullness, depression with pallor of comb and ruffled feathers. On post-mortem examination, it was observed that the livers were swollen, yellowish with fibrinous deposits over the surface and with petechial hemorrhages. On microscopic examination, large basophilic intranuclear inclusion bodies were present in hepatocytes which was suggestive of IBH. Diagnosis was further confirmed by Polymerase Chain Reaction (PCR).

Keywords: Inclusion Body Hepatitis, adenovirus, avian.

Poultry Health: Poster Presentations

PHP-01

Pathology and molecular detection of fowl adenovirus isolated from commercial poultry with respiratory disease complex in Andhra Pradesh

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Fowl adenoviruses (FAdVs) are distributed globally and precise pathogenic role of several FAdV serotypes remains ambiguous; however, these viruses may behave as opportunistic pathogens, often exacerbated by immunosuppressive conditions or concurrent infections. The present study aimed to detect and assess the involvement of FAdV in commercial poultry flocks affected with respiratory disease complex (RDC) using polymerase chain reaction (RT-PCR), along with respiratory pathology. A total of 488 commercial poultry with a history of RDC from Andhra Pradesh were investigated. Tissue samples were collected from affected birds and screened by RT/PCR for FAdV and other respiratory pathogens. Tissues were also histopathologically examined. In the present study, out of 488 birds with respiratory disease complex were examined, FAdV was recorded in 31 (6.35%) birds, of which it occurred as a single infection in 8 (1.64%) birds and along with other infectious agents (APEC and MG) in 23 (4.71%) birds. FAdV and APEC were noticed concurrently in 13 cases (2.66%), and concurrent infection of FAdV and MG was seen in 10 cases (2.05%). The trachea revealed congestion/haemorrhages and exudate. The other lesions recorded were pulmonary congestion and oedema, fibrinous air-sacculitis, pericarditis, perihepatitis, and congested kidneys. The tracheal epithelium revealed eosinophilic intranuclear inclusion bodies. Molecular detection of the virus is carried out by conducting PCR targeting the hexon gene, which yielded 897 bp-sized amplicons, confirming the presence of the virus. The findings demonstrate that FAdV can act as either a primary or secondary etiological agent in respiratory disease complex, in combination with other respiratory pathogens.

Key words: Fowl adenoviruses, Molecular detection, Pathology, poultry.

PHP-02

AI-driven predictive pathology and smart poultry health surveillance: a One-Health approach from the Vindhyan region of India

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Can artificial intelligence-based image analytics and data-driven modeling enhance early diagnosis and decision-making in poultry disease surveillance under Indian field conditions?. Field data on respiratory and enteric disease outbreaks were collected from commercial poultry farms across the Vindhyan region between 2023 and 2025. Gross and microscopic lesion images were processed using convolutional neural network (CNN) classifiers trained on 12 000 annotated images covering avian influenza, infectious bronchitis, and Newcastle disease. Parallelly, climatic, management, and production parameters were integrated into a random-forest model to predict outbreak risk. AI outputs were validated against molecular (RT-PCR) and histopathological findings. The AI system achieved 94.2 % diagnostic accuracy and reduced diagnostic turnaround time by 68 %. The risk-prediction model identified humidity (>80 %) and stocking density as key correlates of outbreak probability. Integration of AI with laboratory data improved sensitivity for early detection of mixed infections by 22 %. A mobile-based dashboard enabled real-time farmer alerts and geo-spatial disease mapping. Artificial intelligence holds transformative potential in poultry health management by enabling rapid, field-ready diagnostics, predictive epidemiology, and One-Health integration. Adoption of such digital tools can significantly enhance disease resilience, productivity, and sustainability of the Indian poultry sector.

Keywords: Artificial Intelligence, Poultry Health, Predictive Pathology, Disease Surveillance, One Health.

PHP-03

Prevalence, molecular identification, and antimicrobial resistance of *Campylobacter* spp. from poultry and poultry handlers in Kashmir Valley

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The present investigation was undertaken to generate comprehensive information on the prevalence, molecular identification, and antimicrobial resistance profile of *Campylobacter* species circulating among poultry and poultry handlers in the Kashmir Valley. The study encompassed ten districts—Srinagar, Ganderbal, Budgam, Anantnag, Baramulla, Pulwama, Shopian, Kupwara, Bandipora, and Kulgam—representing diverse geographical and production systems. A total of 1350 samples were collected, including 900 from poultry (faecal swabs, cloacal swabs, and meat samples) and 450 from poultry handlers (faecal and hand swabs). All samples were screened for *Campylobacter* spp. by polymerase chain reaction (PCR) targeting genus- and species-specific genes. The results revealed an overall *Campylobacter* prevalence of 17.8% (161/900) in poultry and 8.2% (37/450) in poultry handlers. Among the poultry isolates, *Campylobacter jejuni* was the predominant species (12.8%), followed by *C. coli* (1.8%), while in poultry handlers, *C. jejuni* and *C. coli* accounted for 6.6% and 1.6% of isolates, respectively, as confirmed by PCR amplification of the *mapA* and *ceuE* genes. The district-wise analysis indicated that Srinagar recorded the highest prevalence (26.6% in poultry and 17.7% in handlers), followed by Ganderbal (24.4% and 11.1%) and Budgam (21.1% and 11.1%), while Kulgam exhibited the lowest prevalence (11.4% and 2.2%). Antimicrobial susceptibility testing against six commonly used antibiotics revealed that most *C. jejuni* (89.8%) and *C. coli* (95.5%) isolates were sensitive to gentamicin and erythromycin, indicating their continued efficacy. However, variable resistance patterns were noted against other antibiotics, emphasizing the emerging threat of antimicrobial resistance in *Campylobacter* spp. in the region. The study underscores the zoonotic potential of *Campylobacter* and highlights poultry and their handlers as important reservoirs for human exposure. These findings emphasize the need for regular monitoring, improved farm biosecurity, rational antibiotic use, and awareness among poultry workers to reduce the risk of transmission and safeguard public health.

Keywords: *Campylobacter,* Antimicrobial Resistance, Poultry Handlers.

PHP-04

Field evaluation of an integrated intervention protocol for reducing Campylobacter load and zoonotic risk in poultry production systems of Kashmir valley

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The present field study evaluated a comprehensive intervention protocol aimed at reducing *Campylobacter* load and associated zoonotic risk in commercial poultry production systems across the Kashmir Valley. Conducted under the ICMR-funded project "Novel Preemptive Measures to Prevent Next Possible Pandemic: Breaking the Transmission Chain of Multidrug-Resistant *Campylobacter* from Poultry to Humans," the investigation integrated pre-harvest, post-harvest, and handler-level interventions in a One Health framework. Following preliminary laboratory and controlled trials, the optimized feed additive combination—1.5% NPALF + 0.5% thymol + 3% formic acid + 3% medium-chain fatty acids (MCFAs) was implemented on 500 broiler farms and corresponding 500 poultry dressing shops across ten districts. Complementary carcass decontamination with 2.5% acetic acid and 12% trisodium phosphate (TSP) dips, coupled with extensive farmer and handler hygiene training, formed the integrated field protocol. Post-intervention monitoring revealed a 75.6% reduction in *Campylobacter* prevalence in poultry and a substantial decrease in human handler positivity (up to 80% in high-risk districts). Carcass dip treatments completely eliminated surface contamination in several districts. The intervention significantly improved flock health, feed efficiency, and biosecurity compliance while demonstrating scalability, economic feasibility, and strong farmer acceptance. This study validates a multi-hurdle, antibiotic-free approach to *Campylobacter* control in poultry, emphasizing the synergy of feed-based antimicrobials, post-slaughter sanitation, and hygiene reinforcement. The protocol presents a replicable model for AMR mitigation and zoonotic disease prevention in developing poultry sectors and underscores the value of integrated, field-adaptable One Health strategies for sustainable food safety management.

Keywords: Campylobacter, Integrated Intervention Protocol, Zoonotic Risk.

PHP-05

Investigating quails as potential reservoirs of *Mycoplasma* in mixed poultry environments: a molecular approach

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Avian *mycoplasmas* cause's considerable economical losses to the poultry industry, especially in chickens and turkeys in terms of high mortality, reduced meat and egg production and treatment cost all over the world.The economical *mycoplasmas* are *Mycoplasma gallisepticum* (MG)and *Mycoplasma synoviae(MS)*. Both *MG* and *MS* are transmitted laterally *via* direct contact with infected carrier birds and fomites and vertically through infected eggs. In mixed farm settings the quails can act as silent vectors of *Mycoplasma.* By keeping in view this study was aimed to detect the *mycoplasma* in quails by using molecular methods due to conventional methods are time consuming. 64 nasal swabs, 64 oral swabs, 64 cloacal swabs and 64 swabs from infraorbital sinuses were collected from 8 healthy quail farms were maintained in mixed poultry farms in Andhra Pradesh. The collected samples were pooled farm wise and specimen wise. Then the samples were inoculated in PPLO broth and incubated anaerobically at 370C In BOD incubator for 6 days. The color change from brown to yellow was noticed in 5 pooled samples. Then the 5 pooled samples were initially screened for genus *mycoplasma* by targeting 16SrRNA gene and observed positive reaction. Then the samples were tested individually by specimen wise in positive farms. Detected genus *mycoplasma* in 40nasal swabs, 40oral swabs, 20 cloacal swabs and 15 swabs from infra orbital sinuses. Then the positive samples were screened for species identification by targeting mgc2gene for *MG* and vlhA gene for *MS*. Observed all 5 genus *mycoplasma* positive quail farms were also positive for *MS*. Similarly poultry samples were also collected and screened for genus and species *mycoplasma* and noticed *MS* in same mixed poultry farms. For sequencing of 5 positive *MS* samples were sent to private labs. The sequences revealed 98% -99% similarity with other poultry and quail NCBI published sequences. This study concluded that even though the quails are healthy but they are reservoirs for *mycoplasma* infections especially *MS* one of the economic *mycoplasma* may cause production losses in mixed poultry due to quails may act as potential silent carriers. So continuous surveillance and molecular monitoring are very much essential for control and prevention. In this study also quails may act as a reservoir's for *mycoplasma*, highlighting the need for routine screening and control programs.

Keywords: Quails, mixed poultry, Genus mycoplasma, Mycoplasma synoviae, PCR.

PHP-06

Incidence and factors influencing ascites in Raja II coloured broiler

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Ascites syndrome in commercial broiler chickens is a complex condition characterized by fluid accumulation in the abdominal cavity, often resulting from pulmonary hypertension. Commercial broiler industry takes multi prong approach through genetic, environmental, and nutritional interventions. In the present study, ascetics conditions in Raja II colored broiler was analyzed. 1190 day old Raja II chicks from 16 sires were divided into two groups one A with 517 chicks and group B with 683 chicks. Group A and Group B chicks were reared under similar conditions except for the feed, where in group A was given crumble feed and group B with mash starter feed as per AICRP recommendations. The mortality percent in group A was 4.25%, overall incidence of ascetics as 3.09% and 72.74% of mortality was because of ascetics. However, the mortality percent in group B was 3.07%, overall incidence of ascetics as 0.3% and 9.5% of mortality was because of ascetics. Post mortem of the birds showed left ventricular cardiac hypertrophy and pulmonary congestion. Among 16 sire families, ascetics was observed in only five families and ranged from 5.8 % to 20% indicating genetic basis as well for ascetics. Thus, including genetic selection against ascetics as long term strategy and nutritional approach as immediate measure has to be adopted in Raja II colored broilers for reduction in incidence of Ascetics.

Keywords: RAJAII, Crumble feed, Genetics, Ascites, Incidence.

PHP-07

Effect of avian leukosis virus infection on growth and production performance of Vanashree, an improved strain of native chicken

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Avian leukosis is one of the important neoplastic viral diseases of poultry, which affects the economic traits negatively. A study was carried out to investigate the prevalence of avian leukosis virus (ALV) infection in male and female birds of *Vanashree*, an improved strain of native chicken (Aseel-Peela). The prevalence of ALV infection over 11 generations was studied by screening for ALV shedding through the detection of p27 antigen from cloacal swab samples using an ELISA test. The growth and production performance of hens were recorded over the generations. Hens tested negative and positive for ALV shedding were compared for growth and production traits using the data collected over the generations. A higher prevalence of ALV infection was observed in hens with an average of 19.91% as compared to the average of 1.65% infection in cocks. There was no significant effect of ALV infection on growth traits recorded at different ages up to 40 weeks of age. However, the ALV infection had a significant effect on egg production recorded up to 40 weeks of age. Egg production was significantly less (4.58 eggs) in ALV-positive hens when compared to ALV-negative hens. There was a 7.25% reduction in egg production in ALV-positive hens. However, there was no significant effect of ALV infection on age at first egg and egg weights recorded at different intervals. The study concluded that the sex of the birds plays an important role in the susceptibility to ALV infection in slow-growing chickens. Although ALV infection did not affect the growth, age at sexual maturity and egg weight traits, it reduced the egg production numbers in affected hens significantly.

Keywords: Avian Leukosis, native chicken, sex, production performance.

PHP-08

Occurrence of secondary bacterial infections in CIA affected commercial chicken

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Chicken Infectious Anemia (CIA) is a highly contagious, emerging, immunosuppressive disease caused by "Chicken Infectious Anemia Virus." In the present study, CIA was suspected in 21 cases in commercial chicken in coastal districts of Andhra Pradesh as they exhibited severe anemia, generalized weakness and depression. The DNA samples from thymus were used for amplification of VP1 gene of CIAV using specific primers and yielded the desired product of 1390 bp confirming CIA. On postmortem examination, fibrinopurulent serositis and severe septicemia was evident in 12 and 9 birds respectively. Fibrinopurulent serositis displayed as cloudy thick yellowish fibrinous layer on pericardium and perihepatitis whereas severe septicemia displayed as severe congestion and petechiae on epicardium, endocardium, peritoneum and serosal surfaces of intestines along with necrotic foci on liver. Sterile swabs collected from fibrinopurulent lesions yielded characteristic green metallic sheen colonies with dark centers on EMB agar confirming *E.coli*. Tissue imprints collected from liver and heart revealed presence of bipolar organisms in septicemia cases and the sterile heart swabs yielded non hemolytic colonies on blood agar suggestive of Pasteurellosis.

PHP-09

Efficacy of a sequential water disinfection protocol (potassium monopersulfate and sodium dichloroisocyanurate) on reducing *Escherichia coli*-associated mortality and improving productivity in commercial layer flocks

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An experiment was conducted in a commercial layer flock in Berhampur, Odisha to evaluate the efficacy of a sequential water disinfection protocol using potassium monopersulfate (PMPS) and sodium dichloroisocyanurate (NaDCC) in

reducing *Escherichia coli*-associated mortality and improving flock performance. The trial was carried out on a farm with 77,073 layers that had been experiencing high mortality due to colibacillosis. The intervention comprised two consecutive phases: a three-day shock sanitation of drinking water with potassium monopersulfate (ViraCid S, 1 g/5 L) to elevate the Oxidation-Reduction Potential (ORP) from 220 mV to 750 mV, followed by continuous water sanitation using sodium dichloroisocyanurate + PMPS tablets (DiSan, 1 tablet/1000 L) for one month, maintaining ORP at 650 mV. Daily mortality and water ORP were recorded throughout the study period. Post-intervention from day 4, daily mortality started decreasing significantly from 59 to 15 birds, representing a 74.6% reduction. The elevated and sustained ORP (650–750 mV) corresponded directly with improved flock survival, confirming effective suppression of *E. coli* transmission via the water system. The findings demonstrate that sequential application of potassium monopersulfate for shock sanitation followed by sodium dichloroisocyanurate for continuous maintenance is a highly effective strategy for mitigating coliform-associated mortality in layer flocks. Maintaining water ORP above 650 mV is critical for pathogen control, biosecurity, and optimal flock health.

Keywords: Oxidation-Reduction Potential, Water Sanitation, Colibacillosis, Layer Hens, Potassium Monopersulfate, Sodium Dichloroisocyanurate, Mortality Reduction.

PHP-10

Occurrence of *Echinostoma* infection in Muscovy and indigenous ducks reared under semi-intensive conditions

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A flock comprising 50 Muscovy ducks and 100 indigenous ducks of three months of age were reared separately under semi - intensive system at Theni district. The flock owner reported clinical signs of inappetence, dullness and diarrhoea among the birds. External examination revealed no evidence of ectoparasites. Faecal samples were collected randomly from both indigenous ducks and Muscovy ducks for screening of endoparasites. Faecal examination was done by sedimentation technique for detection of endoparasites. Two grams of the faecal sample was homogenized with 10 ml of water and was strained through a sieve. The filtrate was centrifuged at 2000 rpm for 2 mins. The supernatant was discarded. A drop of the sediment was transferred to a microscopic slide and a cover slip was placed over it and viewed under light microscope at 10x objective. Microscopic examination revealed the presence of *Echinostoma spp.* eggs in 20 per cent of indigenous ducks and 40 per cent of Muscovy ducks. Morphologically the eggs had a characteristic yellow colour and elliptical in shape with smooth, thin and transparent outer shell. The detection of *Echinostoma spp.* is of considerable significance for duck health management as these flukes cause severe enteritis, reduced feed efficiency, poor growth and increased mortality. The findings emphasize the need for comprehensive parasite control strategies in semi-intensive rearing systems. Implementation of proper biosecurity and management measures is recommended to prevent recurrence and spread of infection. These measures include proper ventilation, regular cleaning and disinfection of the enclosures, quarantine of newly introduced birds and treatment of the affected ducks and periodic deworming.

Keywords: Trematode, *Echinostoma spp.*, Muscovy duck, Indigenous duck.

PHP-11

Seroprevalence of avian metapneumovirus in commercial layer flocks in India

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In poultry, Avian Metapneumovirus (aMPV) is primarily a respiratory pathogen but is also associated with drops in egg production, poor shell quality, and secondary bacterial infections. In commercial layer farms, subclinical infections are common and often go unnoticed, yet they may contribute to production losses and poor flock performance. Serological surveillance serves as an effective tool to detect field exposure and understand the infection dynamics. The present study was undertaken to determine the seroprevalence of aMPV in non-vaccinated commercial layer flocks. A total of 671 serum samples collected from 44 commercial layer flocks across different regions were tested for aMPV antibodies using a commercial ELISA kit to assess exposure and circulation status. The overall seroprevalence was 77.65% (521/671),

indicating widespread circulation of aMPV in the field. Seropositivity was significantly higher in layers (95.85%) compared to pullets (52.98%), suggesting an increased exposure with advancing age. Regional prevalence varied, with 73.86% in the South, 80.95% in the North, and 97.86% in the East. These findings demonstrate that aMPV infection is prevalent in Indian commercial layer flocks, even in the absence of vaccination, and may be involved in respiratory and production-related disorders. The results highlight the importance of routine Sero monitoring, improved biosecurity, and the strategic implementation of vaccination programs to help prevent infection, reduce subclinical circulation, and minimize associated production losses.

Keywords: Avian Metapneumovirus, Seroprevalence, Commercial Layers.

PHP-12

Haematological and blood biochemical parameters of different breeds of chicken

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An experiment was conducted to study the haematology and blood biochemical parameters of four different breeds of chicken. Blood was collected from 6 birds each of Aseel, Kadaknath, Chabro of 12 weeks of age and White leghorn of 22 weeks of age. RBC concentration (M/mm^3) was apparently higher in Chabro compared to Kadaknath and significantly higher (P=0.003) as compared to other breeds of chicken. Mean corpuscular volume (fl) was significantly higher (P=0.005) in Kadaknath as compared to other breeds of chicken. Mean corpuscular haemoglobin concentration (g/dl) was apparently higher in Chabro as compared to White leghorn and significantly higher (P=0.025) as compared to other breeds of chicken. Haemoglobin concentration (g/dl) was significantly higher (P<0.05) in Chabro as compared to other breeds of chicken. Serum Total protein (g/dl), AST (IU/L), ALT(IU/L) and Total Cholesterol concentrations (mg/dl) were significantly higher (P<0.05) in White leghorn birds as compared to other breeds of chicken. Serum ALP concentration (IU/L) was significantly lower (P<0.001) in White leghorn as compared to other breeds of chicken. Thus, it may be inferred that RBC concentration, Mean corpuscular haemoglobin concentration and Haemoglobin concentration were higher in Chabro as compared to other breeds of chicken. Serum Total protein, ALT, AST and Total Cholesterol concentrations were higher and serum ALP concentration was lower in White leghorn as compared to other breeds of chicken.

Keywords: Haematological parameters, blood biochemical parameters, Aseel, Kadaknath, Chabro chicken.

PHP-13

Evaluation of haematological attributes and blood biochemical profiles in different species of poultry

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A study was carried out to determine the haematological attributes and biochemical parameters of different species of poultry birds. Fresh blood samples were collected from 10 birds each of Guinea fowl (Pearl, Lavender, and White), Japanese quail (CARI-Shweta, CARI-Ujjwal), Turkey (Black and Beltsville small white variety), and broiler (CARIBRO Vishal) of above 3 months of age. WBC (M/mm^3) count was apparently lower in Japanese quails as compared to Black turkeys and significantly lower (P<0.001) than other birds. Further, RBC (M/mm^3) count was significantly higher (P<0.001) in Japanese quails than other birds. Haemoglobin (g/dl) concentration was apparently higher in Japanese quails as compared to guinea fowls and significantly higher (P<0.001) than other birds. In addition, MCV(fl) was significantly higher (P<0.001) in guinea fowl compared to other birds, while MCHC (g/dl) was significantly higher (P<0.001) in broilers compared to other birds. Serum total protein concentration (g/dl) was apparently higher in Japanese quails compared to guinea fowls and significantly higher (P<0.001) than other birds. Further, serum AST concentration (IU/L) was apparently higher in Black turkeys than broilers and significantly higher (P=0.03) compared to other birds. Serum ALP concentration (IU/L) was apparently higher in Black turkeys as compared to Beltsville small white turkeys and significantly higher (P<0.001) than other birds. Serum ALT concentration (IU/L) was significantly higher (P<0.001) in broiler (CARI Vishal) compared to other birds. In addition, total cholesterol concentration (mg/

dl) was significantly higher (P<0.001) in Japanese quails (CARI Shweta) compared to other birds and HDL was significantly higher (P<0.001) in broilers (CARIBRO Vishal) compared to other birds. Hence, it may be concluded that all the haematological and biochemical parameters varied among different species of poultry and the variations reflected species-specific physiological adaptations among different species of poultry.

Keywords: Haematological parameters, Blood biochemical parameters, Guinea fowl, Japanese quail, Turkey, Broiler.

PHP-14

Pathomorphological and molecular characterization of Marek's disease in chicken

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Marek's Disease (MD), a highly contagious lymphoproliferative neoplastic disease caused by an oncogenic *alphaherpesvirus*, has re-emerged as a significant threat to the Indian poultry sector. The current investigation sought to assess the occurrence of Marek's Disease in poultry in ICAR- Directorate of Poultry Research during 2025, with emphasis on its pathomorphological and molecular characteristics. Clinical signs included dullness, paralysis of legs, wings, neck and subsequent unilateral paralysis of extremities resulting in typical posture of cross stretched legs. A total of 156 birds were presented for necropsy examination at ICAR–Directorate of Poultry Research (DPR), of which 87 (55.7%) were confirmed positive for Marek's Disease. Upon necropsy, gross lesions observed were hepatomegaly, spleenomegaly with variable sized greyish-white multiple nodular growths on liver, spleen, intestine, kidney, heart and lungs. Along with these, enlargement of sciatic nerve was observed in some birds. Histopathological examination revealed vacuolation of hepatocytes, necrosis of hepatocytes, cellular swelling, distortion of hepatic cords with infiltration of numerous heterophils along with diffuse infiltration of lymphocytes in sections of spleen. Histopathological examination of kidney sections revealed tubular casts and necrosis, vacuolation of tubules and infiltration of inflammatory cells. Cytology and histopathology of liver revealed numerous proliferating pleomorphic lymphoid cells with increased cellularity which is the characteristic feature of MD. Molecular confirmation was achieved through polymerase chain reaction (PCR) targeting *Meq, pp38, ICP4* and *vIL-8* genes.

Keywords: Poultry, Marek's Disease, neoplastic, paralysis, lymphocytes.

PHP-15

Comparative case study on ancillary control of intestinal coccidiosis using turmeric powder, papaya leaf extract, and garlic essential oil extract alongside antibiotics in Kamrupa variety of chicken

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The present study was undertaken to evaluate the efficacy of turmeric powder, papaya leaf extract, and garlic essential oil extract as ancillary therapeutic agents alongside conventional anticoccidial and antibiotic therapy in the management of intestinal coccidiosis in Kamrupa chickens. A total of 90 Kamrupa chickens aged 50 days exhibited bloody diarrhea, inappetence, and weight loss for five days. Post-mortem examination revealed severe intestinal hemorrhages, while fecal flotation showed oocyst shedding of 60,000–70,000 oocysts per gram, confirming *Eimeria necatrix* infection. The flock was randomly divided into three groups (n=30).

Group T_0: Amprolium (2 g/L) + Tetracycline (1 g/L) for 5 days.

Group T_1: Sulphaquinoxaline (1 g/L) + Enrofloxacin (50 mg/L) for 5 days.

Group T_2: Sulphaquinoxaline (1 g/L) + turmeric powder (0.5 g/kg feed) + papaya leaf extract (0.5% in drinking water) + garlic essential oil (0.06 mL/L) for 7 days.

Oocyst counts and mortality were recorded post-treatment. Group T_0 showed oocyst counts of 54,000–60,000/g, while

Group T_1 showed 40,000–50,000/g after treatment. In contrast, Group T_2 demonstrated a marked reduction to 10,000–17,000/g with zero mortality, compared to 13.33% in both T_0 and T_1 groups. The combined use of turmeric powder, papaya leaf extract, and garlic essential oil extract alongside Sulphaquinoxaline significantly reduced oocyst shedding and eliminated mortality in Kamrupa chickens. This combination shows promise as an effective ancillary approach for the control of intestinal coccidiosis and associated secondary infections in poultry.

Keywords: Kamrupa chicken, Coccidiosis, Turmeric powder, Papaya leaf extract, Garlic essential oil.

PHP-16

Clinicopathological characterization of a suspected velogenic Newcastle disease outbreak in desi chickens in Kadapa, India

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Newcastle disease (ND) continues to threaten backyard poultry production in India, particularly in free-range rearing systems with inadequate vaccination. This report documents a suspected velogenic ND outbreak in desi chickens from Kadapa district, Andhra Pradesh, characterized by sudden onset, rapid spread, and high mortality across multiple age groups. Affected birds exhibited severe respiratory distress, greenish diarrhoea, and neurological signs such as torticollis and paresis. Gross lesions included hemorrhagic tracheitis with caseous exudate, hemorrhagic proventriculitis, enlarged cecal tonsils, and intestinal button-like ulcers. Histopathology revealed epithelial necrosis in respiratory and intestinal tissues, vascular degeneration, and marked lymphoid depletion in primary immune organs. The clinicopathological findings are consistent with a viscerotropic velogenic ND presentation in indigenous poultry. The outbreak underscores the ongoing vulnerability of backyard flocks and highlights the importance of routine ND vaccination and improved biosecurity in rural production systems.

Keywords: Newcastle disease virus (NDV), Velogenic NDV, Desi chicken.

PHP-17

A multi-etiological respiratory outbreak in layer chickens involving Coryza, ILT, and Colibacillosis

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A mixed infection involving Infectious Coryza, Infectious Laryngotracheitis (ILT), and Colibacillosis was observed in a commercial layer chicken, resulting in a severe and complex respiratory disease condition. The clinical signs include facial swelling, nasal discharge, coughing, conjunctivitis, reduced feed intake, and a significant decline in egg production before death.In the affected layer bird, postmortem examination revealed lesions consistent with a mixed infection of Infectious Coryza, Infectious Laryngotracheitis (ILT), and Colibacillosis. The upper respiratory tract showed pronounced swelling of the infraorbital sinuses containing thick mucoid to caseous exudate, along with catarrhal inflammation of the nasal passages, characteristic of Infectious Coryza. ILT-associated changes included severe haemorrhagic and necrotic tracheitis, with blood-tinged mucus, fibrinous plugs, and diphtheritic membranes partially occluding the airway. Lesions attributable to Colibacillosis were evident as fibrinous air sacculitis, pericarditis, and perihepatitis, with extensive yellow fibrin deposits over the air sacs, heart, and liver. The combined infection produced marked respiratory tract damage, exacerbated fibrinous inflammation, and evidence of systemic involvement, reflecting the synergistic effect of viral and bacterial pathogens in worsening disease severity.Diagnosis relied on characteristic lesions at necropsy, bacteriological culture and histopathology.

Keywords: Infectious Coryza, Infectious Laryngotracheitis (ILT), Colibacillosis, Layer.

PHP-18

Influence of neem leaf powder supplementation on cellular and humoral immunity in guinea fowl

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A study was conducted to evaluate the immunomodulatory effects of *Neem* (*Azadirachta indica*) leaf powder (NLP) on both cellular and humoral immune responses in guinea fowl. A total of 120 keets were randomly assigned to four dietary treatments (T0, T1, T2, and T3), receiving 0, 1, 2, and 3 g NLP/kg of basal diet, respectively. Cellular immune responsiveness, assessed by cutaneous basophil hypersensitivity, showed increased skin thickness at 48 and 72 hours post-challenge in NLP-supplemented groups. Mean skin thickness in T1, T2, and T3 was 2.90, 3.20, and 3.05 mm at 0 hours; 3.20, 3.44, and 3.43 mm at 48 hours; and 3.05, 3.36, and 3.30 mm at 72 hours, respectively, compared with 2.86, 2.94, and 2.86 mm in the control group (T0). Humoral immunity, measured through serum immunoglobulin concentrations, was slightly elevated in NLP-treated birds, with values of 3.31, 3.41, and 3.37 mg/dl in T1, T2, and T3, compared to 3.28 mg/dl in T0. The findings suggest that dietary supplementation with 3 g NLP/kg enhances immune competence in guinea fowl and may serve as a natural immunomodulator in poultry nutrition.

Keywords: *Azadirachta indica*, Guinea fowl, immunomodulation, immunoglobulins, *Neem,* poultry immunity.

PHP-19

Antimicrobial resistance in the poultry industry: A comprehensive analysis of origins, impacts, and integrated mitigation strategies for a sustainable future

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While the global poultry industry is an important component of food security, it is also a major epicenter in the emerging antimicrobial resistance (AMR) epidemic, which is expected to kill 10 million people per year by 2050. This resistance stems from the historical and ongoing overuse and misuse of antimicrobials in poultry production, where their use has expanded beyond treating sick birds to include routine disease prevention and, in many regions, sub-therapeutic dosing for growth promotion, creating a persistent selective pressure that favors the evolution of resistant bacteria. The consequences of this AMR genesis are severe and multifaceted, leading directly to treatment failures in humans infected with resistant foodborne pathogens like *Salmonella* and *Campylobacter*, compromising the efficacy of critically important last-resort antibiotics such as colistin, and imposing substantial economic burdens through increased healthcare costs and production losses. Mitigating this complicated issue necessitates a comprehensive "One Health" approach that combines stringent regulatory interventions with basic improvements in farm-level biosecurity, animal welfare, and stocking density. A crucial objective is to develop and deploy effective alternatives to antibiotics, which includes the use of probiotics, prebiotics, phytogenics, and enhanced vaccination regimens. Among the most promising alternatives are biopolymers such as chitosan, which serve as dual-purpose tools by first modulating gut health through direct, non-resistance-promoting antimicrobial action and prebiotic effects within the bird, and then as edible, active coatings on the meat itself to reduce microbial load and break the transmission chain of resistant bacteria to humans. Therefore, confronting AMR in the poultry sector requires a decisive paradigm shift away from prophylactic antibiotic reliance and towards the adoption of these sustainable, multi-faceted strategies, a transition that is imperative not only for the industry's viability but for safeguarding the efficacy of modern medicine and ensuring global public health for future generations.

Keywords: Antimicrobial resistance, One health, Mitigation.

PHP-20

Genetic resistance to poultry diseases: A comprehensive overview

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Genetic resistance to poultry diseases is a sustainable technique that takes advantage of birds' innate immunity via heritable, polygenic characteristics. Major Histocompatibility Complex (MHC) genes, such as B21, are important for

Marek's disease resistance; Toll-Like Receptors (TLRs) regulate innate immunity; and receptor mutations. Furthermore, heritable gut microbiome patterns protect against infections such as Salmonella. This genetic method decreases pharmaceutical use while improving flock health. The MHC-B21 haplotype and NRAMP1 gene prevent Marek's disease; tvb receptor mutations prevent Avian Leukosis Virus infection; Salmonella resistance is regulated by the SAL1 locus and other QTLs; Coccidiosis is prevented by genes for gut integrity and interferon responses; and susceptibility to Infectious Bursal Disease is influenced by the TNK2 gene. Commercial poultry breeds have excellent production metrics, but because of intense selection for growth and productivity, their genetic diversity has been reduced, making them more susceptible to disease. Indigenous breeds, on the other hand, have a wide genetic diversity that provides strong disease resistance despite their reduced productivity. These breeds were created by natural selection in difficult conditions. In order to attain both productivity and sustainability, modern breeding efforts introgress key resistance genes from indigenous breeds into commercial lines, highlighting the crucial trade-off between maximal production and innate resilience. Modern biotechnology is revolutionizing the application of this knowledge. By using genome-wide association studies (GWAS) to find thousands of single nucleotide polymorphisms (SNPs), genomic selection enables breeders to anticipate an animal's breeding value for disease resistance with previously unheard-of accuracy, allowing selection well before any disease exposure. More specifically, it is possible to quickly bestow resistance without cross-breeding by directly introducing particular protective alleles, like the ALV-resistant tvb gene, into commercial germlines using gene-editing technologies like CRISPR-Cas9. Additionally, efforts are being made to introduce their valuable resistance genes into high-producing commercial lines through marker-assisted selection, demonstrating the need of conserving and characterizing the genetics of indigenous chicken. In conclusion, the strategic integration of genetic resistance into poultry breeding programs, by synergizing the resilience of indigenous breeds with the productivity of commercial stocks through advanced genomic tools, is indispensable for constructing a more robust, ethical, and sustainable global poultry industry, ultimately reducing dependence on antimicrobials and enhancing food security.

Key words: Genetic resistance; Poultry disease; Health; production.

PHP-21

Post-mortem examination and histo-pathological changes in commercial layer affected by chicken anemia virus

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Chicken Infectious Anemia (CIA) is an economically important avian viral disease and causes severe economic loss due to vaccination failure and makes the birds more susceptible to secondary infections. Heavy mortality is being recorded while CIA occurs concurrently with other bacterial and viral diseases. Chicken Anemia Virus (CAV) is a major immunosuppressive pathogen in poultry. The present study is carried out to investigate the incidence, pathology and disease pattern of Chicken Anaemia Virus (CAV) and its concurrent infections. A total of 114 layer farms aged 6 to 17 weeks with the history of suggestive of CAV and concurrent infections were investigated. Out of 114 farms, 21 were found to be positive for CAV by molecular detection, out of which 6 had concurrent infections of viral and bacterial diseases. Among them, MG (*Mycoplasma gallisepticum*) and MS (*Mycoplasma synoviae)* was found to be positive in 3 farms. Two farms were found to be positive for Escherichia Coli and one farm was found to be affected with Gangernous dermatitis in which CAV with combination of bacterial agents, viz., *Staphylococcus aureus* and *Escherichia Coli*. was noted. CAV with other bacterial infectious caused more significant histo-pathological changes as compared to CAV affected birds. The organs showed macroscopic lesions of vascular changes like congestion, necrotic skin lesions, often on the wings and lesions on the bottom of the feet. Bacterial clusters were observed in the organs of CAV affected birds and gangrenous dermatitis indicating septicemia due to immunosuppression by CAV, which leads to opportunistic clostridial and staphylococcal infections which causes gangrenous dermatitis. The E.Coli often acts as an opportunistic pathogen that exacerbates the severity of the lesions.

Keywords: Chicken infectious anaemia, layer, immunosuppression, bacterial infection.

PHP-22

Predictive analysis of post-mortem conditions associated with environment variables in chicken using machine learning algorithms

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Poultry population has enormously increased over the decades and huge costs are invested by the poultry industry for the diagnosis of various diseases. Farmers can reduce labour costs and can streamline farming operations, farm biosecurity, antimicrobial usage by utilising the automated frameworks of IoT, Machine learning and Artificial Intelligence (AI). Applications of AI in poultry farming include health monitoring and disease prevention, environmental control, feed management, behavioural analysis, automated systems, predictive analytics and quality control. In predictive analytics, AI and ML models can predict future trends and needs based on the historical data which can help farmers to make informed decisions on management, production and market demands. In the present paper, the environmental data was utilised to visualise the feature importance of environmental variables over the post-mortem conditions recorded at ICAR-DPR using ML algorithms. Created database of chicken farm especially from existing post-mortem (PM) reports for the years 2018-2019, 2019-2020. Data on environmental variables of temperature, rainfall, humidity and wind speed were collected for the respective years mentioned above. The above data was considered for model building using ML algorithms. Univariate, bivariate and multivariate analysis of data were done before developing models using python language. Two different models of Random forest classifier, a ML-based algorithm and a basic Artificial Intelligence(AI) algorithm based model of Neural Networks were built with PM diagnosis as the target variable. Comparison of these two models showed that Random Forest Classifier has better accuracy in predicting PM diagnostic conditions. The interpretation of results based on these models showed that the environment variables of temperature followed by relative humidity are having greater feature importance in predicting the PM diagnosis.

Keywords: Machine learning, Post-mortem, environment variables.

PHP-23

Control of mycoplasma infection in multi age breeding farms

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Mycoplasma is an important disease of economic significance. In affects both respiratory and reproductive systems. This can cause respiratory issues and lower the number of eggs in layers /breeders. Because it is transmitted through eggs, it can badly affect the hatchability /chicks' quality. Egg transmission is important for vaccine manufacturers since infection could contaminate live vaccines and be widely administered to poultry. By damaging uterus it can affect the shell quality. Shape less eggs is a common feature of mycoplasma. Mycoplasma means organisms with soft skin. They have a thin membrane but no cell wall. They are fragile in the environment. They are easily killed by disinfectants and do not survive for prolonged period outside the host. It is a flask shaped organism possessing a specialised tip by which it attaches to respiratory epithelium. Spread within flock occurs through coughing and sneezing. They are responsible not only for clinical disease but for poor weight gain, reduced feed conversion efficiency, reduced hatchability etc. They can act as both primary and secondary pathogens. They cause greater damage when acting together with other pathogens. There are 23 avian mycoplasma but only MG, MS, MM and MI are associated with significant losses in poultry.MG cause CRD in chickens. It tends to run a long course and morbidity may be high but without complicating factors mortality is low. The organism is more difficult to control in multi age farms. Infection during lay can cause egg production losses of 10 to 20% in layers/breeders for a period of 1 month. Over the years tiamulin has been a drug of choice for MG control, But off late, it's efficacy has come down. Fortunately new antibiotics like azithromycin, tylvalsoin are available and are showing promising results. A combination of live or killed vaccines along with antibiotics are producing better results than vaccines or antibiotics alone.

PHP-24

Development of a blockchain-enabled digital application for broiler disease tracking and supply chain transparency

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This project presents a blockchain-powered Digital Application (DApp) designed to enhance disease tracking, traceability and data security in the broiler production chain. Built using the Solana blockchain, Rust smart contracts and a role-based front-end, the system ensures transparent, tamper-proof and real-time data flow across farmers, distributors, sellers and health officers. Core functionalities include batch creation by farmers, QR-based verification, batch transfer through distribution stages, and disease-chain marking using health-officer authorization. The Solana smart contract manages decentralized records for farms, distributors, sellers and health officers, and securely stores batch IDs, timestamps, transfer details and infection status. The DApp incorporates QR scanners, digital dashboards, auto-updating inventory panels and an interactive map to display affected farm locations. Phantom Wallet integration ensures decentralized login and secure transaction signing. Testing confirmed stable program deployment, accurate instruction processing and seamless front-end interaction using Solana Program ID. The system enhances traceability, prevents data tampering, improves outbreak response time and provides stakeholders with transparent supply chain insights. It also reduces paperwork, supports quick recall of infected batches and builds consumer trust through verifiable product history. The study demonstrates the practical application of blockchain in poultry biosecurity and establishes a scalable foundation for future integration of AI-based disease prediction, IoT sensors and smart-contract–driven insurance support.

PHP-25

Molecular detection and phylogenetic characterization of fowl adenovirus in indian poultry: A three-year surveillance (2023–2025)

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The present study reports a comprehensive three-year (2023–2025) surveillance of Fowl Adenovirus (FAdV) infections in commercial poultry across major production zones in India. Diagnostic samples submitted to Poultry Diagnostic & Research Centre (CB/CL) were analyzed using polymerase chain reaction (PCR) for adenoviral genome detection and subsequent molecular characterization. A total of 7,082 samples were screened during the study period. The overall PCR positivity for adenovirus was 9.0% in 2023, 10.7% in 2024, and 6.62% in 2025, with the Western and Southern zones consistently showing higher incidence rates. In 2025, 152 positive samples exhibited hepatic and hydropericardium-associated lesions, confirming the pathogenic role of FAdV in on-going field outbreaks. Phylogenetic analysis of representative isolates from 2025 revealed the circulation of FAdV serotypes 8b and 11, predominantly clustering with previously reported Indian field strains. Isolates from the Western and Eastern zones grouped under FAdV-8b, while isolates from the Western zone clustered with FAdV-11. The presence of multiple serotypes across regions suggests continuous viral evolution, possible recombination events, and inter-regional transmission. This multi-year surveillance highlights the endemic nature and genetic diversity of FAdV in Indian poultry. Continuous molecular monitoring, regional data integration, and inclusion of locally circulating serotypes in vaccine formulations are crucial for effective disease control and prevention of production losses

Keywords: Fowl Adenovirus, PCR, Hydropericardium Syndrome, Surveillance.

PHP-26

Molecular detection, isolation, and phylogenetic characterization of infectious bronchitis virus (IBV) from commercial chicken farms in India (2024–2025)

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The present study aimed to isolate, molecularly identify, and characterize circulating genotypes of Infectious Bronchitis Virus (IBV) from commercial chicken farms across India during 2024-2025 to understand the current epidemiological pattern and support vaccine development. A total of 8,562 tissue samples were collected from commercial chicken flocks exhibiting respiratory symptoms, kidney lesions and drop in egg production between January 2024 and October 2025. Tissue samples or swabs were pooled and processed into 10% tissue homogenates for viral RNA extraction. Real-time PCR targeting the 5′-untranslated region (5'UTR) gene was used for screening. Representative positive samples with Ct values <30 were inoculated into SPF embryonated chicken eggs via the allantoic route and passaged 7–8 times. Samples showing characteristic embryo lesions were confirmed by PCR targeting S1 gene and subjected to sequencing and phylogenetic analysis. Out of 8,562 samples tested, 567 (6.6%) were IBV-positive. Infected embryos showed congestion, hemorrhage, curling, and stunted growth. Sequence analysis revealed that most isolates clustered with Mass (Genotype I Lineage 1) and 4/91(Genotype I Lineage 13), along with a few nephropathogenic (Genotype I Lineage 24) and QX-like (Genotype I Lineage 19) variants, indicating genetic diversity and co-circulation of multiple lineages in Indian poultry. Predominant field IBV belongs to Genotype I Lineage 24. The study demonstrates ongoing IBV circulation and genetic variation in Indian poultry flocks despite vaccination. Continuous molecular monitoring and genotype-specific vaccine updates are essential for effective IBV control and prevention of emerging variant outbreaks.

Keywords: IBV, virus isolation, Real-time PCR, phylogeny.

PHP-27

Metabolic diseases in poultry: Emerging threats of fatty liver hemorrhagic syndrome and visceral gout

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Metabolic disorders are increasingly recognized as emerging challenges in modern poultry production due to intensive genetic selection, high-energy feeding, and environmental stressors. Among these, Fatty Liver Hemorrhagic Syndrome (FLHS) and Visceral Gout have gained significance for their impact on productivity, welfare, and mortality in commercial flocks. The present study aimed to document gross and histopathological changes associated with FLHS and gout in poultry. Liver samples exhibiting enlarged, friable, and yellowish discoloration with multifocal hemorrhages were suggestive of FLHS. Microscopically, hepatocytes showed vacuolar degeneration, lipid infiltration, and hepatic sinusoidal congestion, confirming fatty liver pathology. In cases of visceral gout, characteristic chalky white urate deposits were observed over the pericardium, liver capsule, and air sacs. Histologically, the lesions revealed deposition of urate crystals surrounded by necrosis, heterophilic infiltration, and granulomatous reaction. Special staining techniques further highlighted urate tophi and associated inflammatory response. These findings emphasize the increasing prevalence of metabolic disorders as non-infectious yet economically significant diseases that can mimic infectious conditions in field diagnosis. The study underscores the need for balanced nutrition, adequate water management, and early metabolic monitoring to prevent such conditions. Considering their rising incidence under intensive production systems, FLHS and gout represent re-emerging metabolic threats with profound implications for flock health and sustainability in the poultry industry.

PHP-28

Pathological and bacteriological investigation of *Escherichia coli* infection in poultry with special reference to antimicrobial resistance

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Escherichia coli infection (colibacillosis) continues to be one of the most prevalent bacterial diseases affecting poultry, leading to significant economic losses due to mortality, reduced productivity, and carcass condemnation. The present study aimed to isolate and identify *E. coli* from poultry exhibiting clinical signs of septicemia and reproductive tract infections and to correlate bacteriological findings with gross and histopathological lesions. Postmortem examination revealed characteristic lesions including hepatomegaly with multiple necrotic foci, pericarditis, airsacculitis and enteritis. The oviducts of affected layers showed congestion, thickening, and accumulation of caseous exudate suggestive of *E. coli* infection. Histopathological examination of liver sections demonstrated multifocal necrosis, infiltration of heterophils and lymphocytes, and sinusoidal congestion. Cardiac tissues exhibited fibrinous pericarditis with infiltration of mononuclear cells, while intestinal sections revealed mucosal erosion, villous atrophy, and inflammatory cell infiltration in the lamina propria. The oviduct showed desquamation of epithelial lining and infiltration of inflammatory cells within the submucosa. Bacteriological culture of liver, intestine, and oviduct samples on Eosin Methylene Blue (EMB) and MacConkey agar yielded typical colonies—metallic green sheen on EMB and pink lactose-fermenting colonies on MacConkey agar. Biochemical characterization confirmed the isolates as *Escherichia coli*. Antimicrobial sensitivity testing revealed high resistance to various antibiotics. The study highlights the pathological and bacteriological features of avian colibacillosis and the emerging problem of antimicrobial resistance. Correlation of gross, histopathological, and bacteriological findings aids in accurate diagnosis and understanding of the disease process. The results emphasize the need for prudent antibiotic usage and effective biosecurity measures to mitigate *E. coli* infections and reduce the risk of zoonotic transmission.

PHP-29

Isolation of *Salmonella* species from poultry with pathological correlation: A re-emerging threat to flock health and food safety

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Salmonella infection remains one of the most important bacterial diseases of poultry, causing major economic losses and posing a zoonotic threat to public health. The present study aimed to isolate and identify *Salmonella* species from poultry showing clinical signs of enteric disease and to correlate bacteriological findings with gross and histopathological lesions, along with evaluation of antimicrobial resistance patterns. Postmortem examination of affected birds revealed typical gross lesions including hepatomegaly with congestion and multifocal necrotic foci, catarrhal to hemorrhagic enteritis, and pulmonary congestion. Histopathological examination of liver sections showed multifocal hepatocellular necrosis with infiltration of heterophils and mononuclear cells. Lung sections revealed congestion, edema, and mild pneumonitis, while intestinal tissues exhibited mucosal desquamation, lymphoid depletion, and infiltration of inflammatory cells in the lamina propria. Samples from liver and intestinal tissues were cultured on Xylose Lysine Deoxycholate (XLD) agar, yielding characteristic black-centered colonies typical of *Salmonella* spp. Antimicrobial susceptibility testing by the Kirby–Bauer disc diffusion method revealed variable resistance patterns. The findings highlight the persistence and re-emergence of *Salmonella* infections in poultry and the increasing concern of antimicrobial resistance. Correlation of bacteriological findings with gross and microscopic lesions provides better understanding of the disease process. The study emphasizes the need for continuous surveillance, rational antibiotic use, and improved biosecurity practices to safeguard flock health and prevent foodborne transmission of resistant *Salmonella* strains to humans.

Poultry Products Technology: Oral Presentations

PPTO-01

Lateral flow immunoassay integrated image software for quantification of poultry (chicken) meat

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Meat adulteration involves the practice of tampering with meat products, either by adding non-meat substances, using lower quality meat, or mislabelling meat to deceive consumers about its origin, quality, or type. Meat adulteration can be a significant issue in both raw and cooked chicken. Fraudulent adulteration or counterfeiting of poultry meat poses critical food safety and hygiene risks among consumers and therefore, its authentication is a priority. The present work deals with raising polyclonal antibody against chicken immunoglobulin (IgY) and construction of a lateral flow immunoassay (LFIA) tool for point-of-care detection of undeclared poultry meat. The technique relies on a sandwich-format LFIA utilizing chicken immunoglobulins as biomarkers to identify poultry meat. By raising antibodies that are unique to IgY as a target meat protein, the current assay was constructed to identify poultry meat under both raw and processed conditions. Anti-chicken-Ab as a primary antibody was printed on a nitrocellulose membrane for the test line, whereas Anti-Rabbit-IgG was the secondary antibody for the control line. Gold nanoparticles (AuNPs) were prepared from Gold (III) chloride trihydrate and conjugated with 10 µg Ab. Total proteins extracted from chicken revealed the presence of an intense red colour test line. Furthermore, the developed LFIA was integrated with an image analysis software platform for quantitative interpretation of test results. The software captures and analyses the intensity of the test and control lines, enabling semi-quantitative estimation of chicken protein concentration in meat samples. This integration enhances assay accuracy, minimizes subjectivity in visual interpretation, and facilitates digital documentation. The developed assay is highly sensitive, specific, and suitable for in-situ detection. The method, coupled with image-based quantification, can be effectively employed by food safety and regulatory agencies for rapid point-of-care screening of poultry meat.

Keywords: Adulteration, Gold nanoparticles, Chicken Immunoglobulin (IgY), Lateral flow immunoassay, Point-of-care, Quantification.

PPTO-02

Studies on the development of chicken meat sausage extended with finger millet

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The present study was undertaken to develop finger millet–incorporated chicken meat sausages and to explore the effect of finger millet flour on their shelf life. Chicken meat sausages were prepared using finger millet flour at three levels (T1–6%, T2–10%, and T3–14%). Among the variants, T2 was rated significantly ($P<0.05$) highest for appearance, colour, flavour and overall palatability and was selected for further physicochemical, proximate and storage studies. The pH increased non-significantly with increasing finger millet incorporation, while cooking yield showed a significant increase. Moisture and fat contents were significantly lower in finger millet–incorporated sausages compared to the control, whereas protein and fibre contents were significantly higher. Total ash content showed a non-significant increase in the treated sausages. During refrigerated storage (4±1°C) for 28 days, thiobarbituric acid (TBA) and total plate count (TPC) values increased significantly ($P<0.05$) in both control and treated samples but remained within acceptable limits. Sensory evaluation during storage revealed a gradual decline in all scores, although the 10% finger millet variant consistently received higher ratings for flavour, texture and overall acceptability. It was concluded that functional chicken sausages could be successfully developed by replacing chicken meat in standardized formulation at the level of 10% finger millet flour and the developed product was acceptable up to 28 days under refrigerated storage based on physicochemical, microbiological and sensory quality characteristics.

Keywords: Chicken meat sausage, Finger millet flour, Sensory attributes, Proximate composition, Storage stability.

PPTO-03

In-house method validation for trace analysis of five nitrofuran metabolites in broiler chicken using LC-MS/MS

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A sensitive in-house LC-MS/MS method was validated in accordance to Commission Decision 2021/808/EC for confirmatory analysis of 5 nitrofuran metabolites viz.AOZ, AMOZ, AHD, SEM and DNSAH in chicken meat samples. The extraction is based on 2-NBA derivatization by 16 hours incubation at 37°C followed by extraction using Ethylacetate. This single-step procedure produces sufficiently clean extract in order to control matrix-related signal suppression in the electrospray interface with acceptable recoveries. Nitrofuran marker residues in the extracts were separated on a reversed phase acquity BEH C18 column (100mm×2.1 mm, 1.7µm) in gradient elution mode with a mobile phase consisting of 5 mM Ammonium formate in water (0.1% Formic acid) and methanol. Using electrospray LC–MS/MS with multiple reaction monitoring (MRM), identification and quantification of the metabolites were performed based upon the intensities of mass fragments from the respective precursor ions: AMOZ 335.004>291,262.081; AOZ 236.068>133.91,103.9; SEM 209.068>166,191.9; AHD 249.068>133.97,103 and DNSAH 373.96>182.27,226.03 respectively. The linearity presented good fit (regression coefficient ≥ 0.99) over the quantitation range of 0.1-5 ppb with the lower limit of quantitation (LLOQ) being 0.1 µg/kg. LOQ is lower than the Reference points for action (RPA) set by the EU for nitrofuran marker residues (0.5µg/kg). This validated LC-MS/MS method will ensure trace level quantification and confirmation of 5 nitrofuran metabolites in chicken meat.

Keywords: Antimicrobials, Nitrofuran metabolites, LC-MS/MS, Chicken meat.

PPTO-04

Nanoliposomal encapsulation of chicken collagen hydrolysates for sustainable and active chicken gelatin-alginate packaging films

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This study focused on creating a sustainable active packaging film by loading bioactive collagen peptides into nanoliposomes and incorporating them within a chicken gelatin–sodium alginate matrix derived from chicken processing by-products. Collagen hydrolysates (<10 kDa) obtained from chicken skin, head, and feet, showing bioactivities, were encapsulated into nanoliposomes (z-average: 63.96 nm; PDI: 0.23; zeta potential: −7.6 mV; encapsulation efficiency: 63.47%) using a thin-film hydration technique. The resulting composite films exhibited enhanced mechanical strength, including higher elongation at break (25.32%) and tensile strength (12.07 MPa), along with significantly ($P < 0.05$) improved barrier properties, reducing water vapor permeability by 27.75% (from 10.91 to 7.88 g·mm/m²·day·kPa) and oxygen permeability by 20.8% (from 5.43 to 4.30 cm³·mm/m²·day·kPa). When applied to cooked chicken patties stored at 4 ± 1 °C for 15 days, the nanoliposome-infused films effectively maintained product quality, evidenced by stable redness (*a**), lower lipid oxidation (TBA), and reduced microbial load (TPC). Overall, these results highlighted that nanoliposome-enhanced biopolymer films derived from poultry waste function as efficient sustainable active packaging systems and represent an environmentally friendly replacement for synthetic plastics in extending the shelf life of meat products.

PPTO-05

Bacteriophages as effective alternatives to antibiotics and food safety agents in poultry meat preservation

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Non-typhoidal Salmonella is one of the important foodborne pathogens that causes food poisoning worldwide. Poultry meat acts as important vehicle in transmission of the bacteria. Bacteriophages against nontyphoidal *Salmonella enterica* can be used as alternatives to antibiotics in poultry production, as disinfectant of farm premises and as biopreservatives of poultry meat. The bacteria used in the study belonged to Typhimurium (n=1) and Enteritidis (n=2) serotypes. They were resistant important antibiotics classes like fluoroquinolones, cephalosporins and the latest carbapenems. Three bacteriophages were isolated and transmission electron microscopy revealed Siphoviridae like morphology. Genomic sequencing revealed that the phages belong to Jerseyvirus (42kb), Seunavirus (144kb) and Felixounavirus (87 kb) genus. The three phages do not harbour any host genes, virulence or toxin, AMR and prophage genes. Time-kill assay of the three phages at MoI =1, revealed that the one-fold log10 reduction was observed at 6-hr incubation at 37 ℃. Efficiency of plating of the three phages revealed 0.85, 0.78 and 0.76, respectively, which is high, therefore the phages can infect broad host range. Experimental studies involving artificial spiking of chicken meat with Salmonella Typhimurium NCTC strain revealed that there was significant reduction ($p=0.018$), ($p<0.0001$) in Salmonella count in the phage cocktail treatment group on day 2 and day 4, respectively, compared to control. Thus, bacteriophages act as promising bio preservatives against non-typhoidal Salmonellosis in meat.

Poultry Products Technology: Poster Presentations

PPTP-01

Influence of increasing slaughter age on meat quality and welfare parameters in broiler chickens

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An experiment was conducted to determine the influence of increasing broiler's slaughter age on meat quality and welfare. "Ross 308" chicks (n=175) were weighed and randomly distributed among five groups consisting of 35 chicks in each. The experimental birds were fed on commercial maize soya-based basal diet (Crumble). The broiler chicks were reared for up to 49 days and slaughtered at a different age of 35, 42, and 49 slaughter day. The results revealed that cooking yield in chicken meat reflected an increasing trend with increase in broiler slaughter age. The meat pH after 15 min and 24 hours showed decreasing trends. The shear force, values were significantly increasing from 35th to 49th day. L* a* and b* values of sample were significantly increased with increasing slaughter age. The highest water holding capacity was recorded at age of 49th day. 35 days onward welfare parameters viz., gait score, breast cleanliness, foot pad score and hock burn score showed significantly increasing trend. The feather score was best at 35th day. Based on the results, the ross broiler birds reared up to 35 days resulted in better meat quality and welfare parameters.

Keywords: Broiler, Meat quality, Ross 308, Slaughter age, Welfare.

PPTP-02

Carcass, meat quality and sensory attributes of commercial broiler, Rajasri and non-descriptive chickens

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A study was conducted to compare the carcass characteristics, meat quality parameters, and sensory attributes of three backyard chicken varieties- Commercial Broiler (CB), Rajasri (RS), and Non-Descriptive Chicken (NDC) within a slaughter weight range of 1.6-2.0 kg. The birds were off-fed, and six birds from each variety are slaughtered using a modified kosher method to evaluate the carcass and meat quality parameters. The results revealed a significant difference ($p< 0.05$) in the carcass and dressing percentage (DP) of meat among the varieties. The DP ($p<0.05$) recorded for CB, RS and NDC was 79%, 64% and 67%, respectively. However, there was no significant difference ($p>0.05$) among the varieties in the breast, thigh and giblet yields. Meat quality analysis revealed that CB meat exhibited significantly higher ($p<0.05$) pH and water holding capacity, whereas NDC meat showed higher ($p<0.05$) extract release volume (ERV) and a moderate ($p<0.05$) cholesterol concentration (63.484 mg/dL) compared to the other varieties. In contrast, CB meat contained the highest cholesterol concentration (71.477 mg/dL) among the three groups. Sensory evaluation indicated that RS chicken meat scored significantly higher ($p<0.05$) for colour, and flavour attributes, while CB meat exhibited superior ($p<0.05$) juiciness and tenderness when compared to other varieties. Based on the results it can be concluded that CB meat may be preferred for its tenderness, while RS chicken meat is preferred for overall acceptability owing to its moderate toughness, superior colour, flavour and lower cholesterol content in the meat compared to meat from other varieties.

Keywords: Broilers, Non-descriptive chicken, Rajasri chicken, Carcass traits, Meat quality, Sensory attributes.

PPTP-03

Influence of guanidinoacetic acid and dietary energy level on meat quality parameters in broilers

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The present experiment was conducted to evaluate the effects of Guanidinoacetic acid (GAA) supplementation with a low-energy diet on carcass traits and meat quality in broiler chickens. Energy is a primary limiting nutrient for fast-growing broilers, as it supports rapid muscle development and overall growth. Guanidinoacetic acid acts as a precursor of creatine and enhances the efficiency of energy utilization and storage in muscle tissues, potentially improving growth performance under energy-restricted conditions. In this study, a total of 192 Vencobb 430 broiler chicks were reared for 42 days. One-day-old straight-run chicks were randomly allotted into four dietary groups with four replicates of 12 birds each. The control group received a basal diet, while the second group was fed the basal diet supplemented with GAA at 600 g/ton of feed. The third group received a low-energy diet (100 kcal/kg ME less), and the fourth group was fed the same low-energy diet supplemented with GAA at 600 g/ton. Results indicated that GAA supplementation did not improve carcass traits such as breast, thigh, drumstick, back, neck, wing, abdominal fat, or giblet weights. Dressing yield was significantly ($P<0.05$) reduced in GAA-supplemented groups compared to the control. Meat pH and cooking yield (%) also decreased significantly ($P<0.05$), while drip loss and water-holding capacity were not significantly affected ($P>0.05$). It may be concluded that GAA supplementation at 600 g/ton does not enhance carcass yield or meat quality in broilers, particularly when included in low-energy diets. Further research is warranted to optimize dosage and evaluate long-term physiological effects.

Keywords: Broiler, Carcass traits, Drip loss, Guanidinoacetic acid, Meat quality.

PPTP-04

Assessment of antibiotic residues in fresh and cooked broiler meat using high-performance liquid chromatography (HPLC-UV): implications for food safety

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The widespread use of antibiotic growth promoters such as tetracyclines in poultry feed enhances production efficiency but raises serious concerns about public health due to the persistence of antibiotic residues in edible tissues. Detecting and understanding the stability of these residues after cooking are critical for food safety. This study was undertaken to determine the levels of antibiotic residues in fresh and cooked broiler meat using HPLC-UV. A total of 300 day-old broiler chicks were divided randomly into five groups and reared for 42 days. The control group (T_0) received a basal diet without antibiotics, while groups T_1 and T_2 were supplemented with Oxytetracycline (OTC) at 100 ppm and 200 ppm, and groups T_3 and T_4 with Chlortetracycline (CTC) at 100 ppm and 200 ppm, respectively. On day 42, 100 g muscle (breast and thigh) and liver samples were collected and analyzed using HPLC after extraction in McIlvaine buffer (pH 3.85) and solid-phase clean-up. Separation was achieved on a reversed-phase C18 column using a mobile phase of 0.1 M oxalic acid buffer (pH 3.5):acetonitrile:methanol (75:15:10, v/v/v) at a flow rate of 1.2 mL/min with UV detection at 360 nm. The detection limits for OTC and CTC were 5.509 and 5.309 ng/mL, while the minimum detectable quantities were 18.336 and 17.696 ng/mL, respectively. Mean concentrations of OTC and CTC residues in fresh muscle samples ranged between 61.57–95.92 µg/kg across treatments. Cooking under ordinary pressure cooker for 30 minutes significantly reduced residue levels ($P<0.05$), resulting in 60–75% reduction depending on antibiotic type and dosage. Cooked muscle samples of T_1 and T_2 contained 27.06 and 32.91 µg/kg, while T_3 and T_4 recorded 20.42 and 26.50 µg/kg, respectively. The results clearly indicate that adequate cooking temperature and duration substantially reduce antibiotic residues in broiler meat, improving food safety margins for consumers. However, detectable levels even after cooking

emphasize the importance of judicious antibiotic use and regular residue monitoring in poultry production systems.

Keywords: Antibiotic Residues, Broiler Meat, Cooked Meat, Food Safety, HPLC-UV.

PPTP-05

Effect of butter in enhancing spreadability and sensory attributes of meat spread under refrigerated storage

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The utilization of spent broiler breeder hen meat in value-added products is gaining interest due to its cost-effectiveness and potential for waste reduction in the poultry industry. This study was conducted to evaluate the effect of butter on enhancing the spreadability and sensory attributes of meat spread during a refrigerated storage period of 28 days. The meat spread was prepared in three treatment groups with varying levels of butter: T_1 (0 per cent butter), T_2 (3 per cent butter) and T_3 (5 per cent butter). The spreadability and sensory attributes of each formulation were analyzed over the 28-day storage period. The spreadability of the meat spread with 5 per cent butter significantly increased ($p < 0.01$), followed by 3 per cent butter, compared to the control group throughout the storage period. During the refrigerated storage condition, sensory attributes of meat spread with 5 per cent butter increased significantly ($p < 0.01$) when compared to the control group. Both spreadability and sensory attributes decreased as the storage duration progressed. The inclusion of butter improves the spreadability and sensory quality of meat spread prepared from broiler breeder spent hens.

Keywords: Broiler breeder, Spent hen, Meat spread, Spreadability, Sensory quality.

PPTP-06

Impact of frozen storage on physio-chemical changes in egg sausage

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The present experiment was conducted in commercial chicken egg (table egg) and broiler chicken meat. A total of 5 treatment groups were formed with 3 batches. The sausages were prepared and stored at freezing (-18°C) temperature. Stored sausages were subjected to physico-chemical (pH, water holding capacity, tyrosine value and thiobarbituric acid value) on 15 and 30 days of frozen storage. The pH values showed a significant ($P<0.05$) difference up to 15 days of frozen storage. Within the treatment groups in various storage periods showed significant difference ($P<0.05$) in T1. The water holding capacity per cent showed a significant ($P<0.01$) difference on 15th and 30th day of frozen storage. Within treatment group in various storage periods showed significant ($P<0.01$) difference for all treatment groups in water holding capacity per cent during 15 to 30 days of frozen storage. Tyrosine value showed no significant ($P>0.05$) difference up to 30 days of frozen storage. There was a no significant ($P<0.05$) difference noticed in thiobarbituric acid value on 15th and 30th day.

Keywords: Egg Sausage, Broiler Chicken Meat, Physico-Chemical Properties, Frozen temperature.

PPTP-07

Exploration of machine learning for the analysis of external egg quality

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Egg dimensions are one of the key parameters for the classification and grading of eggs for artificial incubation in hatcheries. However, manual measurement methods are often cumbersome, time-consuming, error-prone, and carry the risk of damaging the eggs during handling. Considering these challenges, the present study was undertaken to explore the potential of artificial intelligence (AI) for automatically predicting egg dimensions from images. Image dataset of eggs was created, and machine learning was applied to them. Images were taken from same distance to maintain uniformity of dimensions in the

photographs. The results revealed that Mean Absolute Errors (MAE) of the final predictive model for egg size were 0.29 for length and 0.26 for breadth, with Pearson Correlations of 0.88 for length and 0.81 for breadth. It is concluded that egg dimensions can be predicted from the egg images using machine learning

Keywords: Egg, Chicken, Dimensions, Artificial Intelligence.

PPTP-08

Influence of storage temperature and duration on external and internal quality parameters of chicken eggs

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The present study, conducted at the department of Poultry Science, NTR College of Veterinary Science, Gannavaram, evaluated the quality characteristics of commercial (White Leghorn) and backyard (Rajasri and Desi) chicken eggs under room and refrigeration temperatures (4˚C) up to 28 days. Egg quality parameters were categorized into external (egg weight, shell color, shape index, specific gravity, and air cell depth) and internal (shell thickness, albumen index, yolk index, Haugh unit, and component weights). Egg weight declined significantly with storage duration, more so at room temperature, due to moisture loss through shell pores. Refrigeration minimized this decline. Shell colour remained breed-specific and unaffected by storage, while shape index values were stable across treatments. Specific gravity decreased slightly during storage owing to CO_2 and water loss, with refrigerated eggs maintaining higher values, indicating better freshness retention. Air cell depth increased significantly with time, particularly at room temperature, confirming internal moisture evaporation and albumen thinning. Among internal quality parameters, albumen and yolk indices, as well as Haugh unit, declined progressively with storage, with refrigeration effectively slowing this deterioration. The decline was attributed to protein denaturation, CO_2 loss, and weakening of yolk membranes. Shell thickness showed minor reductions, while component analysis revealed stable shell weights but decreased albumen and yolk weights under room temperature. Overall, temperature and storage duration were the major determinants of egg quality, with breed effects being secondary. Refrigerated storage effectively preserved weight, albumen viscosity, and yolk integrity, emphasizing its critical role in maintaining freshness and nutritional quality of both commercial and backyard eggs.

Keywords: Storage temperature, Duration, Egg quality, Internal and external, Chicken strains.

PPTP-09

Biochemical and microbial dynamics of chicken eggs during storage under different temperature regimes

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The present study evaluated the influence of storage, duration and temperature on the biochemical, organoleptic, and microbial quality of commercial (White Leghorn) and backyard (Rajasri and Desi) chicken eggs. Biochemical analysis revealed a progressive increase in albumen pH from 8.15 ± 0.09 (day 0) to 9.69 ± 0.09 by day 28 at room temperature (4˚C), attributed to CO_2 loss through the shell, consistent with Jin et al. (2011) and Yeasmin et al. (2014). Refrigeration slowed this rise, maintaining pH below 9.5. Yolk pH increased marginally from 6.08 to 6.30, showing greater stability due to the vitelline membrane barrier. Yolk cholesterol content (197–200 mg/g) remained stable across breeds and storage conditions, aligning with Jiang et al. (1991) and Yenilmez & Atay (2023), suggesting minimal influence of temperature

or duration. Total protein content declined significantly with storage, from 13.11 g to 10.08 g, with refrigeration mitigating losses-findings consistent with Jin et al. (2011) and Silversides & Budgell (2004). Organoleptic evaluation indicated that backyard eggs (Desi, Rajasri) initially scored higher in flavor and overall acceptability. However, sensory attributes such as taste, aroma, and texture declined after 21 days, especially at room temperature. These results align with Edirisinghe et al. (2017) and Bing et al. (2022), confirming that refrigeration preserves sensory appeal for longer durations. Microbiological analysis revealed increasing *Salmonella* counts over time, reaching 2.62 log CFU/mL by day 28 at room temperature. Refrigerated eggs exhibited lower counts (2.40 log CFU/mL), supporting Saleh et al. (2020). Blood spots were more frequent in room-stored eggs and correlated with higher microbial loads, corroborating D.P. Smith et al. (2008). Overall, refrigeration effectively slowed biochemical and sensory deterioration and limited microbial proliferation, highlighting its importance in maintaining egg safety, sensory appeal, and nutritional integrity during extended storage.

Keywords: White Leghorn, Rajasri, Desi, pH, yolk cholesterol, total protein, albumen, organoleptic, blood spots, Salmonella count.

PTP-10

Poultry waste to functional ingredient: Neurobehavioral and immunomodulatory potential of spent hen meat hydrolysate

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Spent hens, typically discarded after the end of their laying cycle due to reduced tenderness and increased collagen cross-linking, pose an environmental burden when not sustainably utilized. In this study, meat from the Indian layer breed BV-300 was enzymatically hydrolyzed using Flavourzyme® at pH 6.6 and 54 °C for 30 minutes to produce spent hen meat hydrolysate (SMH), which was subsequently processed into powder by spray-drying and freeze-drying. The degree of hydrolysis (20.95 ± 0.37 %) confirmed efficient protein breakdown. Antioxidant analysis using the DPPH assay revealed significantly ($p < 0.05$) higher radical-scavenging activity in spray-dried hydrolysate (SD-SMH) compared to freeze-dried powder (FD-SMH), likely due to a greater abundance of sulfur-containing amino acids, as validated by GC–MS/MS profiling. SD-SMH also demonstrated superior bioaccessibility after simulated gastrointestinal digestion. In vivo behavioural studies in Swiss albino mice showed that SMH supplementation enhanced spatial learning ability and exhibited anxiolytic effects. Immunological assessments further indicated an immunopotentiating role of SMH, as treated groups showed reduced ear swelling and attenuated skin inflammation following DNCB-induced irritation. Incorporation of SMH at 10 % into whey protein supplements yielded favourable sensory acceptance.

Keywords: Flavourzyme, poultry waste, antioxidant, drying, powder properties, digestibility.

PPTP-11

Microbiological quality evaluation of flavoured egg-based drinks during storage

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Eggs, though nutritionally dense, pose significant microbiological risks due to their high protein and lipid matrix. India, the world's second-largest egg producer (142.77 billion eggs in 2023-24), processes less than 3% of its total production, leading to 15-20% post-harvest losses and seasonal market instability. To address these challenges and explore value-added utilization, a study was conducted to evaluate the microbial safety and shelf-life of six pasteurized egg-based beverages three whole-egg formulations (T1: glass bottle, T2: plastic bottle, T3: plastic pouch) and three albumen-based formulations (T4: glass bottle, T5: plastic bottle, T6: plastic pouch) stored under refrigerated (4 ± 1 °C) and room-temperature (25 ± 1 °C) conditions. Microbial quality was assessed using standard FSSAI methods for total plate count (TPC), yeast-mold count (YMC), coliforms, and *Salmonella*. Initial TPC ranged from 2.259-2.845 $\log_{10}$ cfu/mL. Under refrigeration, whole-egg drinks showed higher microbial growth reaching spoilage limits by day 11-13 whereas albumen-based drinks remained within acceptable limits up to day 15. Among packaging types glass bottles exhibited the best microbial stability showing the lowest final TPC values (4.123 $\log_{10}$ cfu/mL for whole-egg and 3.627 $\log_{10}$ cfu/mL

for albumen drinks). YMC appeared after day 5 but stayed below 3 log_{10} cfu/mL while coliforms and *Salmonella* were absent throughout storage, confirming effective pasteurization and hygienic handling. Overall albumen-based drinks packaged in glass bottles demonstrated superior microbial stability and safety for up to 15 days under refrigeration. The findings highlight that both formulation and packaging type critically influence microbial kinetics, establishing the potential of albumen-based glass-packaged egg beverages as safe, short-shelf-life, protein-rich functional drinks.

Keywords: Egg drink, microbial stability, total plate count, yeast–mold, coliforms, glass packaging, shelf-life.

PPTP-12

Development and quality evaluation of shelf-stable boneless chicken pickle

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Pickling of meat serves as an excellent and economical method for producing shelf-stable meat products. As a highly acceptable, ready-to-eat, and convenient product of Indian origin, pickle offers a valuable alternative for meat preservation. The present study aimed to develop a shelf-stable boneless chicken pickle that could be safely stored at ambient room temperature. Boneless broiler chicken meat, along with a combination of spices, salt, condiment paste, sunflower oil, and vinegar, was utilized in formulating the product. The developed chicken pickle was examined for its physicochemical properties—including cooking yield percentage, pH, and titratable acidity—along with proximate composition parameters such as moisture, protein, and fat content. Microbial quality was assessed by determining total plate count, yeast, and mould levels, and the product was also subjected to sensory evaluation. The pickle exhibited a pH of 4.67 ± 0.21 and a titratable acidity of 0.43 ± 0.26% acetic acid. Its moisture, protein, and fat contents were found to be 27.78 ± 0.91%, 20.51 ± 0.27%, and 48.31 ± 0.32%, respectively. Microbial analysis revealed a total plate count of 0.87 ± 0.18 cfu/g, while yeast and mould were not detected. Based on the overall physicochemical, microbial, and sensory evaluation results, it is concluded that the developed chicken pickle is highly acceptable and offers substantial value addition as a shelf-stable meat product.

Keywords: Chicken pickle, Shelf-Stable, Physico-Chemical characteristics, Proximate Composition, Sensory attributes.

PPTP-13

Chicken meat based ethnic delicacies of Northeastern states of India: its preparation techniques, nutritional and socio-economic significance

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The northeastern states of India, has several authentic traditional meat delicacies that have not been explored documented adequately. A survey was conducted among consumers, home cooks and food stall owners representing different tribes of Northeast India. Detailed data was collected on a variety of traditional chicken meat delicacies, its preparation techniques, consumption pattern and the significance of such chicken meat products. The socioeconomic values and traditions attached to the products were also explored. We have enlisted few chicken meat-based traditional products of Northeastern states of India and the methods of preparation and significance of these products have also been recorded. The loss of these ethnic meat delicacies can be prevented only by increasing its availability and market value. An intervention of food science in optimizing the preparation methods, improving hygiene parameters, and packaging can promise a lucrative business in this sector for local people and may attract consumers from other parts of the country.

Keywords: Chicken meat, delicacies, socioeconomic, traditional.

PPTP-14

Comparison of assorted chicken cut yields in manual and mechanical deboning across different carcass weights

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This study evaluated the influence of different egg storage periods on hatchability, fertility, weight loss, and chick yield in broiler breeder eggs. A total of 924 hatching eggs from a 45-week-old GP626K flock were divided into three treatments based on storage duration: T1 (7 days), T2 (5 days), and T3 (3 days), with 308 eggs per treatment. The eggs were collected, fumigated, and stored under controlled conditions (16–17°C; 75–80% RH). Storage loss, weight loss during incubation, hatchability, fertile hatchability, and chick yield were recorded using standard hatchery procedures. Storage loss increased with longer holding times, with T1 showing the highest loss (1.5%) and T3 the lowest (0.45%). Weight loss during incubation ranged from 10.39% (T3) to 11.54% (T1), remaining within acceptable standards. Hatchability improved as storage duration decreased: 87.98% in both T1 and T2, rising to 91.23% in T3. Fertile hatchability also peaked in T3 (91.53%). Chick yield exceeded the standard 66–68% across all groups, with the highest yield recorded in T2 (75.1%). Overall, shorter egg storage duration significantly improved hatchability and fertile hatchability, likely due to reduced moisture loss and better maintenance of internal egg quality. The study concludes that a 3-day storage period is optimal for maximizing hatchery performance and economic efficiency in broiler breeder operations.

Keywords: Egg Storage Duration, Hatchability, Weight Loss and Chick Yield.

PPTP-15

Bioactive peptide profiling of chicken collagen hydrolysates via green extraction methods

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With rising global demand for meat, the increasing volume of by-products generated across the meat supply chain is now being explored as a valuable source of bioactive compounds. In this study, collagen hydrolysates were produced from chicken skin, head, and feet using ultrasonication and microbial enzymes (Collagenase and Protease). Following tryptic digestion, the peptide composition of the hydrolysates was analyzed using electrospray ionization quadrupole time-of-flight tandem mass spectrometry (ESI-QTOF-MS/MS). The chicken collagen hydrolysates exhibited varying degrees of hydrolysis and diverse molecular weight distributions, demonstrating heterogeneity in peptide polarity and size. *In-vitro* bioactivities; antioxidant, ACE-inhibitory, and lipase-inhibitory properties of the peptides were confirmed through LC-MS/MS and further supported using *in-silico* tools (BIOPEP and Peptide Ranker). Ultrasound-enzyme combinations yielded a predominance of low-molecular-weight peptides (<1500 Da). This indicated that ultrasonication enhanced enzymatic cleavage efficiency, producing smaller peptides with higher predicted bioactivities. PCA revealed clear separation among all treatments with distinct peptide fingerprints, confirming that type of enzyme significantly influences peptide abundance patterns. Peptides with short Gly–Ala–Gly–Pro– motifs commonly derived from type I collagen, known for antioxidant and ACE inhibitory potential, are highly expressed in ultrasonic-protease treated samples. These findings indicate the potential of poultry processing waste as a rich source of novel bioactive peptides.

PPTP-16

Gut microbiota modulation in broilers using native chicken lactobacillus and fruits and vegetable waste products to enhance meat quality

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The quality of broiler chicken meat characterized by key attributes such as tenderness, flavour, juiciness, and nutritional value is a complex trait strongly influenced by both dietary composition and the functional status of the gut microbiota. Chicks don't get healthy gut bacteria from their mothers. Their gut starts empty and can easily be filled by harmful germs. Giving them beneficial microbes early may help growth, immunity, digestion, and meat quality. This study proposes a novel dietary approach to enhance broiler meat quality by modulating the gut microbiota using probiotic Lactobacillus strains derived from native chicken breeds along with nutritionally rich fruit and vegetable waste. *Lactobacillus* strains were isolated from the caecal contents of three native chicken breeds and cultured on MRS agar. Molecular identification using 16S rRNA sequencing confirmed their probiotic potential. In parallel, locally available fruit and vegetable waste including Citrus limetta, dragon fruit, beetroot, pomegranate, corn silk, tomato and jackfruit were freeze-dried and evaluated for their nutritional composition. These components will be incorporated into formulated feed and administered to day-old commercial broiler chicks under controlled feeding conditions and significantly improve gut microbial balance and enhanced key broiler meat quality traits, including tenderness, flavour, juiciness, and nutritional value. This study shows that using good bacteria from native chickens together with healthy fruit and vegetable waste powders can improve the quality of broiler chicken meat. This method is simple, low cost, ecofriendly, reduces waste, and helps farmers produce better quality chicken using locally available resources.

Keywords: Probiotics, gut microbiota, chicken, isolation**,** Lactobacillus, characterization, fruit and vegetable waste meat quality parameters.

Poultry Extension and Economics: Oral Presentations

PEEO-01

Rajasri in the backyard: Building rural resilience and nutrition security in semi-arid region of Telangana

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Backyard poultry farming with "Rajasri" variety birds serves as a viable means to enhance the socioeconomic position of poor individuals in rural areas, as it generates supplementary income while supplying balanced nutrition through eggs and chicken meat, employing the natural food resources accessible in these regions. A total of 2,200 day-old Rajasri chicks are raised in a deep litter system for six weeks under uniform management. At 7 weeks of age, 2000 growers were distributed to 100 women beneficiaries at the rate of 20 birds per beneficiary, comprising 5 villages in the Ailapoor, Joganpalle, Porumalla, Katlakunta, and Mythapur villages of Jagtial District, Telangana State. At beneficiary level the birds were raised with minimal additional nourishment. Up to 52 weeks of age, each bird produced an average of 120 eggs, weighing between 41 to 56 grams. Each bird cost Rs. 153.37 in total, including the cost of the feed, chick and supplemental feed (from 7 to 52 weeks), vaccinations, and medications. Each egg was sold at Rs. 5. Each female and male bird that was culled was sold for Rs. 150 and Rs. 200/kg, respectively. The annual revenue from raising 20 Rajasri backyard birds was approximately Rs.7,751.61 Rajasri backyard poultry units supplied supplemental income to underprivileged rural residents. Because it is "low input and high output technology," it assists rural underprivileged people in improving their nutritional status as well as income to satisfy small home expenses. Thus, the current study highlights the significance of promoting backyard chicken raising, particularly Rajasri among the less fortunate segments of society.

Keywords: Backyard farming, Livelihood, Nutritional security, Rajasri, Rural area.

Poultry Extension and Economics: Poster Presentations

PEEP-01

Rural poultry farming in Himalayan state of Himachal Pradesh: Progress, prospects, and the role of *Himsamridhi*, location specific poultry variety for hilly regions

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Rural poultry farming is now occupying key role in farming portfolio of hill farmers in the North-Western Himalayan region. The harsh climatic conditions, seasonal connectivity issues, limited feed resources, low land holding and high-altitude conditions constrain the productivity of conventional poultry production system, necessitating the adoption of region-specific, low-input systems. To cater the gaps for rural poultry production system, location specific poultry *Himsamridhi* developed under All India Coordinated Research Project on Poultry Breeding, has gained significant attention for adaptability to cold climates, scavenging ability, and sustainable performance under backyard systems. With an average egg production of 140-160 eggs per year under village production system and body weights ranging from 1.5–2.2 kg, *Himsamridhi* demonstrates both economic viability and resilience in marginal environments. Field observations and case studies highlight its success in enhancing women-led backyard farming enterprises, promoting nutritional security, and offering a sustainable alternative to contract broiler farming in hill states. After the release of cross as variety there is increasing demand for the variety as evident from supply chain for the last five years. The most attractive feature of the variety is its low feed requirement due to lighter body weight compared to other heavier variety. The increasing supply of chicks through state organizations and the integration of farmer participatory models indicate strong potential for scaling up rural poultry initiatives. The light weight bird with optimum shank length also ensures its agility under free range system/village production system. The percent supply of the developed variety to the total chicks distributed through different agencies in the state is progressively increased from 5% to 20% since the distribution/ release of variety (2017-2025). Projections suggest that with supportive policies, breed improvement programs, and extension interventions, rural poultry farming could significantly contribute to protein sufficiency, poverty alleviation, and climate-resilient agriculture in the Himalayan context.

Keywords: Rural poultry, Himsamridhi, Himalayan region, Backyard system, Food security, Climate resilience.

PEEP-02

Influence of economic parameters and season on broiler performance efficiency factor (BPEF) in commercial farming

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This study examines the impact of economic parameters and seasonal variations on the Broiler Performance Efficiency Factor (BPEF) in commercial broiler chicken farming of Tamil Nadu, India. Data were collected from 348 batches across regions including Trichy, Perundurai, Vellore, and Krishnagiri over one year (January to December 2023). BPEF was computed using the formula: [mean market weight (kg) × livability (%)] / [mean market age (days) × feed conversion ratio (FCR)] × 100. Statistical analysis revealed significant seasonal effects ($P<0.01$) on BPEF. Summer recorded the highest market age (39.98 days), lowest market weight (2.20 kg), poorest FCR (1.70), and lowest BPEF (309.35). Winter showed the highest market weight (2.33 kg), better FCR (1.60), and highest BPEF (362.69). Monsoon values were intermediate, with market age of 38.73 days, weight of 2.25 kg, FCR of 1.58, and BPEF of 353.04. Overall means were market age 39.06 days, weight 2.26 kg, FCR 1.63, livability 95.41%, and BPEF 341.32. Pearson's correlation analysis indicated a strong negative correlation between FCR and BPEF (-0.88), highlighting feed efficiency as the dominant factor. Market age positively correlated with FCR (0.56), indirectly reducing BPEF, while livability positively correlated with BPEF (0.44). Market weight showed positive correlations with BPEF (0.46). The findings underscore that feed efficiency primarily drives BPEF, but market age dictated by integrators based on demand indirectly influences feed efficiency and livability, which warrants correction in FCR values as corrected FCR for fixing the growing charges for contract farmers.

Keywords: BPEF, Broiler chicken, Feed efficiency, Market age, Seasonal variation.

PEEP-03

Optimization of slaughter age for improved performance and profitability in broiler chickens

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An experiment was conducted to determine the influence of increasing broiler's slaughter age on growth performance, immunity and economics. "Ross 308" chicks (n=175) were weighed and randomly distributed among five groups consisting of 35 chicks in each. The experimental birds were fed on commercial maize soya-based basal diet (Crumble). The broiler chicks were reared for up to 49 days and slaughtered at a different age of 35, 42, and 49 slaughter day. In case of male broiler, there was significant effect on carcass traits like thigh ($P<0.05$), back ($P<0.05$) and shank width ($P<0.001$) while in case of female there was significant differences were recorded in the giblet ($P<0.05$), shank length ($P<0.05$) and shank width ($P<0.001$) from slaughter age of 35 to 49 days. The results revealed that in case of female the giblet % significantly decreased with increasing slaughter age. It was observed that there was significant ($P<0.05$) increase in overall length of intestine in male while in case of female there was no significant ($P>0.05$) change in any segment of intestine (duodenum, jejunum, ileum) as slaughter age increased. The H/L ratio, and serum corticosterone values were significantly increasing from 35th to 49th day. Based on the results, the broiler birds reared up 35 days resulted in better EEF, immune status and maximum profit.

Keywords: Broiler, Economics, Growth performance, Immunity, Slaughter age.

PEEP-04

Effect of backyard poultry farming interventions on livelihood security of beneficiary tribal women in Uttarakhand

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This study was conducted to evaluate the effect of backyard poultry farming on the livelihood security of the tribal beneficiaries under DAPST programme of Central Avian Research Institute. Training and inputs (25 chicks, 50 kg feed, and other inputs) were provided to Tharu tribal women of selected villages of Udham Singh Nagar district of Uttarakhand. In order to measure the effect of backyard poultry on livelihood security of tribal women, a Livelihood Security Index was developed with major indicators—food, economic, health, educational, and social security. A sample size of 120 respondents was taken, comprising 60 beneficiaries and 60 non-beneficiaries. Using the developed index, data were collected from respondents of selected area, tabulated, analyzed and interpreted. The results revealed that beneficiaries consistently recorded higher livelihood security across all indicators as compared to non-beneficiaries, with markedly better food (0.82 vs. 0.65), economic (0.60 vs. 0.46), health (0.79 vs. 0.67), educational (0.54 vs. 0.47), and social security (0.69 vs. 0.49) scores, and overall livelihood security (0.69 vs. 0.55) scores. Findings indicated that the livelihood security of beneficiaries (69%) was considerably higher than that of non-beneficiaries (55%), demonstrating the positive impact of backyard poultry interventions on tribal women's livelihoods.

Keywords: Effect, Backyard poultry, Livelihood security, tribal women.

PEEP-05

Success story of poultry farmer Nishapati under tribal sub plan, Sarguja: Sustainable poultry farming with improved practices

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Poultry farming activities started in the selected villages (Village-Sonwahi & Devipur, from District-Surajpur and Village-Sargawan & Village-Sakalo from District-Ambikapur, Division-Sarguja) under ICAR- tribal sub plan (TSP) Sarguja project. Total 100 ST beneficiaries (93 women and 7 men) were selected to execute the programme in the year 2023-24. One such ST beneficiary is Mrs. Nishapati from Village-Sargawan District-Ambikapur, Division-Sarguja who has become small poultry entrepreneur and now earning about Rs.10,000 to 12,000 per month from poultry farming. During first phase of TSP-Surguja, four days awareness cum demonstration programme at Villages Sargaon she has participated and selected as beneficiary. In second phase, seven days training programme on scientific poultry farming she has participated at Veterinary Polytechnic Surajpur. Like other 100 ST beneficiaries she has also received 250 kg poultry feed, 200 chicks (Vanraja,Grampriya/Kalinga brown), 5 drinker, 4 feeder, 1 chick guard and also one small scale 800 eggs capacity egg incubator has been installed at her village panchayat. Like other beneficiaries of the village she is using this egg incubator machine for chick production. Now, she has maintained continuous birds in their shed and earning sustainable source of income as poultry keeping. It helped her for socio-economic upliftment and improving their livelihood. Mrs. Nishapati also prepared her low-cost poultry shed, she is well aware about bird's vaccination, biosecurity in poultry house and also feeding homemade poultry feed of low cost. Out of 100 beneficiaries more than 50 such beneficiaries have adopted poultry keeping activity as their supplement source of income regularly and about 10 beneficiaries have started their small-scale poultry farm. Their success story also prepared and uploaded in YouTube for awareness for other farmers.

Keywords: Tribal sub plan, Sarguja, Poultry, Entrepreneur.

PEEP-06

Performance, constraints, and socio-economic impacts of backyard poultry farming: Evidence from a field study in Udham Singh Nagar and Champawat districts of Uttarakhand

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Backyard poultry farming plays an increasingly significant role in enhancing rural nutrition and livelihood resilience in Uttarakhand. This study evaluated the productivity, management practices, and socio-economic contributions of backyard poultry systems in Udham Singh Nagar and Champawat through a field survey conducted. A total of 120 households (60 per district) were selected using stratified random sampling, and data were collected through structured interviews, flock observations, and participatory rural appraisal tools. Results show marked differences between the two districts. Average flock size in Udham Singh Nagar was 14.2±4.8 birds/household, significantly higher than the 8.7±3.1 birds/household recorded in Champawat. Annual egg production per hen averaged 112 eggs in the plains and 86 eggs in the hills, reflecting differences in feed availability, breed composition, and environmental stress. Despite lower productivity, Champawat households relied more heavily on poultry for home consumption, with 73% reporting eggs as their primary animal-protein source, compared with 48% in Udham Singh Nagar. Disease prevalence—particularly Newcastle disease and parasitic infestations-emerged as the most critical constraint, affecting 37% of surveyed households. Limited access to veterinary services, predation, and inadequate night shelters were additional challenges, especially in the hilly terrain of Champawat. Economically, backyard poultry contributed Rs.6,200–9,800 annually per household in Udham Singh Nagar and Rs. 3,500–5,400 in Champawat, serving as an important supplementary income stream, particularly for women, who were primary caretakers in more than 80% of the surveyed households. The study concludes that backyard poultry farming holds substantial potential for improving nutritional security and supporting

rural livelihoods in both districts, though region-specific interventions are required. Strengthening vaccination coverage, promoting hardy indigenous breeds, improving low-cost housing, and expanding extension and women-oriented training programs would significantly enhance system productivity and resilience.

Keywords: Backyard poultry farming, BYPF, Nutritional Security.

PEEP-07

Empowering rural livelihoods: Backyard poultry for sustainable income generation and food security among rural scheduled caste farmers in YSR Kadapa district, A.P

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Backyard poultry serves as a vital tool for livelihood improvement, nutritional security, and women's empowerment in rural areas. However, limited technical knowledge, poor management practices, and lack of awareness about value addition restrict the income potential of smallholders. Recognizing this, a specialized capacity-building program was designed to enhance farmers' skills in both scientific backyard poultry rearing and meat and value-added product preparation for diversified income opportunities. A three-day hands-on training program titled "Empowering Rural Livelihoods through Backyard Poultry and Meat Product Preparation" was organized at the College of Veterinary Science, Proddatur. The event was conducted by SVVU, Tirupati, in collaboration with ICAR–NMRI, Hyderabad. A total of 50 rural SC women farmers from five mandals of YSR Kadapa participated. The curriculum combined lectures, demonstrations, and practical sessions on breed selection, feeding, housing, vaccination, disease prevention, and preparation of meat and egg-based value-added products such as cutlets, nuggets, and pickles. Pre- and post-training assessments were carried out to quantify knowledge and skill enhancement. Post-training evaluation revealed a mean knowledge improvement of 69%, with the highest gains observed in disease management (78%), balanced feeding (72%), and meat product preparation and preservation (70%). Confidence in managing backyard units rose from 24% to 91%, while awareness of value addition and marketing strategies improved by 65%. Follow-up monitoring indicated that 60% of trainees had initiated backyard poultry units adopting scientific practices, and 28% began small-scale meat product sales within one month of training. Participants reported an estimated 45–55% projected increase in household income, supported by enhanced family nutrition and greater involvement of women in poultry-related entrepreneurship. Integration of scientific backyard poultry farming with skill training on meat and value-added product preparation substantially strengthens the livelihood base of rural SC farmers. Such integrated approaches enhance profitability, promote self-employment, and contribute to sustainable rural income generation and food security. Collaboration between SVVU and ICAR institutes demonstrates an effective model for inclusive rural development and women-led agri-entrepreneurship.

Keywords: Backyard poultry, Meat products, Value addition, Rural livelihood, SC farmers, Entrepreneurship.

PEEP-08

Constraints in backyard poultry rearing in Uttar Pradesh and Uttarakhand, India

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The primary survey was conducted in the purposively selected 8 villages falling in the interventional area of Development Action Plan for Scheduled Caste/Tribes (DAPSC/ST) in Uttar Pradesh (Fatehganj West and Nawabganj blocks, Bareilly district) and Uttarakhand (Khatima block, Udham Singh Nagar district) to identify the constraints faced by poultry rearers in their backyard poultry production system. The data sample comprised of 120 backyard poultry rearers each of the beneficiaries and non-beneficiaries. The data were collected by personal interview using pre-tested interview schedule that had a list of constraints. Initially, the constraints were identified based on two sources: (1) a comprehensive review of previous studies in similar contexts, and (2) preliminary findings from schedule testing during the research design phase.

Subsequently, during data collection, farmers were asked to validate these constraints and list out other constraints if any based on their personal experiences. They were asked to provide rankings according to the severity, they perceived w.r.t various constraints. The data so collected were tabulated and analysed statistically by using Garretts' ranking technique. Among the listed constraints, high feed cost emerged as the most significant constraint with the highest Garrett's score and first rank. This was followed by low egg production, mortality, problem of predators and unhygienic premises. On the other hand, the marketing problems and lack of space and time were considered comparatively less critical.

Keywords: Backyard poultry, Constraints, Garetts' ranking, DAPSC, DAPST.

PEEP-09

Studies on embryonic mortality in native chicken of Chhattisgarh under backyard rearing system

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To increase reproductive efficiency, it is necessary to assess the infertility and embryonic mortality that leads to hatching failure. Hatching failure results from two main causes: ova failed to be fertilized or fertilized egg failed to hatch in addition to embryonic mortalities occurred at any stage of development. The purpose of the recent study was to characterize the incidence of embryo mortality in native chicken eggs of Chhattisgarh. A prospective cohort study was performed, through breaking of egg and embryodiagnosisin native chicken eggs of Chhattisgarh reared under backyard system. Other data such as hatchability on total egg basis and fertile egg basis, percentage of infertility were reported. Total 02 numbers of hatching and 277 numbers of eggs were observed collected from two villages of Rajnandgaon district of Chhattisgarh. Eggs were uniform in shape, colour with good sound shell quality were selected for hatching. Mortile embryo was categorized into three early, mid and late stage according to the age of the embryo. Hatchability on total egg basis and fertile egg basis was 38.86% and 84.76%, respectively. Fertility recorded was 45.84%. General embryo mortality reached 16.59%. In the first week of incubation 4.54% of the embryos died; in the second week embryo mortality was 6.06% died and in third week the mortality was 9.09%. This may be concluded that the hatchability was low due to low fertility. The fertility may be low as the villagers have more hens as compare to cock in their herd. Hatchability was low as the collected eggs were stored for different duration by the villagers. Embryo mortality is low in all the stages and is acceptable.

Keywords: Hatchability, fertility, embryo mortality.

PEEP-10

Productive performance of improved backyard rural poultry farming in Ranga Reddy District of Telangana

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An improved variety of backyard poultry, namely the Rajasri bird, was demonstrated to rural farm women from the SC community in Ranga Reddy district during 2023-2024 to improve their livelihoods. A total of 1060 birds were distributed to 53 identified SC beneficiary farmers and farm women. Each unit comprised five males and fifteen females (20 birds in each unit), one bamboo basket, 5 kg chick starter feed, a feeder, and a waterer. In the present study, Rajasri birds achieved sexual maturity at 174±14 d with an average body weight of 1250 to 1350 g. The average annual egg production/ bird was 155 to 165 eggs per year, with an average weight of 45 to 55 g. A mortality rate of 2.7% was observed in Rajasri birds. The findings indicated a substantial annual rise in household income of Rs. 17,825 from the sale of eggs and male birds, as well as a notable increase in the consumption of eggs and meat among rural Scheduled Caste families.

Keywords: Rural Women, Rajasri birds, Livelihood, SC Families.

Abstracts for Avitech and IPSA Young Scientist Award-2025

AYSA-01

Development and quality evaluation of egg drink

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India stands as the world's second-largest egg producer, with an annual output of 142.77 billion eggs (2023-24). The poultry sector contributes significantly to the economy, accounting for approximately 1% of national GDP and 12.5% of livestock GDP, while supporting over 6 million livelihoods. Despite this high production, the industry faces price volatility, inadequate cold chain infrastructure leading to 15-20% post-harvest losses (NDDB, 2021), and limited egg processing compared to developed nations. Simultaneously, rising consumer health consciousness has increased demand for protein-rich beverages. The study was conducted in two phases: (1) Product Development & Standardization, focusing on optimization of whole egg and egg albumin-based formulations, flavour selection (cocoa, thandai, cardamom), and physicochemical profiling; and (2) Shelf-Life & Packaging Evaluation, assessing storage stability under refrigeration (4±1°C) and room temperature (25±1°C) using glass bottles, plastic containers, and flexible pouches. Analytical parameters included proximate composition, viscosity, pH, microbial safety (TPC, yeast/mold, coliforms, Salmonella), oxidative stability (TBARS), and sensory quality (colour, flavour, aftertaste). Sensory evaluation identified the cocoa-flavoured whole egg drink (T1) as most acceptable, though it showed higher lipid oxidation (TBARS 0.090) and sedimentation (0.9%) than the egg albumin drink (T4), which exhibited better oxidative stability (TBARS 0.048) and minimal sedimentation (0.5%). Storage trials revealed significant differences ($p<0.05$) across treatments. Whole egg drinks deteriorated faster under refrigeration, with pH reduction and microbial load surpassing 5 log10 CFU/g by days 11–13, whereas albumin variants remained stable until day 15. Glass packaging performed best, extending shelf-life by 2-4 days compared to plastic and pouches. Whole egg drinks initially scored higher for flavour richness, but albumin-based drinks in glass retained superior sensory scores over time. Shelf-life was established at 13 days for glass-packed whole egg drinks (9-10 days in plastic/pouches) and 15 days for albumin drinks in glass (14 days in plastic/pouches). Optimized processing and glass packaging significantly improved shelf-life and quality of egg-based beverages. Albumin drinks demonstrated greater oxidative stability and microbial safety, while whole egg variants, despite higher flavour acceptability, require antioxidant supplementation for enhanced storage stability. The study validates egg-based beverages as commercially viable, nutritious alternatives in India's evolving protein drink market.

Keywords: Egg drink, Shelf-life, Packaging, Oxidative stability, Sensory evaluation.

AYSA-02

Effect of Gama-Amino Butyric Acid and Sodium Butyrate on growth performance, antioxidant status and immune response in broilers

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With increasing restrictions on antibiotic growth promoters (AGPs), identifying safe and effective alternatives has become essential in poultry production. Gamma-aminobutyric acid (GABA) and sodium butyrate (SB) are potential feed additives known to support gut health, improve antioxidant balance, and reduce stress in broilers. In light of this, the study aimed to investigate the impact of GABA and SB on various key performance traits in broilers. A total of 2,100-day-old male broiler chicks (Vencobb 430) were wing-banded, weighed, and randomly distributed into seven dietary diets, each with 12 replicates of 25 birds. All diets were corn–soybean meal based, iso-nitrogenous and iso-caloric. Diets included: D1 – control (basal diet), D2 – control + AGP (BMD 0.5 g/kg), D3 – GABA 0.2 g/kg, D4 – GABA 0.3 g/kg, D5 – sodium butyrate 0.5 g/kg, D6 – GABA 0.1 g/kg + SB 0.25 g/kg, and D7 – GABA 0.2 g/kg + SB 0.5 g/kg. Birds were reared to

42 days under a three-phase feeding regimen (pre-starter, starter, finisher).Data was subjected to one-way ANOVA for statistical analysis (SPSS). Dietary supplementation of GABA and SB, either individually or in combination, did not significantly (P>0.05) affect body weight gain or feed intake. However, inclusion of 0.3 g/kg GABA, 0.5 g/kg SB, and the combined GABA+SB (0.1 & 0.25 g/kg) significantly (P<0.05) improved feed conversion ratio (FCR) compared to the control. Notably, the GABA+SB combination (0.1 & 0.25 g/kg) produced superior FCR relative to birds receiving GABA, SB, or AGP alone. This suggesting a synergistic effect of the combination of GABA and SB on nutrient utilization efficiency. Carcass characteristics, including ready-to-cook percentage (RTC%), abdominal fat percentage, and liver percentage, were unaffected by dietary treatments. In contrast, breast yield percentage was significantly enhanced in birds supplemented with the GABA+SB combination (0.1 & 0.25 g/kg), indicating a positive effect on lean meat deposition. Analysis of antioxidant parameters revealed a significant (P<0.05) increase in glutathione reductase (GRX) activity in birds receiving 0.3 g/kg GABA and AGP compared to the control, whereas other antioxidant markers glutathione peroxidase (GPX), superoxide dismutase (SOD), and lipid peroxidation (LP) remained unchanged. Humoral and cell-mediated immune responses were not significantly influenced by dietary supplementation of GABA or SB. Dietary inclusion of GABA (0.3 g/kg) or sodium butyrate (0.5 g/kg) improved feed efficiency in broilers. The combination of GABA and SB (0.1 & 0.25 g/kg) demonstrated additive benefits on growth performance and breast yield, suggesting its potential as an effective alternative to antibiotic growth promoters in broiler diets.

Keywords: Broilers, GABA, Sodium butyrate, Growth performance, Antioxidant status.

AYSA-03

Assessment of residual feed intake (RFI) as selection trait for developing feed efficient broiler parent line

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Traditionally, feed efficiency has been evaluated using the Feed Conversion Ratio (FCR). However, in recent years, new traits such as Residual Feed Intake (RFI), Residual Intake and Body Weight Gain (RIG), and Residual Gain (RG) have been introduced for selecting breeding birds. In the past, long-term selection programs at CARI focused primarily on improving body weight in broiler parent lines. After more than 30 years of intensive selection for growth, the genetic improvement in body weight has reached a plateau, with little scope for further progress. This makes it essential to shift the focus towards enhancing feed efficiency, especially considering the rising competition for human food resources, increasing feed prices, limited availability of raw materials, and growing market demand for poultry products. Among the newly developed efficiency traits, RFI has gained importance as it provides a more accurate and heritable trait of feed efficiency. Unlike ratio based traits, RFI is calculated using linear regression, which overcomes the statistical limitations of ratio measures. Therefore, the current breeding objective is to improve broiler parent lines by integrating selection for body weight (after 21 generations of improvement in the CSML line) with efficiency traits such as RFI. The aim of the experiment was to combine the genetic basis of RFI with genes related to feed efficiency in chickens. The work was conducted at ICAR-CARI, Izatnagar, using 100 CSML broiler parent chicks (21st generation) from the germplasm unit. Chicks were reared individually under a CRD for 12 weeks on two ICAR-standard diets. Body weight and feed intake were recorded biweekly, and feed efficiency traits (FCR, RFI, RG, RIG) were assessed over 10 weeks to rank birds as high feed efficient (HFE) and low feed-efficient (LFE). At 12 weeks, birds were ranked by feed efficiency traits, with the top 20% classified as HFE and the bottom 20% as LFE. Six birds from each group were then sacrificed to collect jejunum tissue for studying nutrient transporters, gut development, and growth-related genes. HFE birds showed significantly better performance, with 7.87% higher body weight gain, 9.96% lower feed intake, 17.25% better FCR, and improved values for RFI (179.86%), RG (220.03%), and RIG (182.50%) compared to LFE birds. Body weight gain was positively correlated with feed intake and RG, but negatively with FCR, while RFI was positively correlated with feed intake and FCR and negatively with RIG. Gene expression analysis by real-time qPCR revealed upregulation of SGLT1 (nutrient transporter) and GHRL (growth-related) genes, and downregulation of CDx (gut development) genes in HFE birds,

suggesting their role in feed efficiency. Economically, HFE birds consumed 735.5 g less feed and gained 170.55 g more body weight than LFE birds, resulting in a saving of ₹61.55 per bird over 2–12 weeks, or ₹6,156 for 100 birds, highlighting the potential for large-scale economic benefits. The findings of the study confirm that selecting parent birds based on a combination of multiple feed efficiency traits (RFI, FCR, RG, and RIG) is more effective for improving both growth performance and economic returns than relying on a single trait. High feed-efficient CSML birds consistently demonstrated superior performance, including reduced feed intake, improved FCR, and greater body weight gain, resulting in significant cost savings in poultry production.

Keywords: CSML, Feed Efficiency, Residual Feed Intake, SGLT1, GHRL, CDx, Broiler Chickens.

AYSA-04

Effect of dietary supplementation and *in ovo* feeding of L-carnitine on colour, texture, chemical composition and lipid profile of breast muscle (*pectoralis major*) and thigh muscle (*iliotibialis*) of commercial broilers during summer

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L-carnitine is responsible for beta-oxidation of long-chain fatty acids to produce energy thereby exhibiting muscle sparing effect in overall growth, production and performance of broilers. This study was done to assess the impact of *in ovo* and post-hatch L-carnitine supplementation on physicochemical properties of broiler meat. The research aims to identify L-carnitine effect on fat deposition for enhanced consumer's acceptance and market value of broiler production. Five hundred fertile broiler eggs were incubated, and on 18th day, eggs were divided into three groups: un-injected control (UC), sham-injected (SC) and injected L-carnitine (INC). After hatching, 270 day-old-chicks were divided into two subgroups: control diet (T1), control diet with L-carnitine supplementation (T2) -each with three replicates of 15 birds. The average dry and wet bulb temperature was 41.5°C and 25°C respectively. Following slaughter, instrumental color (Hunter Colorimeter); texture (Texture Profile Analyzer); crude protein (%), ether extract (%), total ash (%) (AOAC, 2019); and fatty acid profile (Shimadzu GC-2014) of breast and thigh muscles were studied. Redness value of thigh muscle in dietary LC supplemented group (T2) was significantly higher ($P<0.050$) than that of basal diet group(T1). The work of shear value of thigh muscle in T2 was significantly higher ($P=0.033$) than that of T1. Crude protein (%) values of thigh muscle of birds in UC with T1 were significantly higher ($P=0.032$) than that of UC with T2, and INC with T1 or T2 groups. Ether extract (%) values of breast muscle of birds of INC with T1 or T2 were significantly lower ($P=0.002$) than that of birds of UC with T1 or T2. Ether extract (%) values of thigh muscle of birds subjected to T2 were significantly lower ($P=0.012$) than the T1 birds. Ether extract (%) values of thigh muscle of birds subjected to INC and T2had significantly lower ($P=0.029$) values than that of UC with T1. Total ash (%) values of breast muscle of birds of INC were significantly higher ($P=0.008$) than that of UC group. Total ash percent values of breast muscle were significantly higher ($P=0.016$) in birds of INC with T1 than UC. Saturated fatty acidspercent were significantly lower ($P=0.002$) while mono unsaturated fatty acids percent ($P=0.013$), poly unsaturated fatty acids percent ($P<0.001$) and omega-6 fatty acids percent ($P<0.001$) were significantly higher in breast muscle of birds subjected to INC with T2 as compared to UC birds. Dietary supplemented L-carnitine group led to significantly higher redness value of thigh muscle. Combined *in ovo* and dietary supplementation of L-carnitineled to significantly lower ether extract percent and significantly higher total ash percent in breast and thigh muscle. Further, SFA percent was significantly lower and MUFA, PUFA and omega-6 FA percent were significantly higher in breast muscle of birds subjected to dietary L-carnitine supplementation during summer.

Keywords: *In ovo* feeding, L-carnitine, Texture, Fatty acid profile, Thigh muscle.

AYSA-05

Evaluation of shelf life and its ameliorative strategies of egg

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India is one of the world's top poultry producers, ranking 3rd in egg and 5th in meat production, contributing 30% to the country's agricultural GDP. Valued at $28.18B in 2022, the industry is projected to reach $44.97B by 2028. Southern India, the "Egg Basket" of the nation, supplies most eggs, which are transported across thousands of kilometres. However, poor infrastructure, inadequate cold storage and transport delays lead to major losses—around 6.03% of total eggs, valued at ₹3,287.32 crores annually.Weak regulation and lack of investment in cold-chain systems worsen the situation, hurting both farmers and the industry. To tackle this, we tested CARI EGG SHIELD, a patented herbal spray (Patent No. 202311066448) designed to coat eggs and extend their shelf life. In our study at ICAR-CARI, 1,200 fresh eggs were collected, out of which 600 were treated with the spray remaining are kept as it is in cold storage (10-15°C). Immediately after collection from farms eggs are examined internally and externally. After one month of cold storage, these eggs were monitored under two different temperatures of ambient temperature and cold storageon every six days. External quality indicators like Air cell diameter, Egg Weight and Specific Gravity were significantly higher ($P<0.05$), Egg Color, Shape Index shows no any changes. Internal quality indicators like Haugh Unit, Yolk Index, Albumin Index, Albumin weight, yolk Weight and pH shows significant effect ($P<0.05$) due to storage, while the yolk color shows no changes. Shell integrity remained unchanged, confirming no structural damage during storage. Microbial parameter like TPC and *E.coli*count shows significant effect ($P<0.05$) on Storage of 30 days post cold storage. Results were significant Sprayed eggs stored at 10–15°C stayed fresh two to three weeks longer than untreated eggs, while those at room temperature (26.5°C) lasted a week longer. This study proves that herbal sprays combined with proper cold storage can effectively reduce egg spoilage, save farmers money and boost India's poultry sector.

Keywords: Poultry, Egg Losses, Cold Storage, Herbal Spray, Shelf Life.

AYSA-06

Effect of dietary inclusion of fermented toasted guar meal on growth performance and gut health of commercial broiler chicken

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Inadequate availability and escalating prices of quality feed ingredients have made it increasingly difficult to formulate a balanced and least-cost poultry feed. This scenario encourages the exploration of alternative feed resources instead of traditional sources. Guar meal (GM) emerges as a promising alternative to soybean meal in poultry diets due to its widespread availability and favorable nutritional characteristics, including a crude protein (CP) content of 35–45% and an excellent blend of amino acids, particularly higher lysine and arginine content. However, guar bean contains some anti-nutritional factors like trypsin inhibitor and galactomannan (guar gum), which affects the FCR and growth performance in broilers. Effective strategies such as toasting or fermentation, can enhance the incorporation of GM into poultry rations. The present study was conducted to assess the scope of utilizing toasted and fermented toasted guar meal (FTGM) as a protein supplement in the diet of broiler chicken. A total of 250 day-old commercial broiler chicken (Vencobb 430Y) were randomly distributed into 5 dietary treatment groups with 10 replicates/treatment (5 birds/replicate). The dietary treatments were T1- control diet, T2- TGM inclusion @ 15%, T3- TGM 20 %, T4- FTGM 15% and T5-FTGM 20%. All the rations made are isocaloric & isonitrogenous. Feed and water are provided *ad libitum*. Dietary inclusion of TGM at 15 and 20%, significantly ($P<0.01$) depressed the BWG of broilers. The FTGM inclusion at 15 %, improved the BWG and was comparable to the control group. However, the FTGM inclusion at 20 % did not

improve the BWG when compared to the unfermented TGM 20 group. The dietary inclusion of TGM or FTGM at 15 and 20 % significantly depressed the feed intake when compared to the control group. Significantly (P<0.01) poorer FCR was observed in the TGM 15 and 20 included groups. Feeding of FTGM 15 diet, significantly improved the FCR, which was comparable to the control group. Dietary inclusion of 20 % FTGM did not improve the FCR when compared to the TGM 20 group. The *Lactobacillus* count (log10 CFU/g) was significantly higher and the *E. coli* count and caecal pH were significantly lower in the FTGM diet fed groups when compared to the control and TGM diet fed groups. The inclusion of FTGM in the diet of broilers, improved the intestinal histomorphometry by increasing the villus height (VH), decreasing the crypt depth (CD) and by increasing the VH: CD ratio in the duodenum, jejunum and ileum of broilers when compared to control diet fed birds. FTGM can included up to 15% in broilers diet without showing any adverse effects on performance, with an improved gut health.

Keywords: Fermented toasted guar meal, growth performance, intestinal morphology, broilers, microbial count.

AYSA-07

CRISPR/Cas9-mediated *DMRT1* gene knockout in chicken germ line: A step towards sex-controlled breeding

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The poultry layer industry faces a significant ethical and economic challenge arising from the large-scale culling of male chicks**,** which are non-productive for egg production. Globally, billions of male chicks are eliminated shortly after hatching**,** leading to substantial animal welfare concerns and economic losses**.** Consequently, the development of strategies enabling female-only chick production has become an urgent priority for sustainable poultry breeding. The *DMRT1* gene**,** a pivotal regulator of testicular differentiation and sex determination in chickens, represents a promising molecular target for genome editing approaches aimed at mitigating this issue. Targeted manipulation of *DMRT1* using CRISPR/Cas9-mediated genome editing could offer a novel pathway toward sex-controlled breeding and ethical improvement in the poultry industry. The present study characterized the *DMRT1* gene in the IWH line of White Leghorn chicken, standardized the *in vitro* chicken primordial germ cells (PGCs) culture and disrupted the*DMRT1* gene in vitro in the chicken PGCs through CRISPR/Cas9 system. Genomic DNA and RNA were isolated from gonadal tissues for gene characterization, while PGCs were isolated from embryonic blood of incubated eggs at HH stages 14–16 and maintained under feeder-free conditions. Gene-specific primers were designed for surface specific antigens to characterize cPGCs. The CRISPR/Cas9 construct targeting exon 1 of *DMRT1* was developed, cloned, and transfected into PGCs using electroporation for producing targeted mutagenesis of *DMRT1* gene. The *DMRT1* gene sequence of the IWH line exhibited high conservation with NCBI reference sequences, showing few silent mutations. The chicken PGCs maintained their germline identity, as verified by the expression of marker genes such as SOX2, NANOG, BLIMP1, VASA, and CXCR4. Thus, the procedure of cPGC culture in feeder layer free medium was successfully established which was used for further experiments. The transfection of PGCs with sgRNA in the CRISPR/Cas9-system targeting exon 1 of *DMRT1* gene resulted in successful genome editing. Expression of the ZsGreen1 reporter gene under fluorescence microscopy validated the efficient construct incorporation. This was further confirmed by Sangers sequencing which reiterated the sequence disruptions at the 196th and 199th nucleotide positions in *DMRT1* gene. These results collectively demonstrate successful in vitro gene editing of a sex-determining gene, *DMRT1* in chicken primordial germ cells. The present study successfully established a feeder-free in vitro culture system for chicken primordial germ cells (PGCs) and achieved targeted mutagenesis of the *DMRT1* gene through CRISPR/Cas9-mediated genome editing**.** This work represents a significant advancement toward the generation of genome-edited poultry lines capable of female-only progeny production**,** male chick culling in the layer industry. The current attempt and approach for sex-controlled breeding offers a sustainable and ethically responsible solution**,** with the potential to enhance productivity, reduce economic losses, and improve animal welfare in commercial poultry production.

Keywords: *DMRT1*, CRISPR/Cas9, primordial germ cells, genome editing, sex-controlled breeding.

AYSA-08

Effect of dietary calcium level on ileal digestibility of calcium and phosphorus from dicalcium phosphate in broiler diet

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This study investigated the digestibility of calcium (Ca) and phosphorus (P) in broilers fed diets containing dicalcium phosphate (DCP) with and without balancing Ca levels using limestone. The digestibility of DCP cannot be accurately determined when calcium levels are balanced, particularly using the direct method, so this study also compared the digestibility of calcium in DCP using direct and difference methods while balancing only phosphorus level as practiced in practical broiler diets. A total of 400 Cobb 430Y broilers were assigned to eight dietary treatments varying in Ca and P concentrations, including a Ca- and P-free control to assess endogenous mineral losses with addition of Titanium as a indigestible marker. Ileal content was then collected and analysed for Dry matter, Calcium, Phosphorus and Titanium. Titanium recovery, used as an indigestible marker, was consistent at 92.65%, confirming its reliability. Ileal endogenous losses of calcium and phosphorus were 119.67 and 85.56 mg/kg DMI. Apparent ileal digestibility (AID) and true ileal digestibility (TID) of calcium showed no significant improvement when calcium was balanced at phosphorus levels of 0.42% and 0.45%, with AIDCa and TIDCa values of 70.85% and 71.06% (T2) versus 73.1% and 73.23% (T5), and 67.88% and 68.10% (T3) versus 70.54% and 70.67% (T6), respectively. At 0.40% phosphorus, higher calcium (0.88% in T7) significantly reduced AIDCa to 66.96% compared to 73.85% in T4 with 0.50% calcium. Pooled phosphorus-only balanced diets had slightly higher mean calcium digestibility (AID 70.86%, TID 71.08%) compared to calcium-phosphorus balanced diets (AID 70.22%, TID 70.33%), though differences were not statistically significant. The difference method, accounting for endogenous calcium losses, provided more accurate calcium digestibility estimates with 70.35% digestibility compared to the direct method's 67.88% digestibility, indicating difference with change in methodology. Phosphorus digestibility was significantly greater ($p<0.05$) in P-balanced diets with reduced Ca (AID 80.43–84.28%, TID 80.64–84.50%) compared to Ca-P balanced diets (AID 74.08–77.48%, TID 74.29–77.68%), peaking at 0.50% Ca and 0.40% P. Mean P digestibility was 81.72% (AID) and 81.93% (TID) in P-only diets versus 75.27% and 75.47% in Ca-P balanced diets, indicating excess Ca impairs P bioavailability by forming insoluble complexes. Serum phosphorus remained stable across all treatments ($p>0.05$), while serum calcium varied significantly. ($p<0.05$) The Ca- and P-free diet induced highest serum Ca, likely due to bone mobilization, whereas lowest serum Ca was observed with the lowest dietary P, underscoring phosphorus's role in calcium absorption and homeostasis. This study highlights the importance of calcium and phosphorus levels in diets on ileal digestible coefficients of Ca and P in dicalcium phosphate for commercial broiler chicken. Excessive calcium can hinder phosphorus absorption by forming insoluble calcium-phosphate complexes, which may reduce the digestibility of both minerals. The digestible coefficient of Ca by the difference method is higher (70.35% %) than that by the direct method (67.88%) marking the difference between two methodologies.

Keywords: Broiler, calcium, phosphorus, dicalcium phosphate, digestibility.

AYSA-09

Effect of essential oil nanoemulsion on growth and gut health of broilers

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The burgeoning global population necessitates the sustainable agricultural practices to meet escalating food demands. In this regard, the poultry sector, being a cornerstone for efficient animal protein production, has gained high attention. But the poultry industry is facing one of the critical challenge of antimicrobial resistance (AMR) due to excessive use of antibiotic growth promoters (AGPs), directing the search for alternatives. The essential oils nanoemulsion has the potential in this regard. The present study was designed to prepare and characterize the *Mentha longifolia* (MLEO) and basil essential oil (BEO) based nanoemulsion formulation and investigate its effect on growth and gut health of broilers as a substitute of AGP. Post procurement, GC-MS and FICI of both the oils were analyzed. The nanoemulsion was

prepared using Tween-80 (surfactant) and ultrasound homogenization. In-vivo feeding study was conducted for 42 days with day old CARIBRODHANRAJA broiler chicks (N=240), divided into six dietary treatments *viz.,* T1: basal diet, T2: basal diet + chlortetracycline-335mg (Antibiotic control), T3: basal diet + 25 µl nano-formulation, T4: basal diet + 50 µl nano-formulation, T5: basal diet + 75 µl nano-formulation and T6: basal diet + 100 µl nano-formulation. The number of replicates was five for each treatment comprising eight birds per replicate. Weekly body weight and phase wise weight gain observed. Gut health and caecal microbiology determined following standard protocol. The dominant volatile compounds of MLEO and BEO were octanoic acid (33.80%) and estragole (89.36%) respectively. The FICI value of both the EOs against the poultry field isolates was 0.70±0.07 (0.25−1) whereas for the reference strain *E. coli* ATCC-25922 the FICI value was 0.5. The optimized nanoemulsion had the peak size of 55.23±19.76 nm and Z-average value of 104 nm. The zeta potential and PDI value were -17.6±7.17 mV and 0.208 respectively. The in-vivo study revealed that the body weight on 3rd week was significantly ($p<0.05$) higher in T2 group followed by T4 group whereas on 4th and 5th week both the groups significantly ($p<0.05$) performed better compared to the other groups. The nanoemulsion fed groups showed significantly ($p<0.05$) higher body weight compared to the control group on 6th week. During first phase (1-3rd week) significantly ($p<0.05$) higher body weight gain was observed in T2 group whereas in the finisher phase (4-6th week), the T4 group showed significantly ($p<0.001$) higher body weight gain. The cumulative body weight gain of all the treatment groups was significantly ($p<0.001$) comparable with the control group. The intestinal weight (gm) was significantly ($p<0.05$) higher in T3 and T4 groups whereas the intestinal length (cm) remained unaffected among the treatment group. Significantly ($p<0.001$) lower coliform and higher ($p<0.05$) lactobacillus count (log10 cfu/gm) was observed in nanoformulation fed groups. The total plate count was also significantly ($p<0.05$) lower in all the nanoemulsion fed groups compared to control and antibiotic groups. The recent investigation suggests the suitability of the use of essential oil based nanoemulsion formulation as an alternative of AGPs in poultry feed for sustainable poultry production and has potential implication for both industrial practices and consumer preferences. The supplementation of 50µl of nano-formulation per Kg feed had promising result in growth performance and gut health of broiler.

Keywords: Antimicrobial resistance, *E. coli*, Essential oil, Nanoemulsion, Broiler.

AYSA-10

Innovative strategies using organic agricultural waste and lime for control of housefly at poultry farm

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The intensification of poultry farming has resulted in the accumulation of large volumes of poultry waste, which creates favorable conditions for housefly (*Musca domestica*) proliferation and poses risks to farm hygiene and public health. Feces moisture is a key factor influencing fly breeding, and identifying practical strategies for moisture reduction is critical. This study evaluated the effectiveness of organic agricultural residues and lime powder in lowering poultry feces moisture and suppressing housefly development. Controlled experiments were conducted at the Poultry Research Farm, Department of Livestock Production Management, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. A preliminary three-week trial tested paddy straw, rice husk, lime powder, a blend of all three in equal proportions, and a combination of paddy straw with rice husk at application rates of 4%, 8%, and 12%. Based on preliminary outcomes, 8% applications were selected for a four-week trial (late May to June), followed by one week of post-treatment monitoring. Feces moisture, temperature, adult fly counts, and in vitro larval counts were recorded on Day 0 (pre-treatment), Day 1 (application), Day 2, Day 5, and Days 8, 11, and 14 after the final treatment. The 8% lime powder dusting produced the most significant effect, reducing feces moisture to 36.38% by the fourth week compared with 62.51% in the untreated control. A rapid decline to 29.48% was observed within one day of lime application. Feces temperature was only marginally influenced, with a slight decrease to 32.93°C in lime-treated groups. In vitro larval counts showed inconsistent reductions across most treatments; however, lime powder caused a pronounced decline beginning one day post-application, which persisted up to Day 14 without reapplication. Dusting of lime powder at 8% of fecal weight is an effective, economical, and locally available method for reducing poultry feces moisture, thereby creating unfavorable conditions for housefly breeding. The findings highlight lime powder as a practical component of integrated housefly management strategies in intensive poultry farming systems.

Keywords: Dusting, Feces Moisture, *Musca domestica*

AYSA-11

Development and evaluation of a species-specific synbiotic formulation to enhance performance in commercial broiler chicken

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India's poultry industry has become one of the largest globally, yet it continues to face challenges such as antibiotic resistance, climate-related stress, rising feed costs, and increasing consumer demand for antibiotic-free products. To meet these challenges, strategies that enhance gut health, improve body weight gain, and optimize feed conversion ratio (FCR) hold considerable promise. Among such strategies, synbiotics – formulations that combine probiotics and prebiotics – are increasingly recognized as effective feed supplements for poultry. This study was undertaken at ICAR-Central Avian Research Institute, Izatnagar to develop and evaluate a novel synbiotic product tailored for broilers, with a focus on its effects on growth performance, gut health, and immune competence. Forty *Lactobacillus* isolates from various gut segments of healthy chickens (crop, proventriculus, ileum, caeca) were screened for probiotic potential based on auto-aggregation, co-aggregation, cell surface hydrophobicity, acid and bile tolerance, enzymatic activity, safety (hemolysis, antibiotic sensitivity), and sugar fermentation profiles. On the basis of the probiotic potency assessment, the most promising bacterial isolate was selected, combined with a prebiotic, and stabilized using thermal protectants. The resulting synbiotic formulation was subsequently subjected to spray-drying to obtain a stable powdered product. Feeding trials with lab prepared synbiotic powder were conducted over 42 days using Cobb-430 broiler chicks (N = 224), randomly allocated across seven dietary treatments: basal diet (control, T_1), basal diet plus chlortetracycline (T_2), basal diet with prebiotic (T_3), basal diet fermented with selected *Lactobacillus* isolate (T_4), and basal diet supplemented with synbiotic at 0.5, 1.0, and 1.5 g/kg feed (T_5–T_7). Performance parameters including body weight, feed intake, FCR, mortality, blood biochemical indices, carcass traits, gut histomorphology, gut microbial populations, and immune responses were recorded. The data were analyzed by one-way ANOVA, and mean differences were compared using Duncan's Multiple Range Test in SPSS. The most potent isolate, IL-3, was identified as *Lactobacillus salivarius* through whole-genome sequencing, with confirmed the absence of clinically relevant virulence genes, confirming its probiotic suitability. The synbiotic powder yielded a viable probiotic count of 1.47×10^8 CFU/g which maintained its viability up to four weeks of storage under refrigeration. The farm trial demonstrated that synbiotic supplementation, particularly at 1.5 g/kg (T_7), significantly enhanced growth performance compared to control and antibiotic-fed groups. Birds in T_7 achieved superior body weights at six weeks (2230.83 ±25.14 g; $p < 0.001$) and demonstrated an improved FCR (1.52). Further, blood biochemical profiles revealed enhanced glucose, hemoglobin, and albumin levels, indicating better metabolic and health status. Synbiotic-fed groups exhibited a favorable modulation of gut microflora, marked by increased *Lactobacillus* populations and reduced coliform counts. Histological analysis revealed improved intestinal villus height-to-crypt depth ratios, suggesting enhanced nutrient absorption efficiency. Immune assessments showed significantly higher antibody titers against sheep red blood cells in T_6 and T_7 groups. Additionally, supplementation with 1.5 g synbiotic product resulted in the highest, carcass weight (1882.05 ± 27.19 g), drumstick (229.39 ± 4.53 g), breast (433.35 ± 11.17 g), liver (50.68 ± 1.11 g), gizzard (52.15 ± 1.28 g), bursa (4.54 ± 0.33 g), intestine weight (135.81 ± 7.52 g), and intestine length (250.20 ± 3.70 cm), confirming that supplementation with 1.5 g synbiotic product provided the best overall performance for growth, feed efficiency, gut health, and carcass traits. The developed synbiotic, combining *Lactobacillus salivarius* and a prebiotic, improved growth, gut health, and immunity in broilers, presenting a sustainable alternative to in-feed antibiotics for profitable, antibiotic-free poultry production.

Keywords: Synbiotic, *Lactobacillus salivarius*, broiler performance, gut health, immune response.

Abstracts for Kothandaraman Award-2025

KA-01

Deciphering the gene transcripts responsible for asymmetrical ovarian development in duck

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Ovarian asymmetry is a distinctive feature of birds, where only the left ovary develops into a functional reproductive organ while the right ovary regresses during embryonic growth. Although this phenomenon is evolutionarily significant, the molecular basis underlying right ovarian degeneration in ducks remains largely unexplored. The present study aimed to decipher the transcriptomic mechanisms responsible for this process in *Anasplatyrhynchos* embryos. Ovarian tissues were collected on the 26th day of incubation and subjected to high-throughput RNA sequencing using the Illumina platform. Sequencing reads were quality-filtered and aligned to the duck reference genome, followed by quantification of gene expression and identification of differentially expressed genes (DEGs) using standard bioinformatics pipelines including *FastQC*, *fastp*, *HISAT2*, *feature Counts*, and *DESeq2*. Functional enrichment analysis was performed through *g:Profiler* and *ShinyGO*, while RT-qPCR validation was used to confirm the expression of six key genes (*CASP3*, *LEAP2*, *DAZL*, *DDX4*, *IL-1β*, and *NGF*). Transcriptome analysis revealed 582 DEGs, including 259 genes upregulated and 323 downregulated in the right ovary compared with the left. Genes upregulated in the right ovary were predominantly associated with extracellular matrix (ECM) remodelling, apoptosis, vascular regression, and cytoskeletal organization, with notable contributors such as *MMP2*, *MMP7*, *ACTA2*, *FOXA1*, and *THBS2*. Conversely, genes critical for ovarian development, germ cell survival, and hormonal signalling such as *WT1*, *EMX2*, *LHX8*, *TP63*, *IRX5*, and *WNT16* were significantly downregulated, reflecting the loss of developmental potential and germ cell maintenance in the regressing ovary. Enrichment analyses further highlighted altered transcriptional regulation, peptide hormone signalling, and nervous system pathways, suggesting complex molecular interactions driving ovarian regression. Genes related to muscle tissue development (*MYH11*, *MUSTN1*, *ACTA2*) were also highly expressed, implying cytoskeletal restructuring during the degenerative process. RT-qPCR results supported the RNA-seq data, confirming that *CASP3* and *LEAP2* were upregulated, whereas *DAZL*, *DDX4*, *IL-1β*, and *NGF* were downregulated in the right ovary. Right ovarian regression in ducks is not a passive degenerative event but an active, genetically programmed process characterized by increased apoptotic and ECM-degrading activity alongside suppression of developmental and survival pathways. This study provides the first comprehensive transcriptomic insight into the late embryonic stage of ovarian regression in ducks and identifies key candidate genes (*MMP7*, *ACTA2*, *WT1*, *LHX8*, and *WNT16*) that could serve as valuable targets for future molecular and evolutionary research on avian reproductive asymmetry.

Keywords: Duck, Ovarian asymmetry, Transcriptome, Apoptosis, Gene expression.

KA-02

Genetic diversity and phylogenetic analysis of Tellicherry chicken using complete mtDNA D-Loop sequences

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Indigenous chicken breeds represent a reservoir of adaptive traits such as disease resistance, climate tolerance, and adaptability. Conserving this diversity is critical for long-term poultry improvement and resilience to emerging challenges. Genetic diversity data, particularly from molecular markers like the mitochondrial DNA D-loop, provides insights for designing effective conservation and breeding strategies. Genetic characterisation of Tellicherry chicken, the only registered indigenous breed of Kerala, is essential to inform conservation strategies and ensure sustainable utilisation. Blood samples were collected from 150 Tellicherry chickens, along with red native and multicoloured

chickens for comparison. Genomic DNA was extracted, and the complete mtDNA D-loop region was amplified by PCR and sequenced using Sanger sequencing. Forward and reverse reads were aligned to the chicken reference genome (NC_007235), and sequence editing was performed in MEGA11 and BioEdit. Population genetic parameters, including polymorphic sites, haplotypes, nucleotide diversity (π), haplotype diversity (Hd), and neutrality statistics, were estimated using DnaSP v6. Phylogenetic analysis was conducted with the Maximum Likelihood method under the TN+F+I+G4 model with bootstrap replication. Sequencing yielded high-quality D-loop sequences of 1231–1232 bp in length, with a deletion observed at position 859 in several samples, consistent with previous findings in Nicobari, Jiangsu, and Philippine native chickens. Thirty-four polymorphic sites were identified, comprising three singleton sites and 31 parsimony-informative sites. Nucleotide diversity (π) was 0.00500 and the mean number of pairwise nucleotide differences (k) was 6.160, indicating moderate variability but high sequence conservation (97.2%). A total of 24 distinct haplotypes were identified in Tellicherry population, with haplotype diversity (Hd) estimated at 0.862. Haplotype 3 was predominant, represented by 48 individuals (32% of the sample), while eight haplotypes occurred as singletons, reflecting both common maternal lineages and rare genetic variants. This pattern mirrors findings in Nicobari and other native chicken populations, where a mix of dominant and unique haplotypes contributes to overall genetic richness. Neutrality tests revealed no significant departures from equilibrium (Tajima's D = 0.03476; Fu's Fs = –0.508), suggesting that diversity is largely shaped by mutation and genetic drift, with no evidence of recent selection or population expansion. Phylogenetic reconstruction grouped Tellicherry chickens within haplogroups B, C, D, and E. Their wide haplogroup distribution indicates diverse maternal origins, historical admixture, and possible introgression from East and Southeast Asian chicken lineages. In contrast, red native poultry clustered tightly, showing lower diversity, while multicoloured poultry displayed intermediate variation. This study presents the first comprehensive mtDNA D-loop based assessment of genetic diversity in Tellicherry chicken, revealing moderate nucleotide diversity, high haplotype diversity, and maternal lineages across multiple haplogroups. These results underscore its evolutionary complexity and adaptive potential, emphasising its value as an indigenous genetic resource. The findings provide essential information to guide haplotype conservation, support informed breeding strategies, and prevent loss of unique maternal lineages. Similar studies in other native breeds are critical to safeguard India's valuable poultry germplasm.

Keywords: Tellicherry chicken, mitochondrial DNA, D-loop, haplotype diversity, phylogenetic analysis.

KA-03

Effects of α-Tocopherol supplementation on semen attributes using Quail egg yolk plasma in Aseel cChicken

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Elevating poultry production capacity hinges on incorporating superior germ plasm into progeny, readily facilitated by utilizing outstanding roosters. Semen preservation during cold shock causes damages to the membrane of the sperm cell. Vitamin E is a natural antioxidant, ameliorates oxidative stress in spermatozoa to maintain optimum fertilizing ability (Biswas et al 2007). Since, studies in poultry semen are limited, so it was undertaken to assess the effects of α-Tocopherol supplementation in poultry semen at 4°C. Semen of ten Aseel roosters (36-40 weeks) was collected, maintained Poultry Research Farm, Directorate of Livestock Farms, GADVASU and only with > 70 % motility was pooled in Tris –citric acid-fructose buffer with QEYP (Quail Egg Yolk Plasma). The extended pooled semen was divided into 5 treatments (T). T1 as control group without any vitamin E addition. For T2 to T5 groups 0.5 %, 1 %, 2 % and 3 % vitamin E (w/v) was added and evaluated for different semen attributes at different intervals. Data of various sperm attributes was analyzed by one way ANOVA using SPSS24 program. The supplementation of the α-Tocopherol in different levels to the Tris based quail egg yolk plasma (T-QEYP) extender in poultry semen on spermatozoa quality was evaluated during storage of semen at 4°C for 0, 24,48 and 72 hours. T1 was a control group without any α-Tocopherol addition. For T2 to T5 groups, 0.5 %, 1 %, 1.5 % and 2 % vitamin E (w/v) were added respectively. Treatment groups were evaluated for sperm motility, viability, abnormalities, plasma membrane integrity, acrosome integrity and DNA integrity at 0, 4, 24, 48 and 72 hours of incubation at 4°C. The evaluations of spermatozoa immediately after semen collection and at 4 hours revealed no significant differences among values of treatment groups, whereas after incubating the treatments for longer spans of time, the sperm

progressive motility and viability rates for groups supplemented with α-Tocopherol were significantly ($P < 0.05$) higher than that of the control group. Sperm motility, viability, abnormalities, plasma membrane integrity, acrosome integrity and DNA integrity were significantly higher in 1.5% α-Tocopherol concentration. According to the results of this study we concluded that, the most excellent level of α-Tocopherol for supplementation to the extended semen of poultry in order to improve the sperm motility and viability plus to reduce the morphological defect rates of the spermatozoa up to 72 hours storage time at 4°C is 1.5%. Semen obtained from Aseel roosters supplemented with α-Tocopherol characterized better resistance to storage at 4°C which is reflected by better motility, viability, plasma membrane integrity, acrosome integrity and DNA integrity of spermatozoa after semen storage for 72 hours. 1.5 % (w/v) level of α- tocopherol supplementation improves the sperm attributes upto 72 hours at 4°C storage. Addition of antioxidant could improve quality and longevity of sperms in chilled poultry semen.

Keywords: α-Tocopherol, Chilled Semen, Aseel breed, Sperm Attributes.

KA-04

Effect of dietary supplementation of fenugreek seed powder on growth performance and gut health in broiler chicken

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Fenugreek (*Trigonella foenum graecum*), rich in saponins, flavonoids and alkaloids with antimicrobial, antioxidant and anti-inflammatory properties, has shown potential to improve feed efficiency, weight gain and immunity. However, its effects on gut health and overall production performance are less explored, making it a promising candidate for sustainable poultry nutrition and an alternative to antibiotic growth promoters. A study was conducted at the Department of Poultry Science, Mannuthy, using 160 day-old Vencobb-430Y broiler chicks randomly assigned to five dietary treatments with fenugreek seed powder (0, 2.5, 5, 7.5 and 10 g/kg diet). Weekly body weight, feed intake, mortality, FCR, and livability were recorded. On day 42, blood samples from eight birds per group were collected for serum analysis and another eight were sacrificed to assess carcass traits, meat quality (pH, water-holding capacity, drip loss, cooking loss) and ileal digesta (pH, *Lactobacillus*, *E. coli*). Techno-economic evaluation of treatments was also performed. The dietary supplementation of fenugreek seed powder at 5 g/kg basal diet significantly ($p<0.05$) improved body weight, body weight gain and better FCR during the first and third weeks compared to other dietary treatments. Consequently, this supplementation also resulted in higher cumulative mean body weight gain and better cumulative mean FCR from 1 to 3 weeks. In contrast, birds supplemented with 2.5 g of fenugreek seed powder per kg basal diet showed improved body weight, body weight gain and better FCR during the second week. Feed consumption was not affected, except during the second week, when the birds in the group supplemented with 10 g of fenugreek seed powder per kg basal diet recorded the highest value. The techno economic analysis revealed that birds supplemented with 5 g of fenugreek seed powder per kg basal diet yielded the highest net profit per kg body weight compared to the other dietary groups. Supplementation of fenugreek seed powder at these inclusion levels did not cause any significant differences in serum lipid profile and protein levels, carcass characteristics, immune organs yield, meat quality or intestinal microbial count and pH. supplementation of 5 g of fenugreek seed powder per kg basal diet can be recommended during the pre-starter and starter phases of broilers to improve growth performance and net profit.

Keywords: Fenugreek seed powder, Meat quality, Feed conversion ratio, Gut health, Techno-economic analysis.

KA-05

Effect of supplementing different antioxidants on performance, antioxidant status and immune response in broiler chicken

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Broiler production is a major source of affordable animal protein but rapid growth, intensive farming and environmental stress induce oxidative stress, impairing growth and immunity. Dietary antioxidants help neutralize reactive oxygen

species, enhancing performance and health. Natural (turmeric) and synthetic antioxidants (zinc, chromium, vitamin E, selenium) are widely used to improve growth, feed efficiency, and immune status in poultry. This study evaluated the effects of supplementing these antioxidants on growth, antioxidant status, immunity and economics in commercial broilers. A total of 240 day-old Cobb-400 broiler chicks were randomly allotted to six dietary treatments with eight replicates of five birds each. Diets included a control and the control supplemented with turmeric powder (7.5 g/kg), zinc (100 mg/kg), chromium (1.5 mg/kg), vitamin E (100 mg/kg) or selenium (0.15 mg/kg). Iso-nitrogenous and iso-caloric pre-starter, starter and finisher diets were fed ad libitum for 42 days. Data on body weight, feed intake, feed conversion ratio, carcass traits, immune responses (HI titre to Newcastle disease, CMI to PHA-P), serum protein, cholesterol and antioxidant enzymes (GSHPx, GSHRx, SOD, lipid peroxidation) were recorded. Statistical analysis used SPSS GLM with Duncan's test at P<0.05**.** The experiment was conducted at the Poultry Experimental Station, Department of Poultry Science, College of Veterinary Science, Rajendranagar, Hyderabad to evaluate the effect of supplementing different antioxidants on growth performance, antioxidant status and immune response in broiler chickens. A total of 240 day-old commercial Cobb-400 broiler chicks were procured, individually weighed, wing-banded and randomly distributed into six dietary treatment groups. Each treatment consisted of eight replicates with five birds per replicate. The treatments included a control diet (CD) and CD supplemented with turmeric powder (7.5 g/kg), zinc (100 mg/kg), chromium (1.5 mg/kg), vitamin E (100 mg/kg) or selenium (0.15 mg/kg). All experimental diets were formulated to be iso-nitrogenous and iso-caloric and were offered in three phases: pre-starter (0–14 days), starter (15–28 days) and finisher (29–42 days). Birds were reared under uniform management conditions with ad libitum access to feed and water. Parameters recorded included weekly body weight, feed intake, feed conversion ratio (FCR), livability, carcass characteristics, and organ weights. Immune responses were assessed by measuring haemagglutination inhibition (HI) titre against Newcastle disease virus and cell-mediated immunity (CMI) using cutaneous basophilic hypersensitivity to phytohemagglutinin. Serum biochemical parameters such as total protein and cholesterol were analyzed along with antioxidant enzyme activities, including glutathione peroxidase (GSHPx), glutathione reductase (GSHRx), superoxide dismutase (SOD) and lipid peroxidation (MDA levels). Data collected were subjected to statistical analysis using the General Linear Model (GLM) procedure of SPSS (version 20) and treatment means were compared using Duncan's multiple range test with significance considered at P<0.05. The study revealed that dietary supplementation of antioxidants significantly improved body weight gain and feed conversion ratio, with turmeric (7.5 g/kg) and zinc (100 mg/kg) showing the best performance. Ready-to-cook yield and ND antibody titres were also higher in these groups, while serum protein, cholesterol, and most antioxidant enzymes remained unaffected except for increased glutathione reductase activity. Economic analysis showed the highest net profit with zinc supplementation, indicating zinc and turmeric as effective antioxidants for enhancing broiler growth and profitability.

Keywords: synthetic antioxidants, broiler chicks, performance.

KA-06

Mitigating coccidiosis in broiler chicken through supplementation of *Lactobacillus acidophilus* derived postbiotics

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Eimeria spp.- the "hidden enemies"-cause coccidiosis, an enteric disease of pandemic significance. The widespread use of coccidiostat (ionophore) to control these conditions has led to resistance, residues and toxicity. Enhancing the "flock health plan" with postbiotics or next-generation probiotics offers a promising, cost-effective alternative. A total of 320-day-old VENCOBB 430Y broiler chicks, randomly divided into 10 groups (T1–T10) with 4 replicates of 8 birds each, having with and without infection of -CONT,+CONT and *LA*PB supplemented groups (0.2%, 0.4%, 0.6% v/w) over 6 weeks. On day 24, birds were orally inoculated with 10000 sporulated mixed *Eimeria* oocysts and ameliorative efficacy of *LA*PB on production, immunological and gut health attributes during coccidiosis challenge were studied. Results revealed the significant improvement in weights, weight gains, and average daily gain and feed efficiency at 0.6% level. Protein and enzymatic profile at 16dpi, immune organ index at 7dpi ($p<0.05$), and antibody titers at 19dpv ($p<0.01$) were increased. Lowered oocyst counts, visual score (bloody diarrhoea) was observed in LAPB (0.6%) and diclazuril-treated groups from 6–11 dpi. Improved INF-γ, total antioxidant capacity and lower corticosterone, intestinal

weight was observed ($p<0.05$) in 0.6% LAPB group. In conclusion, inclusion of 0.6% postbiotic in broiler diets improved performance and reduced the severity of infection. The potential of postbiotics (LAPB 0.6% v/w) usage can augment the coccidiostat in mitigating *Eimeria* mixed infection and to tackle AMR over world-wide.

Keywords: *Eimeria*, Coccidiostat, AMR, Postbiotics, *Lactobacillus.*

KA-07

Effect of *in ovo* feeding and supplementation of inorganic and nano zinc on growth performance, economics and immunity of broilers during summer

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Zinc supplementation plays a crucial role in broiler growth, feed efficiency, and immune function, especially under challenging environmental conditions such as summer. This study was done to assess the impact of *in ovo* and post-hatch zinc ($ZnSO_4$ and nano Zn) supplementation in broilers on growth performance, feed conversion ratio (FCR), and immune responses. The research aims to identify the most effective zinc regimen for enhanced productivity and economic efficiency in poultry production Eight hundred sixty-seven fertile eggs were set for incubation and divided into four treatment groups on day 18 for *in ovo* feeding: un-injected control (UC), sham-injected (SC), $ZnSO_4$-injected (INIZ), and nano Zn-injected (INNZ). After hatching, 432 chicks were assigned to three post-hatch diet groups: basal diet only (T1), basal diet plus $ZnSO_4$ (T2), and basal diet plus nano Zn (T3)—each with three replicates of 12 birds. The average dry and wet bulb temperature was 41.5 ^{0}c and 25 ^{0}c respectively. Growth, FCR, and immune parameters, including hemagglutination titer against goat red blood cells, cell-mediated immune response to PHA-P, IgA, IgG, and IgM concentration were studied using ELISA kit. Birds receiving nano Zn via drinking water (T3) showed significantly higher body weight gain (BWG) ($P<0.008$) compared to zinc sulphate (T2) and controls. Additionally, *in ovo* $ZnSO_4$ injection followed by post-hatch nano Zn supplementation significantly enhanced ($P=0.023$) body weight gain relative to control. FCR improved signifycantly ($P=0.026$) in T3 birds compared to basal diet control, with both T3 and the *in ovo* $ZnSO_4$ group supplemented by nano Zn showing lower feed cost per kilogram live weight gain ($P=0.030$ and $P=0.029$, respectively). *In ovo* feeding of nano zinc significantly increased corticosterone and IgA concentration in birds compared to un-injected control birds without any supplementation. Supplementation of nano zinc resulted in significantly higher serum IgA concentration in birds compared to un-injected control birds. Notably, birds on $ZnSO_4$ diets demonstrated significant increases in humoral (hemagglutination and IgM titers, $P<0.01$ and $P=0.03$) and cell-mediated immunity (PHA-P response, $P=0.01$) compared to those on a basal diet. Nano Zn supplementation significantly enhanced broiler body weight gain and improved FCR, reducing feed cost per kilogram live weight gain. Combined *in ovo* and post-hatch nano Zn administration significantly reduced the cost per kg live weight gain. Inorganic Zn supplementation, significantly elicited humoral and cellular immune responses during summer.

Keywords: Nano zinc; $ZnSO_4$; Broiler; Growth performance; Immunity.

KA-08

Effect of supplementation of synbiotic (β-Glucans, MOS and multi-species probiotic) on growth performance, carcass characteristics and gut health in Broilers

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Over the past few decades, extensive research has highlighted their indiscriminate use as a major driver of antimicrobial resistance and residual contamination in poultry-derived foods. As alternatives, synbiotics comprising a synergistic blend of probiotics and prebiotics have gained attention for their ability to improve host health and productivity. Despite promising outcomes, there remains a paucity of scientific evidence on the integrated use of β-glucans and mannan oligosaccharides (MOS) in combination with probiotic strains. A total of 250day-oldVencobb broilers were

randomly assigned to five treatments: T1 – basal diet, T2 – probiotic (Bacillus subtilis, B. coagulans, B. licheniformis, Saccharomyces boulardii; 200 g/MT), T3 – prebiotic (MOS & β-glucans; 500 g/MT), T4 – synbiotic (200 g/MT), and T5 – antibiotic (lincomycin; 100 g/MT). At 42 days, carcass traits, ileal microflora, immune response, and jejunal histomorphometry were assessed. Microbial counts, villus height, and crypt depth were measured. Data were analyzed by ANOVA and Duncan's multiple range test at P<0.05. The present study demonstrated that feed conversion ratio (FCR) was significantly improved (P<0.05) in broilers supplemented with synbiotics compared to other dietary groups at 42 days of age. In contrast, body weight gain and feed intake did not differ significantly (P>0.05) among the treatments, indicating that the improvement in efficiency was primarily due to better nutrient utilization rather than increased intake. Carcass characteristics and relative organ weights also remained unaffected (P>0.05) by dietary supplementation. Histological evaluation revealed that both synbiotic and antibiotic-supplemented groups exhibited significantly (P<0.05) greater jejunal villus height compared to control birds, whereas crypt depth and villus height-to-crypt depth ratios were not significantly altered. Microbiological analysis of ileal digesta indicated that all supplemented groups showed significantly (P<0.05) reduced *E. coli* counts relative to the control, with the lowest counts in the synbiotic group. Conversely, Lactobacillus populations were significantly elevated, with the highest abundance observed in synbiotic-fed broilers. Based on the results, it was concluded that, synbiotic, a synergistic combination of probiotic and prebiotic (Bacillus subtilis, B. coagulans, B. licheniformis and Saccharomyces boulardii, MOS & β-glucans) can be used as an alternative to antibiotic growth promoters to increase overall performance of broiler chicken when compared to probiotic and prebiotic alone.

Keywords: Synbiotic, growth performance, beta glucan, feed conversion ratio, gut health.

KA-09

Sustainable protein for quails: Black Soldier Fly meal and its economic viability

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Black Soldier Fly (BSF) meal is a valuable alternative protein source for poultry, especially broiler quail, amid scarcity and rising costs of traditional proteins like soybean and fishmeal. BSF meal contain approximately 35-42% high-quality crude protein with essential amino acids such as lysine and methionine, crucial for growth and muscle development. Their nutritional profile rivals fishmeal but is more sustainable, converting organic waste efficiently. Incorporating up to 10% BSF meal in diets supports growth, feed efficiency, and immunity, providing an eco-friendly, cost-effective protein solution for poultry production. The birds were divided into three experimental dietary groups to evaluate partial replacement of soybean meal with alternative protein sources. They were fed phase-specific diets-pre-starter, starter and finisher following ICAR (2013) nutritional guidelines. Feed and water were provided ad libitum throughout the study. Group T1 acted as the control with 0% soybean replacement, whereas Groups T2 and T3 had 10% and 15% soybean meal replaced, respectively. Production performance, carcass characteristics, meat quality, and histomorphology parameters were assessed to comprehensively determine the effects of different dietary substitution of BSF meal in broiler quail. The present study demonstrates that broiler quail fed diets supplemented with 10% (T2) and 15% (T3) Black Soldier Fly (BSF) larvae meal exhibited significantly (P < 0.05). higher weekly body weights compared to the control group (T1) over a 5-week period. Although pre-slaughter body weight was higher in T2 (181.12 g) versus T3 (172.88 g) and T1 (162.56 g), but there was not significant (P> 0.05) difference among treatment group. In post-bleeding body weights were significantly (P < 0.05) greater in T2 compared to T1 (174.99 g vs. 158.58 g;), while T3 was intermediate with no significant differences. Carcass evaluation revealed that eviscerated weight, as well as breast and thigh muscle weights, were significantly increased by 10% BSF inclusion (P < 0.05). Also, findings suggest that 10% BSF meal inclusion optimally enhances carcass yield, better meat quality traits in broiler quails with least feed cost compared with others. Intestinal histomorphology analysis revealed significant (P<0.05) increases in villus length and villus width in quail fed BSF diets at both 10% and 15% inclusion levels compared to control. This study shows that 10% BSF Meal inclusion significantly improves broiler quail production performance, and carcass traits compared to control. BSF Meal demonstrated enhanced villus length and width, indicating better nutrient absorption, also better meat quality traits. Overall, 10% BSF Meal is a sustainable, effective alternative to soybean meal for broiler quail nutrition.

Keywords: BSF Meal, histomorphology, carcass quality, broiler quail.

KA-10

Effect of dietary supplementation of nano zinc oxide on egg production, fertility and hatchability of Kuttanad ducks

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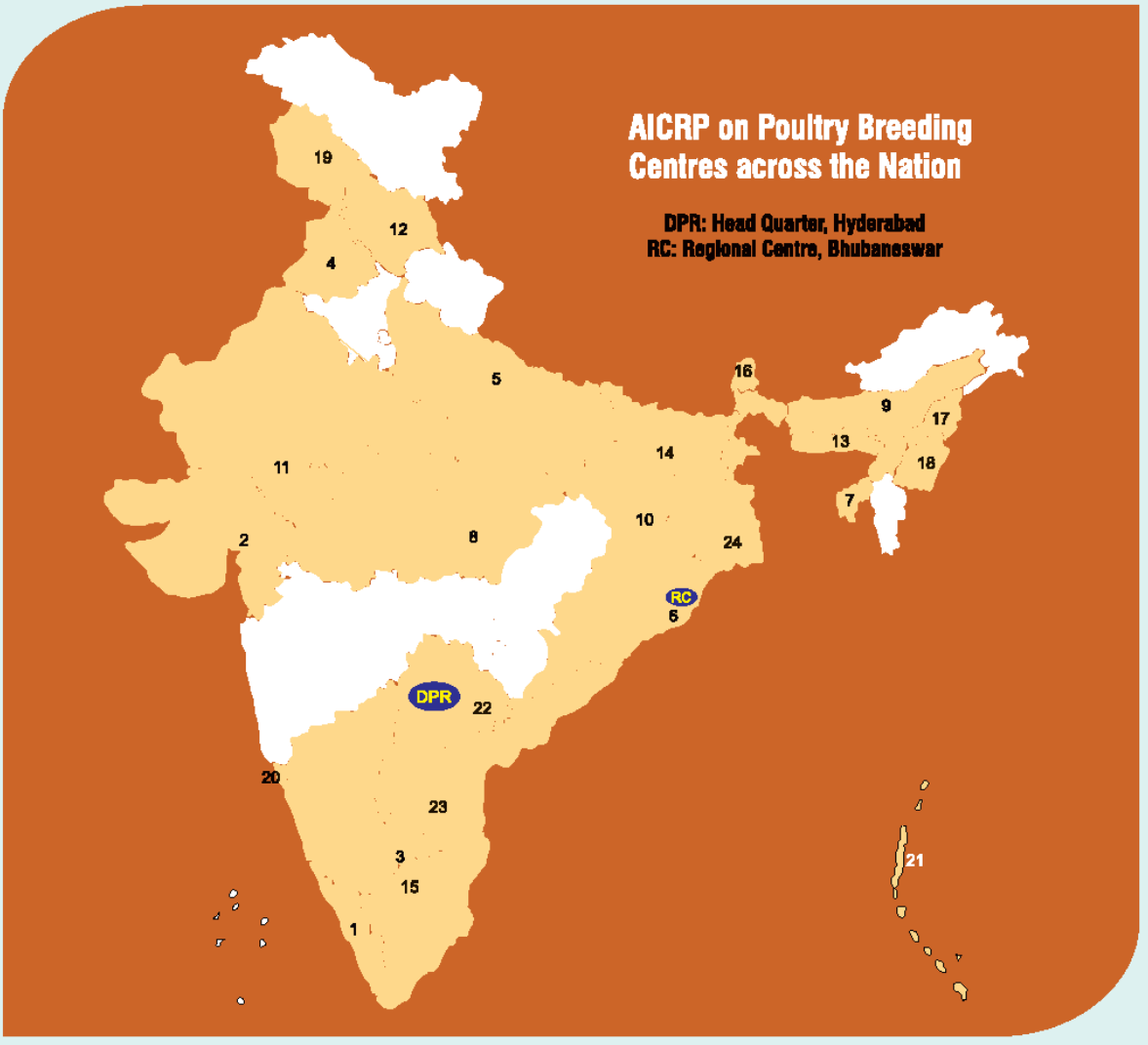
An experiment was conducted at the Avian Research Station, Kerala Veterinary and Animal Sciences University, Thiruvazhamkunnu, to assess the effect of dietary supplementation of nano zinc oxide (ZnO-NPs) on egg production, fertility and hatchability of Kuttanad ducks from 17 to 40 weeks of age. A total of 160 ducks and 20 drakes were randomly allocated to five dietary treatment groups at an age of 16 weeks. Each treatment group had four replicates, with each replicate consisting of 8 ducks and 1 drake. The dietary treatments were: T1 (without zinc supplementation), T2 (80 mg inorganic Zn/kg), T3 (20 mg nano Zn/kg), T4 (40 mg nano Zn/kg) and T5 (60 mg nano Zn/kg). Egg production was evaluated by calculating period-wise duck day and duck housed egg production. Semen quality of Kuttanad drakes were evaluated by both macroscopic and microscopic examination at 28 and 40 weeks of age. Fertility and hatchability of incubated eggs were evaluated from 24 to 40 weeks of age at 28-day intervals. The present study found that dietary ZnO-NPs supplementation showed no significant change in body weight in Kuttanad ducks. The production parameters like feed consumption, feed conversion ratio, egg production and livability showed no significant difference between the treatment groups. The egg weight and egg quality traits like shape index, albumen index and yolk index were also unaffected by the dietary supplementation of ZnO-NPs. The shell thickness showed significantly ($p<0.05$) higher values in 40 and 60 mg nano Zn/kg diet supplemented groups, except in the last period. The reproductive parameters, like macroscopic and microscopic semen quality parameters and glutathione peroxidase activity of seminal plasma of Kuttanad drakes, showed no significant difference between the treatment groups. The fertility and hatchability of Kuttanad duck eggs which were incubated were also not affected by the supplementation of different dietary levels of ZnO-NPs. There turnover feed cost per breeder Kuttanad ducks was calculated as ₹1102.17, ₹1111.36, ₹1063.15, ₹1159.19 and ₹1192.16 for T1, T2, T3, T4 and T5, respectively. Based on the significant improvement in eggshell thickness and superior economic returns, dietary supplementation with ZnO-NPs at 60 mg/kg is recommended for Kuttanad duck breeders to enhance egg quality and profitability.

Keywords: Kuttanad ducks, nanoparticles, semen parameters, fertility and hatchability.



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❖ Tinted brown egg layer
❖ Produce 160- 180 eggs in free range
❖Better adaptability to backyards
❖Better survivability

Srinidhi

❖ A promising dual purpose variety
❖Longer shanks
❖Produce about 150 eggs in free range
❖1.5-1.8 kg at 12 weeks of age

Krishibro ™

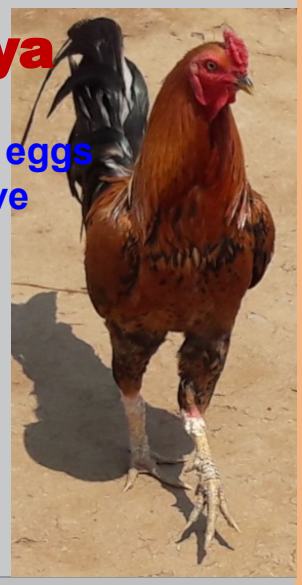
❖Broiler with multicolored plumage
❖1.6 kg body weight in 6 weeks
❖Suitable for small scale intensive farming
❖Good organoleptic quality of meat

Janapriya

- Dual purpose
- Produce 140-150 eggs
- Presence of native inheritance

AICRP varieties

- Pratapdhan
- Kamrupa
- Narmadanidhi
- Jharsim
- Himsamridhi



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