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THE MAGAZINE OF INDIAN POULTRY INDUSTRY | AUGUST 2026

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ARTICLE

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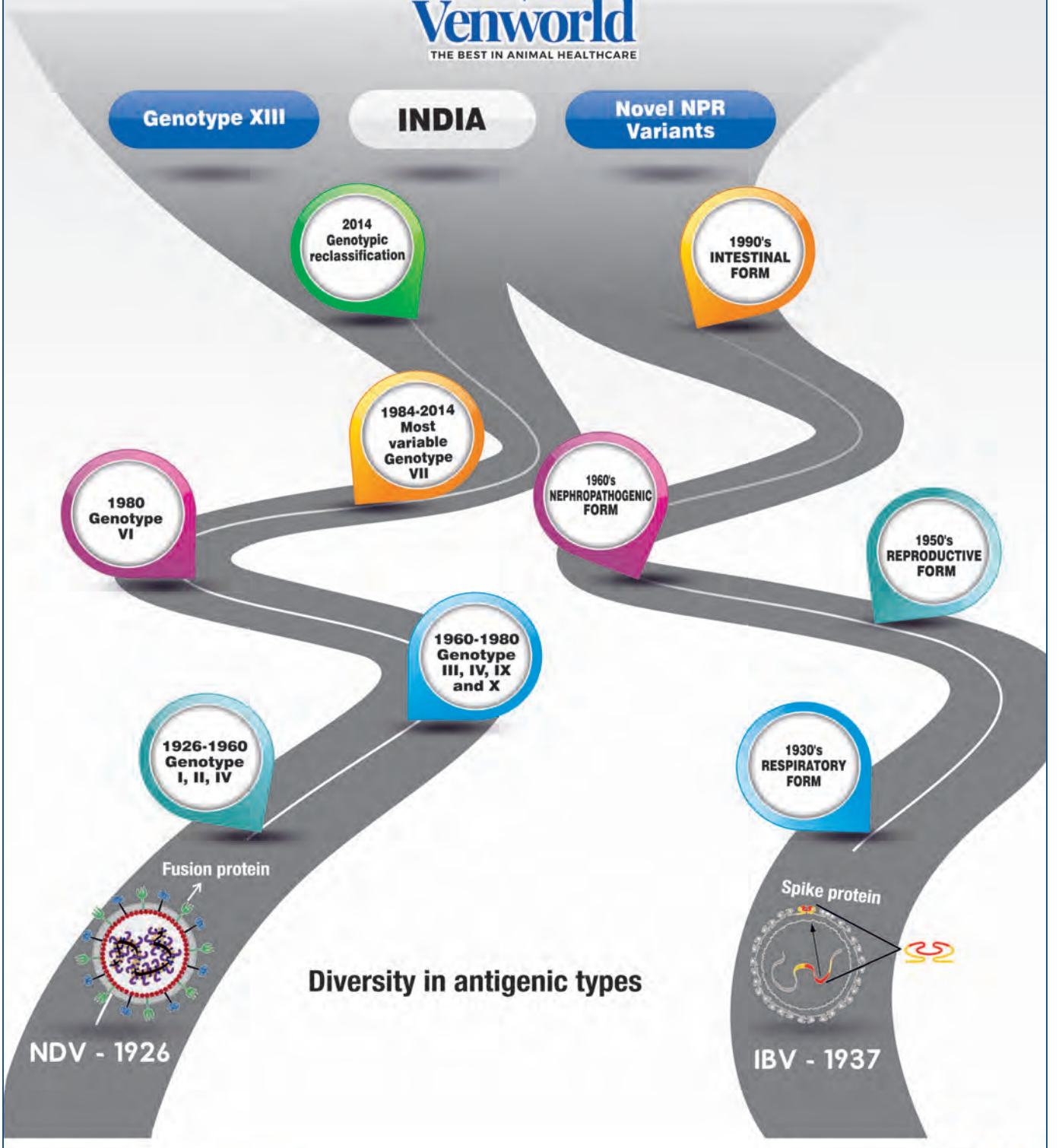

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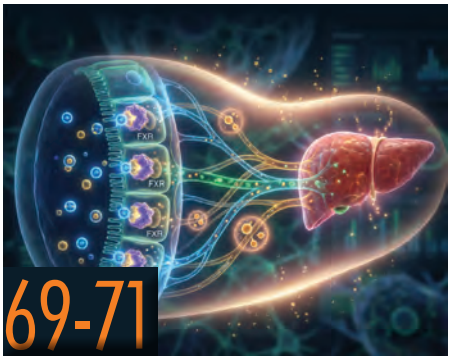

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A DECADE OF DIALOGUE. A LIFETIME OF IMPACT.

G. N. Ghosh
Managing Editor

This August, Indian Poultry Review proudly celebrates the tenth edition of its Annual Conclave—a milestone that reflects not merely the passage of time, but the remarkable evolution of a platform that began as a modest initiative to bring the poultry fraternity together through knowledge, dialogue and collaboration.

What started as a regional forum has today emerged as a respected national and global knowledge exchange, seamlessly bridging print and digital media while connecting farmers, scientists, policymakers, entrepreneurs, processors and industry leaders. Over the past decade, the Conclave has consistently anticipated the industry's changing landscape, encouraging conversations that shape its future rather than merely respond to its present.

Each edition has carried a powerful message—from emerging trends and technological innovations to preparing Indian poultry for global competition; from strengthening food safety across the animal-origin value chain to navigating the realities of the new normal. The platform has championed discussions on poultry startups, inspired young entrepreneurs, explored the consumption preferences of millennials, highlighted the role of livestock in sustainable development and reinforced the importance of efficient, safe and value-driven poultry processing.

The Indian poultry sector today stands at the crossroads of opportunity and responsibility. As consumer expectations evolve and sustainability, traceability and biosecurity become defining priorities, the industry must embrace innovation without losing sight of affordability, nutrition and inclusivity. The Annual Conclave has demonstrated that informed dialogue is the catalyst for meaningful transformation.

As we celebrate ten successful years, we reaffirm our commitment to fostering ideas, partnerships and policies that strengthen India's poultry ecosystem. The next decade must be one of greater resilience, technological excellence and global leadership—ensuring that Indian poultry continues to nourish the nation while setting new benchmarks for the world.

Research Abroad

Effects of Bacillus Amyloliquefaciens and Phytase Administration on Growth Performance and Organ Weights in Broiler Chickens During the Hot-Humid Season

Zakari FO, Okoro P, Agweche OS, Idoga ES, Oladipo OO, Jonathan KB, Adaji OG, Emennaa P, Sati N, Uchendu C, and Aluwong T.
J. World Poult. Res. 16(2): 168-180, 2026;
pii: S2322455X2600016-16
DOI: https://dx.doi.org/10.36380/jwpr.2026.16

Abstract:
In tropical regions, heat stress reduces broiler chicken productivity, highlighting the need for developing alternative growth promoters to replace antibiotics. The present study aimed to evaluate the effects of dietary phytase (AxtraPhytase) and the probiotic Bacillus amyloliquefaciens (B. amyloliquefaciens) on the growth performance and feed intake in broiler chickens during the hot-humid season in Jos, Plateau State, Nigeria. A total of 180 broiler chickens, 15 days old, were randomly allocated to four experimental groups. Each group consisted of 45 chickens with three replicates per group and 15 chickens per replicate. The dietary groups included a control group fed the basal diet without additives (Ctrl), a probiotic group supplemented with B. amyloliquefaciens at 1 × 10 CFU/kg (Prob), a phytase group supplemented with AxtraPhytase enzyme at 200 FTU/kg (Phy), and a combined group that received probiotic and phytase (Phy + Prob). The broiler chickens experienced challenging environmental conditions throughout the study, with average measurements of 29.00 ± 0.40°C for dry-bulb temperature, 68 ± 1.54% for relative humidity, and 27.99 ± 0.50°C for the temperature-humidity index. All these factors were higher than the optimal range for broiler thermal comfort. The live weight, weight gain, feed intake, organ weight, and feed conversion ratio were assessed.

On day 42, live and organ weights in the treated groups were significantly higher than those in Ctrl. All supplemented groups indicated increased weight gain. Feed intake was higher in the Ctrl and Prob groups compared to the Phy and Phy + Prob groups. These findings indicated that supplementation with phytase, alone or in combination with B. amyloliquefaciens, improved growth performance, feed efficiency, and organ development while modulating feed intake during heat stress. The present results demonstrated that B. amyloliquefaciens, phytase, or their combination enhanced growth performance, organ weights, feed efficiency, and overall productivity in broiler chickens subjected to heat stress during the hot-humid season in Nigeria. The current results supported the use of phytase and B. amyloliquefaciens in tropical poultry production.

Physiological, Histopathological, and Molecular Characterisations of Escherichia coli Infection in Commercial Laying Hens in Basrah Governorate, Iraq

Abbas SS, Ali RAA, Saood AI, Seger WM, Najem HA, Khaleefah IA, and Abdulrasol MA.
J. World Poult. Res. 16(2): 157-167, 2026;
pii: S2322455X2600015-16
DOI: https://dx.doi.org/10.36380/jwpr. 2026.15

Abstract:
Colibacillosis represents one of the most important bacterial diseases affecting poultry production, particularly in commercial laying hens, where it leads to marked economic losses. The present study aimed to evaluate the physiological, histopathological, and molecular characteristics of Escherichia coli (E. coli) infection in commercial laying hens in Basrah Governorate, Iraq. A total of 250 laying hens aged 35 weeks with clinical signs and postmortem lesions of colibacillosis were examined. Bacterial isolation was performed using conventional culture methods, followed by molecular confirmation using PCR targeting the 16S rRNA gene. Blood samples were collected for hematological analysis, and tissue samples from the liver and oviduct were processed for histopathological examination. The results showed a clear decrease in red blood cell (RBC) count, white blood cell (WBC) count, haemoglobin (Hb), and haematocrit (Hct) values in infected hens compared with healthy controls. In contrast, mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) were significantly increased in infected hens compared with healthy controls. Histopathological findings showed severe pathological alterations in the liver and oviduct, including vascular congestion, inflammatory cell infiltration, vacuolation, haemorrhage, and necrosis. Molecular analysis confirmed the presence of E. coli through successful amplification of the 16S rRNA gene. The findings of the current study suggest that E. coli infection induces marked physiological and tissue-level alterations in laying hens, which may adversely affect their health and productivity, highlighting the need for effective control measures on poultry farms.

Effect of Supplementation of Linseed Oil on Growth Performance of Giriraja Poultry Birds

S.R. Shegokar*, N R Pisal, S. P. Nage, S. D. Chavan, G.V. Thakare, P. A. Kahate, R. D. Dhage and N. O. Khandare

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The present experiment was conducted on supplementation of Linseed (Linumusitatissimum) oil in the feed of Giriraja Poultry Birds with the aim to assess the effect of feeding Linseed oil on live body weights, body weights gain, weekly feed consumption, cumulative feed consumption, feed conversion ratio (FCR), dressing percentage, fatty acid profile of breast and thigh muscle, mortality percentage, sensory quality of breast and thigh meat and economics of Giriraja poultry birds. 150-day old Giriraja chicks were procured from Government Regional Hatchery, Nagpur. They were randomly and equally distributed into five treatment groups T1, T2, T3, T4, and T5 with 30 numbers of chicks in each group. Linseed oil was added in experimental ration at different levels. The dietary treatments consisted of one basal T1 (control), supplemented with T2 (2% Linseed oil) T3, (3% Linseed oil), T4, (4% Linseed oil), and T5 (5% Linseed oil). The average live body weight at seventh week of age was 1271.60, 1343.40, 1478.73, 1370.23 and 1253.03 (g/birds) in T1, T2, T3, T4, and T5 treatments groups respectively. The corresponding weekly body weights gain at the end of seven weeks of age were 312.97, 339.83, 372.33, 325.50 and 318.53 (g/birds) in T1 to T5 treatment groups, respectively. The average total weekly feed consumption g/birds during the experimental period at end of seventh week was recorded as 677.0, 682.8, 669.7, 673.9, and 672.4 for T1, T2, T3, T4, and T5 treatment groups respectively. The cumulative feed consumption at seventh weeks of age recorded were 2650.9, 2676.9, 2648.4, 2655.0 and 2614.8 (g/birds) in T1, T2, T3, T4 and T5 treatment groups respectively.

The feed conversion ratio of various groups at seventh week in T1, T2, T3, T4 and T5 were 2.11, 1.98, 1.79, 1.94 and 2.09 respectively. The average dressing percentage among the different treatment group varied between 70.52 (T1) to (T5) 69.11 percent. Numerically higher dressing percentage was recorded in treatment T3 (74.51). The fatty acid profile of breast and thigh muscle recorded in percent in all treatment groups were significant. However, the decreasing trend of total omega n-3 to n-6 ratio for breast muscle recorded were 25.91,10.50, 4.0, 3.02, & 2.14 for treatments T1, T2, T3, T4 and T5, respectively. Similar trend was noticed for thigh muscle for n-3 to n-6 ratio supplemented with linseed oil were 24.75, 10.67,4.67, 3.0 & 2.20, respectively. The overall mortality in Giriraja poultry birds of various groups during the experimental period was null.

The net profit per bird was highest in T3 (Rs.133.5) followed by T2 (112.26), T1 (109.22), T4 (106.42) and lowest in T5 (Rs.78.15). It is concluded that, the treatments T3 and T2 were the most beneficial in feeding of Linseed oil on net return in Giriraja poultry birds as compared to T5 group.

Evaluation of Whole Paddy Grain on the Carcass Traits of Commercial Broiler Chicken

Akhilesh, Ashok. A.*, Raj Manohar G. and Bandeswaran C.

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A biological experiment was conducted at Department of Poultry Science, Madras Veterinary College, Chennai to evaluate the effect of whole paddy grain on carcass traits of commercial broiler chicken. A total of 144 broilers were weighed, wing banded and randomly allotted on a weight equalisation basis to 4 treatment groups with 3 replicates in each treatment with 12 chicks in each replicate. Four treatment rations containing whole paddy grain at levels of 0% (T1), 5% (T2), 10% (T3) and 15% (T4) of the total ration at the expense of maize were formulated to contain nearly isocaloric and iso nitrogenous. Carcass traits and cut up parts were recorded at the end of 42 days.

Statical analysis revealed that significantly higher Preslaughter Live Weight ($P<0.05$) was recorded in T4 (2750.16±76.44), T3 (2696.66±74.44), T2 (2750.16±76.44) than T1 (2403.00±123.96). New York Dressed Weight was observed significantly higher ($P<0.05$) in T4 (2560.16±74.35), T3 (2508.50±71.26), T2(2518.33±72.92) than T1 (2240.66±116.13). Eviscerated Carcass Weight was observed significantly higher ($P<0.05$) in breast weight among treatments. Back weight was recorded significantly higher ($P<0.05$) in T3 (409.00±26.38) than T1 (320.66±24.36). Thigh weight was recorded significantly higher ($P<0.05$) in T4 (312.83±17.79) and T2 (306.33±9.84) than T1 (259.83±16.31). Drumstick weight was recorded significantly higher ($P<0.05$) in T4 (317.83±21.11), T3(285.33±12.79), T2 (287.33±9.58) than T1 (240.16±14.02). Wingweight was observed significantly higher ($P<0.05$) in T4 (237.83±16.48) and T3 (234.66±7.20) than T1 (198.00±12.83). Neck weight was observed significantly higher ($P<0.05$) in T4 (182.33±10.11) and T2 (181.33±4.60) than T1 (153.83±8.27).

Maximum and significantly ($P<0.05$) higher carcass traits were observed in 15% treatment. Inclusion of whole paddy grain furnished superior carcass traits.

The Impact of Bile Acid and Natural Emulsifier Supplementation on Serum Biochemical Parameters and Immune Response in Broiler Chicken

Ashish Vedpathak, K. Y. Deshpande*, S. J. Manwar, P. S. Kuralkar, G. J. Panchbhai and T. U. Surnar

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The study titled, "The impact of bile acid and natural emulsifier supplementation on serum biochemical parameters and immune response in broiler chicken" was conducted by distributing 360 broiler chicks (Vencobb-430) in 6 groups containing 4 replicates of 15 chicks each. The diets were formulated as per BIS (2007) standards for control; while treatment group contained 5% oil inclusion on iso-caloric and iso-nitrogenous basis without any supplementation in T_1, with bile acid supplementation @250 g/ton in T2 and 500 g/ton T3, with emulsifier supplementation @250 g/ton in T4 and 500 g/ton in T5. The total cholesterol was found significantly lower in T4 than T0 and T_1. The villi length and VL:CD ratio increased significantly in bile acid and emulsifier supplemented groups than control. The weight of bursa (g) and spleen (g) was significantly lower in control (T0). Whereas a numerical improvement in serum antibody titers in bile acid and natural emulsifier supplemented groups was noted over control. The histomorphometric analysis of bile acid and emulsifier supplemented groups showed normal parenchyma with minimal lipid accumulation and mild congestion sporadically. Histomorphology of thigh muscle in bile acid and emulsifier supplemented groups revealed minimum deposited of lipid droplets between the muscle fibers. Breast muscle of T3 and T5 revealed normal parenchyma and moderate intra myofibrillar deposition of lipid droplets. It is concluded that, dietary supplementation of bile acid or emulsifier at 500g/ton to high fat diets improved biochemical parameters, immune response, histomorphology of intestine, liver and muscle of broiler chicken.

Effect of Feeding of Black Soldier Fly (HermetiaIllucens) Larvae Meal on the Performance of Commercial Broiler Chicken

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Black soldier fly larvae (BSFL) have gained significant importance as a possible feed ingredient for a variety of monogastric animals including poultry. Easy availability, low cost, rich amino acid profile, antimicrobial and prebiotic properties makes BSFL a very good alternative protein source for soyabean in poultry birds. To assess the effect of supplementation of Black Soldier Fly Larvae Meal (BSFLM) as a replacement of soyabean on body weight gain, feed intake, FCR, immunity status, histopathology, 200 Vencobb broiler birds of single hatch were randomly divided into 5 treatment groups. Each group consists of 5 replicates with 08 birds each replacing soybean meal from 0-100% with BSFLM. The dietary treatments were: T1: Basal diet - 0% ; T2: -25%, T3- 50%, T4 - 75% and T5 - 100% replacement of soyabean meal with BSFLM. The experiment was carried out for six weeks in cage system and fed as per BIS, 2007. The BSFLM was supplied by the Insectika Biotech Pvt. Ltd. which was produced through AI based bio reactor insect farming. During the experimental feeding period, there was significant ($P<0.05$) improvement in body weight gain and FCR up to 75% replacement group than control. Antibody titer measured against Ranikhet disease (ND), Infectious Bursal Disease (IBD) and cutaneous basophilic hypersensitive response against PHA-P was significantly ($P<0.05$) higher in BSFL supplemented birds than control. Histopathological examination of liver and kidney after staining by hematoxylin and eosin (H&E) stain showed no significant alteration insupplemented birds. It may be concluded that soyabean meal can be replaced with BSFLM @ 75% in the commercial broiler chicken ration that showed improved the body weight gain, FCR and immunity without any adverse effect on vital organs.

Effect of Dietary Rice Husk as Insoluble Fiber on the Production Performance and Egg Quality in Layers

J. A.Gawande, M.R.Wade, S.J. Manwar, Swapnil Tandale*, Pranchal Supe and Amol Choudhari

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The trial was conducted to evaluate the effect of dietary rice husk as insoluble crude fibre on the performance and egg quality in layers. A total of 144 layers aged 25 weeks were divided into 4 groups, each of which had 6 repetitions with a total of 6 hens in each replicate. The dietary treatments were the control (T1) basal diet containing 6% CF, the insoluble CF enhanced using rice husk at 25%, 50%, or 75% above 6.0% CF for T2, T3, and T4 respectively. Productive performance was recorded for 10 weeks and egg quality was evaluated fortnightly. The birds fed rice husk (7.5, 9.0 or 10.5% CF) showed significantly lower feed consumption as compared to control. The egg production was lowered @ 1.38%, 2.84%, 4.81% in birds fed CF with rice husk at 7.5%, 9.0%, 10.5% respectively as compared to control. The HHEP/HDEP of the control and T2 groups are comparable. The birds fed with 7.5% CF found nonsignificant FCR on egg number basis However, the birds fed with 9.0 or 10.5% CF found poor FCR as compared to control. The percent weekly egg production, egg weight was reduced with increasing in CF. The egg surface was decreased with increasing CF level. Body weight, Shape index, Haugh unit, Albumin index, yolk index, yolk colour score, percent eggshell weight, egg shell thickness was not affected by higher insoluble CF levels. Economically birds fed with 25% CF got the highest profit per egg andcost of egg production reduced up to 3.8% over control. The Rice husk based feed was cost effective when compared with control. In conclusion, the 50% insoluble crude fiber over 6% CF could be included in layers chicken diet however 25% insoluble CF is most economically beneficial compared to other rice husk groups.

Source : 39th Annual Conference & Symposium of IPSACON 2024

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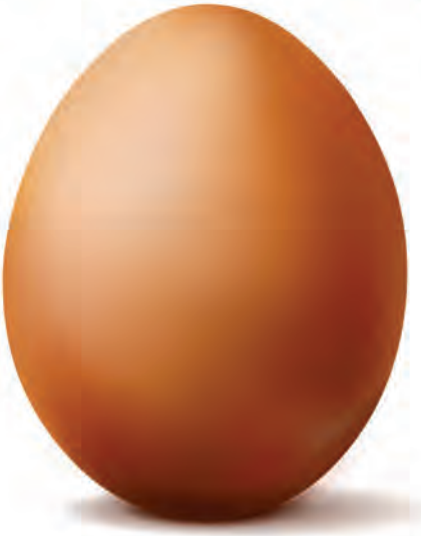

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Article

Emergence of Viral Variants, Their Diagnosis and Prevention in Poultry

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Viral variants in poultry are a major cause of economic losses, often emerging through mutation and recombination to evade vaccines and cause severe disease, including respiratory, immunosuppression, and neoplastic (tumor-forming) conditions.

Diseases caused by evolving viral variants include:
1. Avian Influenza (AI) - Influenza A, RNA Virus
2. Infectious Bronchitis (IB) -RNA Coronavirus
3. Infectious Bursal Disease (IBD) -RNA Birnavirus
4. Newcastle Disease (ND) -RNA Orthoavulavirus 1
5. Marek's Disease (MD) – Herpes DNA virus

1. Avian Influenza (AI) - Influenza A Virus (Bird flu)

Avian influenza viruses are highly variable, constantly changing via antigenic drift (small changes) and antigenic shift (large changes).
Caused by Influenza A viruses.

- **Variants:** Subtyped by Hemagglutinin (H1–H16) and Neuraminidase (N1–N9) proteins

Pathotypes

- **Highly Pathogenic (HPAI):** Variants like H5N1 and H5N8 can cause up to 100% mortality
- **Low Pathogenic (LPAI):** Variants like H9N2 circulate widely, causing milder respiratory issues but significant economic loss
- **H5N1 Variants:** Highly pathogenic (HPAI) strains, such as the 2.2.1.2 variant in Egypt, have shown high mortality rates (up to 100%) and severe septicemia
- **H5N8 Variants:** Clade 2.3.4.4b variants have caused significant mortality and respiratory distress in broiler chickens, often reassorting with other strains
- **H9N2 Variants:** Low pathogenic (LPAI) H9N2 variants are endemic worldwide, causing production losses (reduced egg production, respiratory problems) and increasing susceptibility to secondary infections

2. Infectious Bronchitis (IB) - Coronavirus

Infectious Bronchitis Virus (IBV) has high genetic variability and constantly evolves, making strain-specific vaccine selection essential.

A gamma coronavirus with high genetic variability.

- **Variants:** Classified into over 30 lineages (e.g., GI-1 to GI-27, QX-type, 793B)
- **Variant Strains:** Variants (e.g., QX-like, 4/91, D274) cause respiratory disease, severe kidney disease (nephropathogenic strains), and significant egg production drops
- **Reproductive Damage:** Early infection with certain variants can cause permanent damage to the oviduct, resulting in "false layers" that never produce eggs
- **Impact:** New variants emerge frequently through recombination, affecting the respiratory tract, kidneys, and reproductive systems (leading to misshapen eggs or "false layers")

3. Infectious Bursal Disease (IBD) - Birnavirus

Also known as Gumboro disease, it affects young chickens by destroying the bursa of Fabricius, causing immunosuppression.

- **Variant IBDV Strains:** Since 1986, variant strains emerged that cause subclinical infections, severe immunosuppression, and sometimes mortality, often breaking through maternal immunity
- **Very Virulent (vvIBDV) Strains:** Emerged in Europe in 1989, causing high mortality (up to 60% or higher)
- **Impact:** It destroys B-lymphocytes in the bursa of Fabricius, causing severe immunosuppression and making birds vulnerable to other diseases

4. Newcastle Disease (ND) - Orthoavulavirus 1

Caused by Newcastle disease virus (NDV), ranging from mild (lentogenic) to fatal (velogenic) variants.

- **Variants:** Strains are grouped by virulence: Velogenic (highly fatal/Exotic ND), Mesogenic (moderate), and Lentogenic (mild, often used for vaccines)
- **Velogenic Strains:** Cause high mortality (up to 100%), nervous signs (twisted neck, paralysis), and severe respiratory distress
- **Vaccine Evasion:** Virulent strains are still sporadically isolated from vaccinated flocks due to genetic diversity between field strains and vaccines

5. Marek's Disease (MD) - Herpesvirus

A highly contagious disease that causes tumors in the nerves and visceral organs.

- **Variants:** Strains range from mild to very virulent+ (vv+MDV)
- **Virulence Evolution:** The virus has evolved into very virulent (vvMDV) and very virulent+ (vv+MDV) forms, which can overcome traditional vaccine protection
- **Tumor Induction:** Variants can induce lymphomas in liver, spleen, kidney, and other organs
- **Impact:** Causes paralysis ("range paralysis") and tumors in internal organs. While vaccines exist, they do not prevent infection or shedding of field variants

Summary of Major Viral Disease Impacts		
Viral Disease	**Key Impact**	**Variant/Evolution Feature**
Avian Influenza	Up to 100% mortality	High reassortment (H5N1, H5N8, H9N2)
Infectious Bronchitis	Egg drop (70%), respiratory	High S1 protein variability (QX, 4/91)
Infectious Bursal	Immunosuppression	Very virulent (vvIBDV) & variant strains
Newcastle Disease	100% mortality	Velogenic strains, vaccine evasion
Marek's Disease	Tumors, paralysis	Evolved to higher virulence (vv+MDV)

Economic & Management Challenges

- **Vaccine Evasion:** New variants can "escape" protection provided by standard vaccines, requiring constant surveillance and updated vaccine seeds
- **Secondary Infections:** Viral triggers often weaken the immune system, allowing common bacteria like E. coli or Mycoplasma to cause severe disease
- **Biosecurity:** Because many variants are environmentally hardy (e.g., IBD can survive for months in litter), rigorous poultry biosecurity measures are essential

Disease / Variant	Early Symptoms to Watch For
Avian Influenza (HPAI)	Sudden unexplained death; swelling/purple discoloration of the head, comb, and wattles; pinpoint hemorrhages on legs.
Newcastle Disease	**Nervous signs:** Twisted necks (torticollis), tremors, or paralysis. **Digestive:** Bright green, watery diarrhea.
Infectious Bronchitis	Intense respiratory distress (gasping/coughing); Nephropathogenic strains cause increased water intake and wet litter (diuresis).
Marek's Disease	Early "range paralysis" (one leg forward, one back); grayish color change in the eye (iris); or palpable skin tumors
Infectious Bursal Disease	Sudden onset of depression, ruffled feathers, huddling, and decreased food/water intake. **Subclinical Indicators (0-3 weeks old):** Reduced weight gain, poor feed conversion, "wet" litter, and uneven flock growth.

Symptom-Specific Markers by Disease

While symptoms overlap, certain physical signs are characteristic of specific viral variants:

Diagnosis

Diagnosis of viral variant diseases in poultry relies on a multi-tiered approach that progresses from clinical observation to advanced molecular characterisation. Because clinical signs—such as respiratory distress, diarrhea, or drops in egg production—often overlap between diseases like Avian Influenza (AI), Newcastle Disease (ND), and Infectious Bronchitis (IB), laboratory confirmation is essential.

Initial detection often occurs on the farm through monitoring flock health and using rapid, on-site tools.

Screening & Field Diagnosis

1. **Clinical Examination:** observing clinical signs
2. Antigen-Capturing Immunoassays (Rapid Antigen Tests)
3. Vocalisation & Image Analysis

Laboratory Tests

1. Virus Isolation (VI)
2. Molecular Diagnosis (RT-PCR): Real-time RT-PCR
3. Isothermal Amplification (LAMP)

Characterisation of Viral Variants

1. Sanger Sequencing
2. Next-Generation Sequencing (NGS):
3. DIVA Tests

Serological Testing

Serology measures the immune response (antibodies) to determine previous exposure or vaccine efficacy.

1. ELISA
2. Hemagglutination Inhibition (HI) Test
3. Agar Gel Immunodiffusion (AGID)

Action Steps for Suspected Outbreaks

- **Isolate Immediately:** If a few birds show symptoms, isolate the affected group and restrict all human and equipment movement between houses
- **Monitor Daily Mortality:** Keep a rising daily tally. If mortality approaches 50% or higher in under 48 hours, it is a high-pathogenicity emergency
- **Professional Reporting:** Do not move live birds or products off-premises. Contact a veterinarian or your state animal health official immediately for PCR testing or virus isolation

Prevention

Control of viral variant diseases in poultry requires an integrated strategy that combines stringent biosecurity, advanced vaccination protocols, and robust surveillance. Because viruses like Avian Influenza (AI) and Infectious Bronchitis (IB) mutate rapidly, management must be dynamic to address emerging "pathotypes" or antigenic variants.

1. Strategic Biosecurity (First Line of Defense)
2. Advanced Vaccination Strategies
3. Surveillance and Rapid Response
4. **Supporting Flock Resilience:** Nutrition and stress prevention

Conclusion

Viral variants significantly impact the global poultry industry, often causing respiratory, neurological, or reproductive diseases. These variants emerge through antigenic drift (minor mutations) or antigenic shift (recombination of viral segments), which can lead to vaccine failure and high mortality rates.

Viral variants in poultry primarily cause highly contagious respiratory, immunosuppressive, and neoplastic (tumor-causing) diseases. The most significant of these are driven by "variants" or "strains" of Avian Influenza, Newcastle Disease, and Infectious Bronchitis, which constantly evolve to bypass existing vaccines.

Article

Green Feeding Strategies for Indian Poultry: Beyond Traditional Feed Ingredients

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Green Feeding and the Future of Indian Poultry

The Indian poultry industry has undergone remarkable transformation during the past four decades, evolving from traditional backyard production systems into one of the world's fastest-growing commercial livestock sectors. Today, India ranks among the leading producers of eggs and poultry meat, supported by continuous advances in genetics, health management, housing systems, and nutritional technologies. The sector contributes substantially to national food security by providing affordable, high-quality animal protein while creating employment opportunities across feed manufacturing, breeding, processing, veterinary services, and marketing. Despite this impressive growth, poultry production remains highly dependent on feed, which accounts for approximately 65–70% of total production costs. Conventional poultry diets rely predominantly on maize as the principal energy source and soybean meal as the major protein ingredient. However, climate change, shrinking agricultural land, fluctuating market prices, competition from ethanol production, and increasing human food demand have made this dependence increasingly unsustainable. Consequently, green feeding strategies have emerged as an innovative and sustainable approach to poultry nutrition. Green feeding extends beyond merely replacing feed ingredients; it integrates resource efficiency, environmental sustainability, precision nutrition, and circular economy principles to optimise productivity while reducing ecological impacts. By promoting diversified feed resources and advanced nutritional technologies, green feeding represents a strategic pathway toward resilient, profitable, and environmentally responsible poultry production in India.

Why India Needs Green Feeding Strategies

The need for green feeding strategies has become increasingly urgent as multiple economic and environmental pressures converge on the Indian poultry sector. Climate change has significantly affected agricultural productivity through irregular monsoons, prolonged droughts, heat waves, floods, and changing pest dynamics, thereby reducing the stability of maize and soybean production. Simultaneously, increasing demand for maize from the ethanol industry and for soybean from food and export markets has intensified competition for these essential feed ingredients. Such market volatility directly influences feed prices and reduces profitability for poultry producers, particularly small and medium-scale farmers. Furthermore, India's expanding population and rising income levels continue to increase demand for poultry products, necessitating greater production efficiency without proportionately increasing resource consumption. Green feeding addresses these challenges by encouraging diversification of feed ingredients, improved nutrient utilisation, reduced dependence on imported commodities, and greater use of locally available feed resources. It also aligns with national priorities such as climate-smart agriculture, sustainable livestock production, and resource conservation. By integrating scientific feed formulation, environmentally friendly technologies, and region-specific feed resources, green feeding enhances resilience against future uncertainties while ensuring long-term feed security and economic sustainability for the poultry industry.

Challenges of Conventional Feed Ingredients

Although maize and soybean meal have remained the foundation of poultry nutrition for several decades due to their excellent nutritional quality and consistent performance, excessive dependence on these ingredients presents several limitations. Maize cultivation requires substantial quantities of water, fertilisers, and land, making it increasingly vulnerable to climate variability and competing industrial demands. Similarly, soybean production faces challenges associated with fluctuating international prices, weather-related yield instability, and competition with human food industries. In addition, transportation of these bulk commodities across long distances contributes to greenhouse gas emissions and increases feed manufacturing costs. Heavy reliance on a limited number of ingredients also reduces flexibility in feed formulation and exposes poultry producers to supply-chain disruptions. Conventional feeding systems frequently result in inefficient nutrient utilisation, leading to excessive nitrogen and phosphorus excretion that contributes to soil degradation, water pollution, and eutrophication. These environmental concerns have prompted nutritionists to explore diversified feed resources capable of maintaining productivity while reducing ecological footprints. Consequently, future poultry nutrition is gradually shifting from ingredient-based feeding toward nutrient-based and sustainability-oriented feeding systems, where resource efficiency, environmental responsibility, and economic resilience become equally important alongside production performance.

Climate-Resilient Energy Sources Beyond Maize

Diversification of energy sources represents one of the most practical and immediate approaches to implementing green feeding strategies in India. Although maize has traditionally

served as the principal energy ingredient in poultry diets because of its high metabolisable energy, digestibility, and palatability, its future availability is increasingly threatened by climate change, expanding ethanol production, and competing demands from the food and industrial sectors. Consequently, nutritionists are exploring climate-resilient cereals capable of partially replacing maize without compromising bird performance. Sorghum (jowar) has emerged as one of the most promising alternatives owing to its drought tolerance, lower water requirement, and nutritional profile comparable to maize, particularly in modern low-tannin cultivars. Likewise, pearl millet (bajra), finger millet (ragi), foxtail millet, and other nutri-cereals possess considerable potential because of their adaptability to arid and semi-arid regions, higher protein content, and superior resilience under climate stress. Broken rice, cassava meal, sweet potato meal, and processed tapioca products can also serve as supplementary energy sources where regionally available. These alternative cereals not only diversify feed resources but also support the Government of India's promotion of Shree Anna (millets), thereby creating synergies between livestock nutrition, climate-smart agriculture, and sustainable crop diversification. Their successful incorporation into poultry diets, supported by modern enzyme technologies and precision formulation, can substantially reduce dependence on maize while improving feed security and resilience.

Alternative Plant Protein Sources Beyond Soybean Meal

Soybean meal has long been regarded as the gold standard protein ingredient in poultry nutrition due to its high crude protein content, excellent amino acid profile, and superior digestibility. Nevertheless, rising production costs, market volatility, climatic uncertainties, and increasing competition from human food industries necessitate diversification of protein resources. India possesses a wide range of indigenous oilseed meals and legume-derived proteins that remain underutilised despite their nutritional potential. Groundnut cake, sunflower meal, sesame meal, safflower meal, canola meal, linseed meal, cottonseed meal, guar meal, and pea protein concentrates can partially replace soybean meal when incorporated within scientifically established inclusion levels. Recent advances in feed processing, including dehulling, extrusion, fermentation, solvent extraction, and enzyme supplementation, have substantially improved nutrient digestibility while reducing anti-nutritional factors such as tannins, phytates, gossypol, and glucosinolates. The adoption of digestible amino acid formulation further enables nutritionists to combine multiple plant protein sources while maintaining optimum amino acid balance and bird performance. Such diversification not only strengthens feed security but also encourages regional cultivation of oilseed and pulse crops, thereby enhancing farm income and reducing transportation-related carbon emissions. Future poultry diets are, therefore, expected to rely on scientifically balanced combinations of multiple protein ingredients rather than excessive dependence on soybean meal alone.

Agro-Industrial By-products and Circular Bioeconomy

One of the most promising dimensions of green feeding is the efficient utilisation of agro-industrial by-products within a circular bioeconomy framework. India produces millions of tonnes of agricultural residues and food-processing by-products annually, many of which possess substantial nutritional value but remain underutilised or are discarded as waste. Rice bran, rice polish, wheat bran, wheat middlings, maize gluten feed, distillers dried grains with solubles (DDGS), pulse milling residues, brewer's grains, bakery waste, fruit and vegetable processing residues, and sugar industry by-products represent valuable feed resources that can partially replace conventional ingredients after appropriate processing. Their utilisation transforms waste into wealth, reduces environmental pollution, lowers feed costs, and improves overall resource-use efficiency. Modern processing technologies—including extrusion, pelleting, fermentation, enzyme treatment, and mycotoxin management—have significantly enhanced the nutritional quality, digestibility, and safety of these unconventional ingredients. Furthermore, integrating poultry production with crop agriculture facilitates recycling of nutrients through manure utilisation, thereby creating closed-loop farming systems that conserve natural resources and reduce dependence on synthetic fertilisers. Adoption of circular bioeconomy principles thus contributes simultaneously to environmental sustainability, economic resilience, and climate-smart livestock production. As India advances toward a resource-efficient agricultural economy, agro-industrial by-products are expected to become increasingly important components of sustainable poultry feed formulations.

Insect Protein and Novel Feed Resources: The Next Frontier in Poultry Nutrition

The search for sustainable protein sources has brought insect-derived proteins to the forefront of poultry nutrition research. Among the various candidates, the Black Soldier Fly (Hermetiaillucens) has emerged as the most promising because of its exceptional ability to convert organic waste into high-quality protein and lipids with minimal environmental impact. Black Soldier Fly larvae typically contain 40–50% crude protein, balanced essential amino acids, medium-chain fatty acids such as lauric acid, and bioactive compounds that enhance gut health and immunity. Compared with soybean cultivation, insect farming requires significantly less land, water, and energy while producing lower greenhouse gas emissions, thereby supporting the principles of climate-smart agriculture and the circular bioeconomy. Besides Black Soldier Fly larvae, mealworms (Tenebrio molitor), silkworm pupae, and housefly larvae have also demonstrated considerable potential as alternative feed ingredients. Simultaneously, novel protein sources such as duckweed (Lemna spp.), azolla, moringa leaf meal, and aquatic plants are receiving increasing scientific attention because of their rapid growth, high protein content, and local availability. Although regulatory frameworks, consumer perception, and commercial-scale production remain important challenges in India, continuous technological advances are expected to facilitate wider adoption during the coming decade. Diversifying protein sources through insect farming and novel biomass production will strengthen feed security while significantly reducing the ecological footprint of poultry production.

Algae, Single-Cell Proteins, and Fermented Feed Ingredients

Microbial biotechnology has opened entirely new avenues for sustainable poultry nutrition through the development of algae, single-cell proteins (SCP), and fermented feed ingredients. Microalgae such as Spirulina, Chlorella, Schizochytrium, and Nannochloropsis are rich sources of highly digestible protein, essential amino acids, vitamins, carotenoids, antioxidants, minerals, and omega-3 fatty acids. Beyond improving growth performance, these ingredients enhance yolk pigmentation, meat quality, antioxidant status, immune competence, and reproductive performance, making them particularly valuable for premium poultry products. Likewise, single-cell proteins produced from yeast, bacteria, fungi, and other microorganisms represent highly sustainable alternatives because they require minimal land and water while exhibiting rapid biomass production. Yeast-derived proteins additionally provide β-glucans, mannan oligosaccharides, nucleotides, and other functional compounds that improve gut health and disease resistance. Fermentation technologies have further enhanced the value of conventional feed ingredients by degrading anti-nutritional factors, improving nutrient digestibility, increasing amino acid availability, and

enriching feeds with beneficial metabolites. Fermented soybean meal, rice bran, DDGS, and oilseed meals have consistently demonstrated superior nutritional performance compared with their unprocessed counterparts. Collectively, algae, microbial proteins, and fermented feed ingredients exemplify the transition from conventional feed resources toward knowledge-intensive, biotechnology-driven poultry nutrition systems that maximise resource efficiency while minimising environmental impact.

Precision Nutrition and Feed Enzyme Technology

The success of green feeding depends not only on the selection of alternative ingredients but also on maximising the efficiency with which birds utilise available nutrients. Precision nutrition represents a paradigm shift from traditional feed formulation by supplying nutrients according to the bird's genetic potential, physiological stage, health status, and environmental conditions rather than relying on generalised nutrient recommendations. Modern formulations increasingly employ standardised ileal digestible amino acid systems, net energy concepts, and dynamic least-cost optimisation models that improve nutrient-use efficiency while reducing feed costs and environmental nutrient losses. Complementing precision nutrition, feed enzyme technology has revolutionised the utilisation of unconventional feed ingredients. Exogenous enzymes such as phytase, xylanase, β-glucanase, cellulase, protease, amylase, and multi-enzyme complexes hydrolyse anti-nutritional compounds and structural carbohydrates that otherwise limit nutrient availability. Phytase improves phosphorus utilisation, thereby reducing dependence on inorganic phosphorus supplements and minimising phosphorus excretion. Fibre-degrading enzymes facilitate greater inclusion of wheat bran, rice bran, sunflower meal, and DDGS, while proteases enhance amino acid digestibility, enabling reductions in dietary crude protein without compromising growth performance. The combined application of precision nutrition and enzyme technology, therefore, expands formulation flexibility, lowers production costs, reduces greenhouse gas emissions associated with nutrient wastage, and strengthens the sustainability of poultry feeding systems. These scientific innovations form the technological foundation upon which future green feeding strategies will be built.

Functional Feed Additives and Gut Health: Enhancing Efficiency Naturally

The transition toward green feeding is closely linked with the growing use of functional feed additives that improve nutrient utilisation, gut health, immunity, and overall productivity without relying on antibiotic growth promoters. Following global concerns regarding antimicrobial resistance (AMR), poultry nutrition has increasingly shifted toward natural alternatives such as probiotics, prebiotics, synbiotics, postbiotics, organic acids, phytogenic feed additives, yeast cell wall products, and plant-derived bioactive compounds. These additives promote the establishment of a healthy intestinal microbiota, enhance digestive enzyme activity, strengthen gut barrier integrity, and improve nutrient absorption, thereby increasing feed conversion efficiency and reducing disease incidence. Phytogenic additives derived from garlic, turmeric, ginger, oregano, thyme, cinnamon, neem, and tulsi possess antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory properties that support sustainable poultry production. Organic acids, including formic, propionic, butyric, and citric acids, improve intestinal pH and inhibit pathogenic bacteria, while yeast-derived β-glucans and mannan oligosaccharides stimulate innate immunity and intestinal health. The integration of these functional additives into poultry diets complements precision nutrition by improving biological efficiency, reducing environmental nutrient losses, and supporting antibiotic-free production systems. Consequently, functional nutrition has become an indispensable component of green feeding strategies, contributing simultaneously to bird welfare, food safety, environmental sustainability, and the One Health approach.

Artificial Intelligence, Internet of Things, and Smart Feed Manufacturing

Digital transformation is rapidly redefining the future of poultry feed manufacturing through the integration of Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT), robotics, blockchain, and cloud-based analytics. Modern feed mills are evolving into smart manufacturing systems capable of continuously monitoring ingredient quality, moisture, temperature, pellet durability, mixing uniformity, and nutrient consistency in real time. AI-assisted feed formulation analyses large datasets on ingredient composition, bird performance, feed prices, and market trends to generate optimised least-cost formulations while maintaining nutritional precision. Near-Infrared Spectroscopy (NIRS) further enables rapid assessment of nutrient composition, allowing feed formulations to be adjusted dynamically according to ingredient variability. IoT-enabled sensors installed in storage facilities, feed mills, transport systems, and poultry houses facilitate continuous monitoring of feed quality, environmental conditions, and bird responses. Such digital technologies minimise human error, improve manufacturing efficiency, reduce feed wastage, and enhance traceability throughout the supply chain. Blockchain technology further strengthens transparency by enabling complete documentation of ingredient sourcing, processing, and distribution. Together, these innovations create an intelligent feed ecosystem capable of responding rapidly to changing production conditions while improving economic efficiency and environmental sustainability. As Industry 4.0 technologies become increasingly affordable, their integration into India's poultry feed sector will accelerate the adoption of precision and green feeding practices.

Environmental Sustainability, Carbon Footprint, and Circular Bioeconomy

Environmental sustainability lies at the heart of green feeding strategies because feed production contributes the largest proportion of greenhouse gas emissions associated with poultry farming. Sustainable feed systems, therefore, seek to reduce environmental impacts through improved nutrient utilisation, diversified feed resources, efficient manufacturing, and circular resource management. Life Cycle Assessment (LCA) has become an important scientific tool for evaluating the environmental footprint of feed ingredients from cultivation and processing to transportation, feeding, and manure management. Studies consistently demonstrate that replacing resource-intensive feed ingredients with climate-resilient cereals, agro-industrial by-products, insect proteins, algae, and microbial proteins can substantially reduce carbon emissions, water consumption, and land-use requirements. Precision nutrition and enzyme supplementation further decrease nitrogen and phosphorus excretion, thereby reducing soil degradation, eutrophication, and ammonia emissions from poultry farms. The circular bioeconomy strengthens sustainability by converting agricultural residues, food-processing by-products, and organic waste into valuable feed ingredients while recycling poultry manure as an organic fertiliser for crop production. Such integrated crop–livestock systems improve resource-use efficiency, conserve natural resources, and minimise waste generation. For India, where agricultural diversity generates abundant biomass residues, circular bioeconomy approaches provide a practical pathway toward low-carbon, climate-resilient poultry production. Green

feeding, therefore, represents not merely a nutritional innovation but a comprehensive environmental strategy that aligns poultry production with global sustainability goals and India's vision of Viksit Bharat 2047.

Feed Security, Economic Viability, and Farmer Adoption

The long-term sustainability of India's poultry industry depends upon achieving feed security through diversified, economically viable, and region-specific feeding strategies. Feed security extends beyond ensuring adequate availability of feed ingredients; it encompasses affordability, nutritional quality, safety, resilience to climate change, and stability of supply chains. Green feeding strategies contribute significantly to feed security by reducing dependence on maize and soybean meal through the integration of climate-resilient cereals, alternative oilseed meals, agro-industrial by-products, insect proteins, algae, and microbial proteins. From an economic perspective, diversified feed formulations minimise exposure to fluctuations in global commodity prices and reduce transportation costs by utilising locally available resources. Furthermore, value addition to agricultural residues creates new business opportunities for rural entrepreneurs, feed manufacturers, and farmer-producer organisations while supporting the circular bioeconomy. However, successful adoption requires greater awareness among poultry farmers regarding the nutritional value, safe inclusion levels, and economic benefits of alternative feed ingredients. Strengthening extension services, on-farm demonstrations, digital advisory platforms, and capacity-building programmes will be essential to build confidence among producers. Public–private partnerships involving research institutions, feed industries, poultry integrators, and farmer organisations can further accelerate the commercialisation and adoption of green feeding technologies. Ultimately, improved feed security will not only enhance profitability but also strengthen national food security through sustainable poultry production.

Research Priorities and Policy Interventions for Sustainable Feed Systems

The transition towards green feeding requires coordinated investments in research, innovation, infrastructure, and supportive public policies. Future research should focus on the identification and nutritional characterisation of indigenous feed resources, development of climate-resilient feed crops, optimisation of processing technologies for unconventional ingredients, and commercialisation of insect protein, algae, and microbial proteins. Emerging disciplines such as nutrigenomics, metabolomics, microbiome science, and artificial intelligence should be integrated into poultry nutrition research to develop precision feeding systems tailored to specific genetic lines and production environments. Simultaneously, national policy frameworks should encourage cultivation of alternative feed crops through targeted incentives, strengthen quality standards for novel feed ingredients, and promote investment in modern feed manufacturing technologies.

Establishing a comprehensive National Feed Resource Database would enable nutritionists and feed manufacturers to access region-specific information on nutrient composition, digestibility, anti-nutritional factors, and ingredient availability. Regulatory support for insect farming, biotechnology-based feed production, and circular bioeconomy initiatives will also be critical for accelerating commercialisation. Furthermore, enhanced collaboration among universities, ICAR institutions, government agencies, private feed industries, start-ups, and international organisations will facilitate rapid translation of research into commercial practice.

Such integrated policy and research initiatives are essential for building a resilient, competitive, and environmentally sustainable poultry feed sector capable of supporting India's growing demand for animal protein.

Future Outlook

Green feeding strategies represent the future of sustainable poultry nutrition in India. As feed costs continue to rise and climate change intensifies pressure on agricultural resources, reliance on conventional feed ingredients alone is no longer sufficient to sustain the rapid expansion of the poultry industry. Diversification of feed resources through climate-resilient cereals, alternative plant proteins, agro-industrial by-products, insect meal, algae, microbial proteins, and fermented feed ingredients offers a practical pathway toward enhanced feed security and reduced environmental impact. Complementing these resources with precision nutrition, enzyme technology, functional feed additives, artificial intelligence, IoT-enabled feed manufacturing, and circular bioeconomy principles will further improve nutrient-use efficiency, reduce greenhouse gas emissions, and strengthen economic resilience. The successful implementation of green feeding strategies will depend upon robust scientific research, supportive government policies, effective extension programmes, and active collaboration between academia, industry, and farmers. Looking ahead, the Indian poultry sector has the opportunity to become a global leader in sustainable feed innovation by adopting knowledge-based, resource-efficient, and climate-smart nutritional practices. Such a transformation will contribute not only to improved poultry productivity and farmer profitability but also to environmental conservation, food security, and the realisation of the national vision of Viksit Bharat 2047. Green feeding is, therefore, more than a technological advancement—it is a strategic framework for building a resilient, competitive, and environmentally responsible poultry industry capable of meeting the nutritional demands of future generations.

The transition from conventional feeding systems to green feeding strategies marks a paradigm shift in poultry nutrition. Rather than focusing solely on maximising production, future feeding programmes must balance productivity with environmental sustainability, resource efficiency, animal health, and economic viability. India's diverse agricultural resources, expanding biotechnology sector, and strong poultry industry provide a unique opportunity to lead this transformation. Through innovation, scientific research, precision nutrition, and supportive policy frameworks, green feeding can become the cornerstone of sustainable poultry production, ensure long-term feed security while protect natural resources and supporting climate-resilient agricultural development.

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Article

When the Climate Changes, the Food on Our Table Changes too

SHRIDHAR speaks

Tarun Shridhar
Director General, Indian Chamber of Food and Agriculture, and former Secretary, Ministry of Fisheries, Animal Husbandry and Dairying, Govt.of India

Visualise a farmer standing in a field that should have been green and thriving; instead, the soil is cracked from drought, while hundreds of kilometres away, a fisher returns from the sea with half the catch he expected, and in another village, a poultry farmer struggles as a prolonged heatwave causes birds to stop feeding and laying eggs. These scenes are no longer imaginary or isolated; they are becoming increasingly common across the world. There is an old farmer's saying: "Watch the sky, trust the soil; the harvest will come." For generations, this wisdom worked. The sky gave rain on cue, the soil responded, and food appeared on the table. Today, however, the sky is sending worrying signals: more intense, more erratic, and increasingly threatening. The world's farmers, herders, poultry growers, and fishers are discovering, often at great personal cost, that the reliable rhythms of seasons are giving way to a new and unsettling disorder.

The World Meteorological Organization (WMO) confirmed in early 2025 that the year 2024 was the warmest on record, reaching an average temperature of 1.55°C above pre-industrial levels, the first calendar year to cross the symbolic 1.5°C threshold. This is not merely a statistic. It is a line in the sand, and humanity has crossed it. The consequences for food and agriculture are already visible, measurable, and deeply troubling.

Agriculture in a Warming World

Agriculture has always been at nature's mercy. But climate change has loaded the dice. Droughts, floods, erratic rainfall, and extreme heat events are no longer rare surprises: they are features of the new normal. In recent years, the increasing intensity of what scientists call "global weirding"- erratic rainfall, unseasonal frosts, prolonged dry spells- has adversely affected farming across the world, contributing to numerous record-low harvests.

A sweeping global research study conducted by professors at the University of Minnesota in 2024, with more than 20 experts from around the world, found that as climate change puts more pressure on the global food supply, agriculture itself is forced to adopt practice s that further accelerate climate change. It is, in a very real sense, a vicious cycle- the victim and the perpetrator rolled into one.

The numbers tell a stark story. Under high-emission scenarios, experts have warned that future crop yields might plummet by 25% by the end of this century. The combined effects of heat and drought alone have already decreased global average yields of maize by 11.6%, soybeans by 12.4%, and wheat by 9.2%. Drought-related yield losses have occurred in about 75% of the global harvested area.

For India specifically, the picture is alarming. National Innovations in Climate Resilient Agriculture (NICRA) study revealed that in the absence of adaptation measures, climate change is likely to reduce rain-fed rice yields by 20% during the 2050s and between 10–47% during the 2080s. Wheat yield is likely to be reduced by 19.3% during the 2050s and 40% by the 2080s. Kharif maize yields could drop by 10–19% by 2050 and more than 20% by 2080. These are not abstract projections; they describe the future of food for more than a billion people.

The story doesn't end with quantity. Climate change is also affecting quality. Increased temperature, shifts in rainfall patterns, and elevated surface greenhouse gas concentrations lead to lower grain protein concentration and reduced levels of minerals and vitamins in plants. As one researcher put it: we may end up with more food that nourishes us less.

Silent Suffering of Livestock

If crops are threatened by climate change, livestock are being quietly devastated. Animals are not just suffering from the heat; their entire life support system is unravelling. Feed quality is falling, water is scarcer, and diseases once confined to tropical zones are spreading into new territories. Heat stress is one of the most significant, yet underreported, consequences of global warming on the animal husbandry sector. According to The Lancet, when the ambient temperature exceeds an animal's thermoneutral zone, everything suffers: weight gain, milk yield, fertility, and immunity. For cattle, particularly dairy cows, the numbers are stark. A landmark study published in Science Advances in 2025 found that a single day of extreme heat can cut milk production by up to 10%. Worse, the effects of that hot day can linger for more than 10 days, and cooling technologies only offset about half of the losses.

Globally, for a high greenhouse-gas emission scenario, production losses from heat stress in cattle are estimated to amount to $40 billion per year by the end of this century, representing 10% of the value of production of meat and milk from cattle in 2005. Even under a low emission scenario, losses would be $15 billion per year. In both scenarios, losses in most tropical regions, which include South Asia and Sub-Saharan Africa, are projected to be far greater than in temperate regions.

India's situation is a case in point.

Research published in 2025 by PERI University of Massachusetts found that between 2012 and 2019, India's coastal regions saw a 2.7% decline in the bovine population accompanied by a 22.1% increase in sheep and goat populations, a grassroots adaptation strategy where farmers are shifting toward smaller, heat-tolerant ruminants. But this shift is driven by desperation, not planning. Large and medium landowners can afford sophisticated cooling and management interventions; marginal and landless households remain highly vulnerable.

Disease: The Expanding Frontier

Climate change weakens but empowers the pathogens that prey on them. Changes in temperature, rainfall patterns, flooding, and humidity are accelerating pathogen metabolic processes and reproductive rates, and the consequences are showing up in real time. Insect-borne livestock diseases that were once confined to the tropics are increasingly threatening farms in temperate countries and vice-versa. The climate change-disease nexus is turning the once distant threats into neighbourhood emergencies.

Climate change also attacks livestock indirectly by degrading the resources they depend on. Excessive heat, droughts, and floods can reduce crop yields, decrease nutritional content of forage, and increase the risk of pests, pathogens, and weed outbreaks. NASA projections show that corn crop yields are expected to decline by 24% in the next 30 years, directly threatening animal feed supplies worldwide.

Poultry Sector: Small Birds, Big Problems

Poultry is perhaps the most climate-sensitive of all domesticated animals. Birds cannot sweat; they rely on panting and behavioural changes to stay cool. But when ambient temperatures exceed the birds' thermoneutral zone (typically 18–28°C), they simply cannot cope.

When the heat rises, production falls. Heat stress effects on poultry are economically devastating. Research published across multiple peer-reviewed journals consistently shows that heat stress reduces: a) Egg output and quality, including shell weight, shell thickness, egg weight, and egg safety; b) Broiler growth; c) Reproductive performance in both females and males; and d) Immune function making birds more susceptible to infections. The economic consequences are stark. It is estimated that in a typical 20,000-bird poultry house, one severe heat wave can cost a farm between Rs 6 to 10 lakhs in a single production cycle. For large-scale commercial poultry farmers in tropical countries like India, where summer temperatures regularly exceed 40°C in many regions, this is a growing existential concern.

Climate change adds another dimension: it doesn't just create more hot days; it also affects the availability and cost of feed ingredients. Reduced crop yields translate directly into higher feed costs, squeezing margins further. Feed and water scarcity, increased disease pressure from emerging pathogens, and rising energy costs for ventilation and cooling are converging into a perfect storm for the poultry sector.

Fish in Troubled Waters

If agriculture depends on rainfall and temperature, fisheries depend on the health of aquatic ecosystems. Climate change is altering oceans, rivers, lakes, and coastal environments in profound ways.

Oceans absorb much of the excess heat trapped by greenhouse gases. As seawater temperatures rise, fish species migrate toward cooler waters. This shift affects fishing communities that have traditionally depended on predictable fish populations. Many fishers report travelling farther and spending more time at sea to obtain the same catch.

Ocean warming is also linked to coral bleaching. Coral reefs serve as nurseries and habitats for countless marine species. Their decline threatens biodiversity and fisheries productivity.

Another challenge is ocean acidification. Increased absorption of carbon dioxide makes seawater more acidic, affecting shell-forming organisms and disrupting marine food chains.

Inland fisheries are not immune. Rivers and lakes experience altered flow regimes, changing water temperatures, and reduced oxygen levels. Aquaculture, often promoted as a solution to growing seafood demand, also faces climate-related risks. Heat stress, disease outbreaks, water scarcity, and extreme weather events, all affect fish farms. The livelihoods of millions of coastal and inland fishing communities are, therefore, at stake.

Adapting to the Challenge

Knowing the threat is only the first step. The more urgent question is: what do we do? Fortunately, the story is not entirely bleak. Scientists, policymakers, farmers, and communities around the world are developing and deploying a range of interventions, from high-tech precision farming to ancient indigenous wisdom. The key is to act with urgency, and at scale.

Human Face of Climate Change

Climate change discussions are often reduced to numbers and statistics, yet its impacts are ultimately human. Consider a small farmer who loses a crop because rains arrived a month late. Consider a dairy farmer whose animals produce less milk during a prolonged heatwave. Consider a fisher whose traditional fishing grounds no longer yield enough catch. Behind every climate statistic lies a personal story. Women, smallholders, indigenous communities, and landless workers are often among the most vulnerable groups. They typically have fewer resources to absorb shocks and recover from losses. The impacts can ripple across entire communities. Reduced farm income affects education, healthcare, nutrition, and social well-being.

> "We are the first generation to feel the impact of climate change and the last generation that can do something about it."
>
> — Christiana Figueres, Former UN Climate Chief

Climate change is, therefore, not merely an environmental issue. It is a development issue, an economic issue, and increasingly, a social justice issue. There is a deep moral paradox at the heart of this story: the communities that have contributed least to greenhouse gas emissions are suffering the most from their consequences. As food systems activist Olivier De Schutter observed, "Small-scale farmers in the Global South are being hit first and worst by climate change, though they did not cause this crisis."

Adapting Agriculture to a Warmer World

The good news is that solutions exist. Adaptation does not mean surrendering to climate change. It means adjusting systems to reduce vulnerability and enhance resilience.

One of the most important strategies is the development and adoption of

climate-resilient crop varieties. Scientists are breeding crops that can tolerate drought, heat, floods, and salinity. These innovations are already helping farmers maintain productivity under difficult conditions. Improved water management is equally critical. Techniques such as drip irrigation, sprinkler systems, rainwater harvesting, and precision irrigation can significantly improve water-use efficiency.

Conservation agriculture offers another pathway. Practices such as minimum tillage, crop rotation, and residue retention improve soil health, increase moisture retention, and enhance resilience. Agroforestry, the integration of trees with crops and livestock, can provide shade, improve biodiversity, sequester carbon, and diversify farm income.

Digital technologies are also becoming powerful adaptation tools. Mobile-based weather advisories, satellite monitoring, and early warning systems help farmers make informed decisions.

As Dr. M. S. Swaminathan, the architect of India's green revolution often emphasied, the future lies in "evergreen revolution": increasing productivity without causing ecological imbalance.

Climate-Resilient Livestock Systems

Livestock adaptation begins with animal comfort and welfare. Simple measures such as improved housing, shade structures, ventilation, cooling systems, and access to clean drinking water can reduce heat stress significantly.

Breeding programs can help develop animals that are more tolerant to heat and disease. Adaptation requires acknowledging the remarkable climate resilience of our indigenous breeds. Gir, Sahiwal, Tharparkar have evolved over centuries to thrive in harsh conditions, handling extreme heat, resisting diseases, and surviving on minimal grazing. Yet these indigenous breeds have been progressively displaced in many regions by exotic high-yielding breeds that are productive in temperate climates but vulnerable in the tropics. The trend of shifting toward smaller ruminants seen in coastal India, more sheep and goats, and fewer bovines, represents farmers' own grassroots adaptation: it deserves policy recognition and support.

Better fodder management is equally important. Drought-resistant fodder crops, fodder banks, and silage production can ensure feed availability during difficult periods. Veterinary surveillance systems must also be strengthened to monitor emerging diseases and respond quickly to outbreaks. Integrated crop-livestock systems can enhance resilience by making better use of resources and reducing dependence on external inputs.

Future-Proofing the Poultry Sector

The poultry industry is responding through improved housing design, better ventilation, automated cooling systems, and nutritional interventions. Researchers are exploring feed formulations that help birds cope with heat stress. Genetic improvements would also contribute to greater resilience. However, technology alone is not enough. Farmer training, access to finance, insurance mechanisms, and extension services are equally important. Small producers, who account for a significant share of poultry production in many countries, must not be left behind.

Sustainable Fisheries and Aquaculture

Adaptation in fisheries requires both ecological and social measures. Protecting marine ecosystems, restoring mangroves, conserving wetlands, and reducing pollution can strengthen the resilience of aquatic systems. Sustainable fisheries management is essential to prevent overexploitation of already stressed resources.

For aquaculture, improved water management, disease surveillance, climate-resilient infrastructure, and diversification of cultured species can reduce vulnerability.

Community-based approaches often work best because fishers possess valuable local knowledge about changing environmental conditions. Combining scientific expertise with traditional wisdom can generate more effective solutions.

Role of Policy and Governance

Adaptation cannot be left solely to individual farmers, livestock keepers, or fishers. Governments have a crucial role to play. Investments in agricultural research, rural infrastructure, irrigation systems, weather forecasting, and extension services are essential. Crop insurance and risk-management mechanisms can help households recover from climate shocks. Financial incentives can encourage climate-smart practices. Policies should also promote sustainable land use, water conservation, biodiversity protection, and renewable energy adoption.

International cooperation remains vital because climate change does not respect national boundaries. As former UN climate chief Christiana Figueres observed, "We are the first generation to feel the impact of climate change and the last generation that can do something about it."

Vulnerability to Resilience

Climate change presents one of the greatest tests humanity has ever faced. The food and agriculture sector sits at the centre of this challenge because it must simultaneously feed a growing population, support livelihoods, and adapt to changing environmental conditions. The road ahead will not be easy. Rising temperatures, water scarcity, extreme weather events, and shifting ecosystems will continue to create uncertainty.

Yet agriculture has always been a story of adaptation. Farmers have survived droughts, floods, pests, and economic disruptions for centuries by learning, innovating, and persevering.

Today, the challenge is larger and more complex, but the principle remains the same. The goal is not merely to protect existing systems but to transform them into systems that are more resilient, sustainable, and inclusive. The future of food security will depend not only on how much we produce, but on how wisely we manage our natural resources and how effectively we support those who produce our food.

FAO's Strategy on Climate Change 2022–31 emphasises making agrifood systems more "efficient, inclusive, resilient, and sustainable". These four words are not just bureaucratic aspiration: they are a practical roadmap. Efficiency means getting more food from the same resources. Inclusivity means ensuring adaptation tools reach the smallest farmer, the most remote fisherfolk. Resilience means building systems that can absorb shocks and bounce back. Sustainability is doing all of this without depleting the natural capital that future generations will depend upon. The focus around sustainability is also embracing the concern of food inflation triggered by reduced output on account of climate change. Cindy Gerhardt of Planet-B.io, a Dutch industrial biotech accelerator warns, "It is not about preventing climate change. It's about dealing with it and finding solutions, because otherwise prices are going to rise too high." Feeding 10 billion in 2050, in such a scenario, would be a formidable challenge.

In the end, climate change is not only about rising temperatures. It is about the choices societies make today. Those choices will determine whether future generations inherit a world of increasing scarcity and uncertainty or one of resilience, innovation, and shared prosperity.

The stakes could hardly be higher. When the climate changes, the food on our table changes too. Our focussed intent should be to ensure that there is still enough on that table for everyone.

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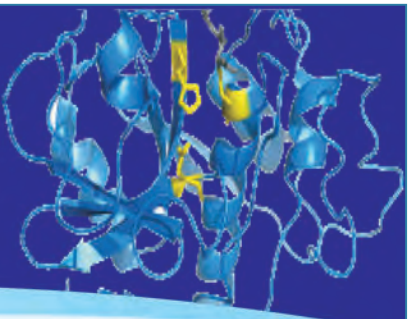

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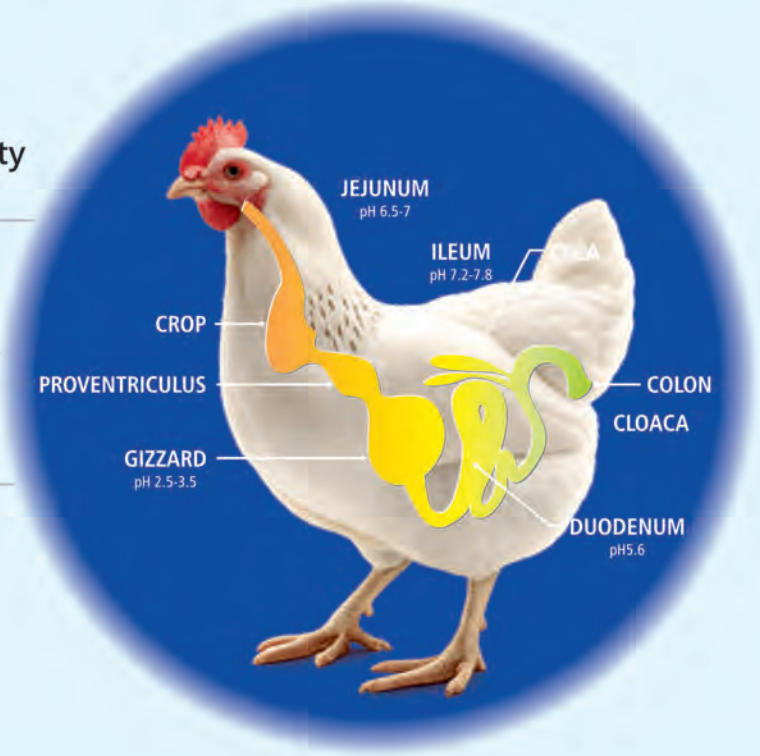

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Article

Bacillus Subtilis PB6– A Reliable and Optimal Solution for Dysbacteriosis in Broilers

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Kemin Industries South Asia Pvt. Ltd.

Introduction

Modern broilers achieve high body weight and improved Feed Conversion Ratio (FCR), but this performance places significant stress on the gut, making them susceptible to bacterial enteritis, dysbacteriosis, necrotic enteritis (NE), and coccidiosis. Poor gut health elevates FCR and leads to wet litter, respiratory stress, increased litter handling needs, and higher treatment costs. In India, a considerable cost per ton of feed is incurred for the management and treatment of gut health disorders, particularly dysbacteriosis. Subclinical necrotic enteritis (NE) arises when intestinal dysbiosis facilitates the overgrowth and upward migration of Clostridium perfringens from the hindgut to the upper gastrointestinal tract, resulting in substantial but often undetected economic losses. Predisposing factors include coccidiosis, high protein diets, abrupt feed transitions, prolonged off feeding, poor shed management, and immunosuppression. Rising conventional feed ingredient prices and subsequent increased inclusion of non-conventional raw materials, recurrent viral outbreaks, and non-judicious antibiotic use further weaken intestinal health.

In recent years, the broiler industry has been experiencing coccidiosis and subclinical NE as two primary diseases for intestinal health upset. Next to these two diseases, nonspecific bacterial enteritis/dysbacteriosis occurs, caused by an imbalance in the nonspecific bacterial population in the poultry gut. Sometimes it is also called SIBO (Small Intestinal Bacterial Overgrowth), manifested as undigested feed particles in droppings (Fig. 3a,b), diarrhea, wet litter, watery intestinal content (Fig. 4a), thin intestinal membrane (Fig. 4b) and dilated serosal blood vessels (Fig.5a), resulting in poor performance of broiler birds. So, to analyse the severity of dysbacteriosis and coccidiosis in the Indian context, macroscopic observation of the intestinal tract of broiler chicken across the country was performed in the year 2024 as a regular annual program by the Kemin Technical Services team. Macroscopic dysbacteriosis and coccidiosis scores were assigned to commercial broilers by experienced veterinarians during necropsy across Indian states. Bacillus subtilis PB6, a patented organism, has an active microbial property that can specifically show inhibitory action on the Clostridium perfringens population and promote the growth of other beneficial bacteria. The present study evaluated the efficacy of Bacillus subtilis PB6 in 2024 in Indian states. The study was conducted among Indian broiler producers, both PB6 users and non-users. Assessment of the prevalence of dysbacteriosis and coccidiosis in Indian broiler farms was done and analysed to see the effect of PB6 in controlling dysbacteriosis.

Trial Design/ Method

Johnson & Reid's lesion-scoring procedure for coccidiosis was carried out during the study. A dysbacteriosis scoring system, developed by the Kemin technical team and in line with the method described by Teirlynck et al., 2011, was used in this study. During the year 2024, 499 Indian broiler farms were analysed from 71 broiler integrators across different regions. From each broiler farm, 3-5 healthy live birds were sacrificed by cervical dislocation by an expert veterinarian and immediately necropsied. Intestinal lesion scoring was conducted and recorded immediately at farms. A total of 1513 broiler birds with a mean age of 26 days and an age range between 15 and 45 days were selected based on Dysbacteriosis and Coccidiosis Prevalence During The Year 2024.

Results & Discussion

The intestinal health monitoring in 71 broiler integrations across different regions of India in the year 2024 resulted in an average dysbacteriosis score of 1.00 in PB6 users, which was numerically lower than that of non-PB6 users, which was 1.09. The average coccidiosis score was more than 0.9 in both PB6 users and non-users. The results showed that PB6 users had numerically lower dysbacteriosis scores than non-users, while the prevalence of coccidiosis was the same in PB6 users and non-users across the country during the year 2024. The mean lesion score of coccidiosis and TMLS in Bacillus subtilis PB6 users and non-users during the year 2024 is shown in the figure. 2. Regional variation was also observed across India for both total mean lesion score (TMLS) and dysbacteriosis.

- TMLS by region: West (1.77; highest), East (1.43), North (1.07), South (0.60; lowest).
- Dysbacteriosis score by region: West (1.25; highest), South (1.08), East (0.89), North (0.67; lowest).

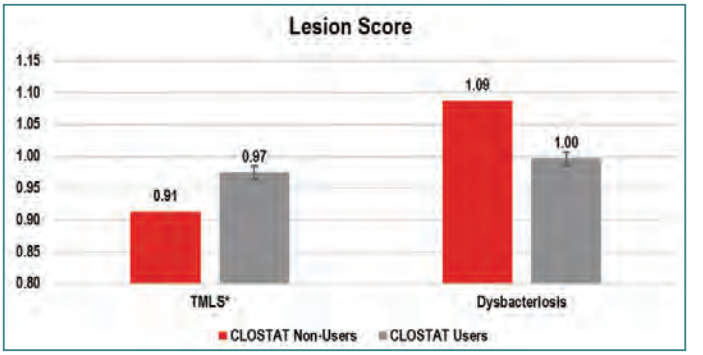

Fig. 1: Dysbacteriosis lesion score and Total mean lesion score (TMLS) of coccidiosis at Bacillus subtilis PB6 users and non-users during the year 2024

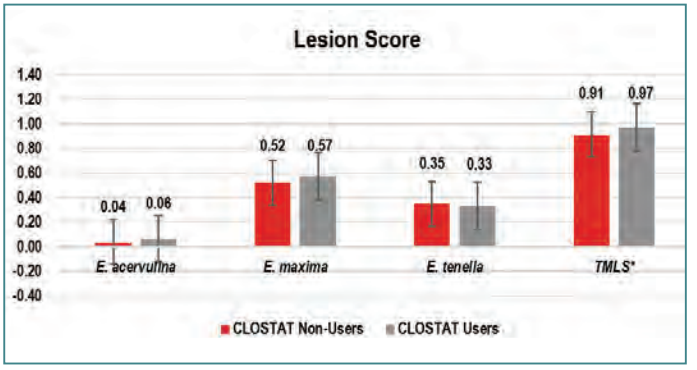

Fig. 2: Mean lesion score of coccidiosis and TMLS at Bacillus subtilis PB6 users and non-users during the year 2024

Figs. 3a and b: Undigested particles with orange mucus in feces

Figs. 4a and b: Watery intestinal content and thin intestinal membrane

Figs. 5a and b: Dilated serosal blood vessels and orange intestinal content with undigested feed particles

Nowadays, the poultry industry faces multiple challenges, like improper raw material quality with higher fungal contamination, along with various adulterations of feed raw materials and their inferior quality, leading to immunosuppression, which results in various disease outbreaks, and environmental challenges, which have a direct adverse impact on productivity. Over the last 2-3 years, it has been found that the incidence of subclinical coccidiosis is increasing year-round, regardless of season. The major reasons are resistance to commonly used anticoccidials due to improper anticoccidial rotation that does not follow the golden rules of rotation, immunosuppression due to inferior-quality raw materials, and emerging diseases and environmental variations, etc. As coccidiosis is a major predisposing factor for NE or dysbacteriosis, its incidence has become more prevalent, which is shown in the lesions in the figures above (Figs. 1 & 5b). Several feed additives, like organic acids, probiotics, prebiotics, essential oils, etc., were tried to control gut health issues as an alternative to AGP.

Among these alternatives, probiotics have gained worldwide recognition for managing gut health effectively. In the present study, we have also observed numerically better control of dysbacteriosis in the CLOSTAT user group. PB6 is a natural strain isolated from the healthy chicken gut, and it is known to secrete surfactins and other secondary bacterial peptides, which have antibacterial activity against common pathogens like Clostridium spp. Although the TMLS of coccidiosis is numerically higher in CLOSTAT users than non-users, Bacillus subtilis PB6 is still helping to minimise dysbacteriosis more efficiently in CLOSTAT users than non-users, as evidenced by a numerically lower dysbacteriosis score in Bacillus subtilis PB6 users than non-users.

Conclusion

The findings of the 2024 study indicate that coccidiosis and dysbacteriosis occurred consistently across all regions of India's broiler market, irrespective of seasonal variations. Gut health challenges are aggravated by extreme day-night temperature variations, poor/compromised ventilation, and the use of foggers or water spraying during extreme summer conditions. During this study, we found that Bacillus subtilis PB6 users were able to maintain better intestinal health than non-users during the year 2024. The study concluded that Bacillus subtilis PB6 is a reliable and sustainable solution for managing dysbacteriosis, even in challenging situations such as coccidiosis, pressure from non-conventional raw materials, indiscriminate use of AGPs, and AGP bans.

So, Bacillus subtilis PB6 can maintain intestinal health not only by its direct killing action on Clostridium perfringens but also by maintaining the harmony of intestinal microbiota. Bacillus subtilis PB6 can be used as a unique tool to maintain gut health, as a complete replacement for AGPs, or with AGPs, at a subtherapeutic dosage by poultry producers. Hence, Bacillus subtilis PB6 will help to manage gut health & protect gut health from the deleterious effects of necrotic enteritis and dysbacteriosis.

(References on request)

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COVER

THE HEAT IS ON

Heat stress is already affecting bird performance, feed efficiency, mortality and farm economics. At the same time, changing climatic conditions are creating new pressures on disease control, resource availability and the environmental footprint of poultry production. The question is no longer whether climate change will affect Indian poultry, but how prepared the sector is to respond. In this cover story, One Health consultant, **Dr. Chanchal Bhattacharya** examines the journey from managing heat stress to building true climate resilience— and why a more sustainable, integrated approach will be essential if poultry is to remain a cornerstone of India's food and nutritional security

The Climate Imperative

The Indian poultry sector is no longer just an agricultural success story: it is a massive macro-economic engine valued at over Rs. 2 lakh crore. Producing more than 140 billion eggs and nearly 5 million tonnes of chicken meat annually, the industry stands at a critical crossroads. Climate change has shifted from a distant, future forecast into an immediate, daily operational hurdle. Today, it directly impacts bird health, feed conversion ratios, disease patterns, farm margins, and, ultimately, national food security.

On a global scale, the vulnerability of poultry production to climate disruption mirrors a broader crisis unfolding across major agricultural economies. From the intensive broiler operations of the US Sun Belt and the expanding multi-tier facilities in Brazil to the emerging poultry corridors across Sub-Saharan Africa and Southeast Asia, rising global temperatures threaten global protein supplies. International climate models predict that by mid-century, over 60% of global poultry production hubs will experience severe or extreme thermal stress for more than 90 days a year. This worldwide vulnerability creates a dual economic shock: localised mass mortality events during extreme weather anomalies, and a systemic, long-term degradation of feed conversion efficiency. Furthermore, globalised supply chains mean that localised climate failures—such as droughts shrinking South American soybean yields or extreme heat disrupting grain transport in North America—instantly ripple through international markets, driving up baseline production costs everywhere. Consequently, multinational breeding corporations and global regulatory bodies are pivoting toward long-term climate-adaptation frameworks, realising that standard operational playbooks are no longer viable under permanent climatic instability.

In recent years, unprecedented summer heatwaves have swept across northern, western, and southern India. Temperatures regularly breach the 45°C mark in key poultry-producing hubs across Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra, Punjab, and Haryana. These extreme weather events are placing immense strain on production systems originally built for historical weather baselines rather than today's unpredictable climate shifts.

Because poultry represents the most affordable, highly bioavailable source of animal protein for millions of Indians, building climate resilience is no longer an environmental aspiration— it is a strategic necessity for the subcontinent's geopolitical and nutritional stability.

The Macro-Economic Canvas of Indian Poultry

To appreciate the gravity of the climate threat, one must first understand the scale and velocity of the Indian poultry industry. Over the past four decades, this sector has undergone a structural transformation—shifting from a decentralised backyard farming practice into a highly organised, vertically integrated, technology-driven powerhouse.

Production Topography and Key Hubs

The geographical distribution of India's poultry infrastructure makes it highly vulnerable to localised climate shocks. The industry is concentrated in specific regional clusters:

- **The Southern Triad (Andhra Pradesh, Telangana, Tamil Nadu):** This region accounts for a massive share of the country's egg production and commercial broiler integrators. Regions like Namakkal (Tamil Nadu) and the peripheral districts of Hyderabad are globally recognised poultry capitals
- **The Western Belt (Maharashtra, Gujarat):** This zone is dominated by large-scale commercial broiler operations catering to massive urban consumer markets
- **The Northern Granary (Punjab, Haryana, Western Uttar Pradesh):** This area is characterised by extreme seasonal temperature swings, where winters drop to near freezing and summers consistently climb past 45°C

Economic Contribution and Livelihoods

The poultry sector contributes significantly to India's agricultural Gross Value Added (GVA). Unlike traditional crop farming, which is highly seasonal, poultry provides a year-round, predictable cash flow to rural communities.

It acts as a vital safety net for small and marginal farmers, employing over 5 million people directly and supporting an estimated 25 million downstream livelihoods, including feed cultivators, logistics providers, cold-chain operators, and retail distributors.

Macro-Economic & Structural Metrics

This table outlines the contrasting scales, output volumes, and climate vulnerabilities of the global vs. Indian poultry landscapes.

Indicator	Global Poultry Industry	Indian Poultry Industry
Market Valuation / Scale	Dominates the global meat sector; projected production of 104.9 million metric tons (approx. 50% of global meat growth).	Valued at over Rs 2 lakh crore (~$24–28 billion); highly integrated commercial sector.
Annual Production Volume	Leading global animal protein source by volume.	140+ billion eggs and nearly 5 million tonnes of chicken meat.
Livelihood & Economic Safety Net	Core commercial asset in the Americas/Europe; major poverty-allevia-tion driver in developing regions.	Employs 5 million people directly and supports 25 million downstream livelihoods (feed, logistics, retail).
Geographic Climate Exposure	Over 60% of global production hubs will experience severe thermal stress for over 90 days/ year by mid-century.	Highly concentrated in climate-vulnerable zones: Southern Triad (AP, Telangana, TN) and the Northern Granary (Punjab, Haryana).
Annual Heat Stress Financial Damage	$2.36 billion in annual losses in the United States alone (due to mortality, slow growth, and immune suppression).	Seasonal losses concentrated in peak summer months, severely impacting independent and smallholder operations.

Why Poultry is Biologically Vulnerable to a Warming World

Birds face a distinct evolutionary disadvantage when confronting extreme heat. Unlike mammals, avian species completely lack sweat glands. Furthermore, their bodies are wrapped in a highly effective insulating layer of feathers designed to trap heat rather than release it. Consequently, their primary mechanism for heat dissipation is behaviour-based: panting.

The Thermoneutral Zone and Thermal Stress

The optimal ambient temperature for adult commercial poultry, their thermoneutral zone, lies strictly between 18°C and 24°C. Within this narrow window, birds maintain their core body temperature without expending metabolic energy to warm or cool themselves.

When the environmental temperature climbs past 30°C, and particularly when it is accompanied by high relative humidity (common in coastal states like Andhra Pradesh and Tamil Nadu), the bird's heat dissipation mechanisms fail. Panting relies on evaporative cooling from the respiratory tract. If the air is already saturated with moisture, this process stalls, triggering a dangerous physiological breakdown.

The Physiological Cascade of Heat Stress

1. **Respiratory Alkalosis:** As a bird pants rapidly to cool down, it expels excessive amounts of carbon dioxide through its lungs. This loss alters the blood pH, pushing it toward an alkaline state. This shift disturbs the delicate acid-base balance of the blood, impairing cardiovascular function and cellular metabolism
2. **The Calcium-Shell Dilemma:** Blood alkalinity directly decreases the concentration of ionised calcium in the bird's bloodstream. For commercial layers, this creates a severe operational problem. The shell gland requires a steady supply of calcium and carbonate ions to synthesise eggshells. Under heat stress, calcium binding drops drastically. Even if the feed contains adequate calcium, the bird's internal transport mechanism is broken, leading to a sharp rise in thin-shelled, cracked, or unmarketable eggs
3. **Intestinal Integrity Failure (Leaky Gut):** To cope with high external temperatures, the bird's autonomic nervous system diverts blood flow away from internal organs (like the gastrointestinal tract) toward peripheral tissues (such as the comb, wattles, and skin) to maximise heat radiation. This prolonged reduction in blood flow starves the intestinal lining of oxygen. The tight junctions between intestinal cells break down, leading to "leaky gut syndrome." Pathogens and toxins can then cross directly into the bloodstream, triggering systemic inflammation, poor nutrient absorption, and elevated mortality rates

Farm-Level Production & Performance Metrics

This table captures the direct, quantifiable performance degradation that occurs when environmental parameters cross the birds' thermoneutral zone (18°C to 24° C).

Performance Parameter	Baseline (Optimal Climate / EC Housing)	Climate Stress Impact (Unmitigated Open Houses)
Flock Mortality Rate	Under 3% per production cycle.	Spikes to 10% or higher when ambient temperatures breach $38^{0}\circ\text{C} - 42^{0}\circ\text{C}$.
Egg Laying Capaci-ty (Layers)	Stable peak performance at 90–95% laying efficiency.	Drops sharply by 5% to 20% during severe summer heatwaves.
Feed Conversion Ratio (FCR)	Optimal efficiency; birds convert feed to biomass without metabolic wasting.	Severe degradation; even a 1% negative shift in FCR can completely erase farm profit margins.
Egg Quality & Marketability	Strong, thick eggshells with low breakage rates.	Massive increase in thin-shelled, cracked, or unmar-ketable eggs due to the calcium-shell dilemma.
Farm Operational Costs	Baseline utility and energy spending.	Energy costs projected to rise 15–25% to power automated ventilation and cooling pads.

The Emerging Threat to India's Protein Security

Poultry is a cornerstone of nutritional security in India, offering low-income households access to affordable, high-quality protein, essential amino acids, vitamins, and minerals. Data from the Food and Agriculture Organization (FAO) and domestic livestock assessments confirm that poultry remains the country's fastest-growing animal protein segment, far outstripping dairy and red meat consumption growth.

Socio-Economic Ripple Effects

When a severe heatwave strikes a poultry cluster, the resulting drop in production causes immediate, sharp contractions in retail markets. This supply-demand gap results in fast-moving price volatility. For middle- and low-income Indian families, a sudden 30% spike in the price of eggs or chicken meat forces a pivot toward lower-quality, nutrient-poor diets.

The Impact on Backyard and Gender-Led Poultry Operations

While commercial integrators have some capital to buffer against climate shocks, the impact is often devastating for smallholders and women-led backyard poultry operations.

Rural backyard poultry, utilising indigenous breeds like Aseel, Kadaknath, or improved varieties like Vanaraja, is heavily dependent on the natural environment. While these indigenous breeds possess higher natural heat tolerance than exotic strains, extreme weather events reduce their scavenging range, slash their erratic egg output, and deplete the primary financial asset of rural women.

When backyard flocks perish due to extreme heat or climate-induced disease, rural households lose an immediate source of disposable income often used for health and education expenditures.

Feed Security Under Climate Stress

Feed sourcing alone commands roughly 65% to 70% of total poultry production costs. The two bedrock ingredients of Indian poultry feed—maize (corn) as the primary energy source and soybean meal as the core protein source—are highly sensitive to shifting weather patterns, including prolonged droughts, erratic monsoons, unseasonal rainfall, and localised water scarcity.

The Vulnerability of Maize and Soybean Supply Chains

Maize is predominantly a rainfed crop in many parts of India, making its yield highly dependent on the timely arrival and even distribution of the monsoon. Climate models show increased frequency of long dry spells punctuated by short, intense downpours across major cultivation states like Madhya Pradesh, Karnataka, Bihar, and Maharashtra.

These shifting weather patterns create a volatile market for raw feed materials. When crop yields decline, feed processing plants must compete for limited supplies, driving up prices and squeezing farm margins.

The Alternative Feed Matrix

To buffer against this volatility, researchers, feed millers, and nutritionists are turning to alternative, climate-resilient feed crops and non-traditional ingredients. Diversifying raw material sourcing is shifting from an optional cost-saving measure to a core requirement for long-term operational survival.

- **Sorghum (Jowar):** An excellent energy source to replace maize. It features high drought tolerance and requires 30-40% less water than maize, though its tannin content requires careful processing to preserve digestibility
- **Pearl Millet (Bajra):** Serves as a reliable energy and protein source that thrives in poor, sandy soils and high-temperature zones. However, rapid lipid oxidation requires short storage windows or antioxidant stabilisation
- **DDGS (Distillers Dried Grains with Solubles):** A nutrient-dense by-product of ethanol production. It decouples feed sourcing from direct crop failures, though buyers must watch for variable nutritional profiles and concentrated mycotoxin risks
- **Insect-Based Proteins (Black Soldier Fly Larva):** Offers a high-density protein source with a low water and land footprint by growing on organic waste streams. Scaling this up depends heavily on developing clearer regulatory frameworks
- **Algae Supplements (Spirulina/Chlorella):** Provides essential micronutrients and immune support. It can be cultivated in brackish or non-arable wastewater setups, though high processing and drying costs currently limit large-scale inclusion

Direct Financial Losses per Bird (Indian Market Context)

A direct look at the per-bird and unit-level financial damage during peak summer heat stress periods.

Production Segment	Direct Loss (Per Bird/Cycle) (Rs.)	Total Loss (Including Indirect Factors*)(Rs.)	Financial Impact on a Standard 10,000-Bird Unit
Commercial Broiler Flocks	10 – 30	30 – 65	Up to Rs 300,000 – Rs 650,000 total loss per cycle
Commercial Layer Flocks	25 – 60	40 – 85	Up to Rs 400,000 – Rs 850,000 cumulative loss per year

**Note: Indirect factors account for reduced carcass meat yield, uneven flock weights, elevated medication costs from heat-induced immuno-suppression, and downgraded egg batches.*

Supply Chain & Raw Material Feed Matrix

Because feed constitutes 65% to 70% of total poultry production costs, upstream agricultural climate volatility severely alters farm economic stability.

Feed Raw Material	Baseline Vulnerability	Climate Shift & Quality Risks	Climate-Resilient Adaptation Strategy
Maize (Corn) (Primary Energy Source)	Highly dependent on regular monsoon rainfall across MP, Karnataka, and Bihar.	Erratic rains create sudden supply gaps, severe market price volatility, and raw material inflation.	Blend or substitute with drought-resistant grains like Sorghum (Jowar) or Pearl Millet (Bajra).
Soybean Meal (Core Protein Source)	Sensitive to extreme heat and prolonged dry spells during critical growth stages.	Reduces overall domestic yields, squeezing commercial integrator profit margins.	Incorporate stable alternatives like DDGS or scale up sustainable Insect-Based Proteins (BSFL).
Harvested Grain Storage	High risk of moisture exposure from unseasonal post-harvest rains.	High humidity drives 15–20% grain rejection rates due to dangerous Aflatoxin and Ochratoxin contamination.	Implement mechanical grain dryers, strict silo moisture controls, and high-dose dietary mycotoxin binders.
Alternative Crops (Sorghum / Pearl Millet)	Underutilised in traditional, rigid feed formulations.	Rapid lipid oxidation in pearl millet limits storage windows; sorghum tannins require careful processing.	Cultivation requires 30–40% less water than maize, proving highly stable in marginal, arid soils.

Climate Change and Disease Dynamics

A less visible but equally critical consequence of a warming climate is its impact on disease epidemiology. Sustained high temperatures paired with erratic humidity levels create ideal

environments for pathogen survival, vector proliferation, and the mutation of viral strains.

Vector-Borne Diseases and Parasitic Shifts

Warmer winters and longer, humid summers accelerate the life cycles of insect vectors, ticks, and mites. The common poultry red mite (Dermanys susgallinae) and various mosquito vectors replicate much faster at elevated temperatures. These pests cause systemic stress, anemia, and discomfort in birds, while serving as effective vectors for fowl pox and other blood-borne pathogens.

The Mycotoxin Crisis in Wet and Humid Storage

One of the most dangerous consequences of erratic weather is the surge in mycotoxin contamination. When unseasonal rains hit maize and soybean crops during harvest, or when high humidity characterises commercial feed storage warehouses, moulds like Aspergillus flavus thrive.

These moulds produce deadly secondary metabolites known as Aflatoxins, Ochratoxins, and T-2 toxins. Even in low concentrations, mycotoxins damage liver function, impair feed conversion, and cause profound immunosuppression.

Immunosuppression and Vaccine Failure

Heat-stressed birds produce high levels of corticosterone, a primary stress hormone. Corticosterone directly suppresses the activity of the bursa of Fabricius and the thymus gland—the primary organs responsible for producing antibodies and immune cells in poultry.

As a result, a flock experiencing chronic heat stress cannot develop strong immunity from standard vaccination protocols against major threats like Newcastle Disease (Ranikhet), Infectious Bursal Disease (IBD), and Highly Pathogenic Avian Influenza (HPAI). This leaves flocks highly vulnerable to sudden outbreaks, even when vaccinated.

Smart Poultry Farming: The New Normal

To counter these environmental pressures, the design of the modern poultry farm is evolving away from traditional open-sided sheds and toward strict environmental control and digital integration.

Environmentally Controlled (EC) Housing vs. Open-Sided Sheds

In high-heat zones across India, open-sided sheds—which rely purely on natural wind movement and basic ceiling fans—are proving insufficient to keep commercial birds alive. Modern producers are investing heavily in Environmentally Controlled (EC) housing systems. These completely sealed structures utilise advanced engineering to decouple the internal environment from external weather extremes.

Key Engineering Systems of EC Houses

- **Tunnel Ventilation:** Large exhaust fans at one end of the building pull air through the entire length of the house at high velocity, creating a wind-chill effect that lowers the effective temperature felt by the birds
- **Evaporative Cooling Pads:** Hot ambient air enters the shed through porous cellulose pads saturated with water. As the dry air passes through the wet pads, the water evaporates, drawing latent heat from the air and dropping internal shed temperatures by 6°C to 10°C
- **Automated Feeding and Watering Lines:** These setups adjust feeding times to cooler periods of the day, reducing the metabolic heat generated by birds during digestion. High-flow nipple drinkers ensure constant access to cool water, preventing dehydration

Data-Driven Farm Management

The future of climate resilience lies in data-driven farm management. Modern commercial operations are installing sensor arrays that continuously track key variables:

- **The Temperature-Humidity Index (THI):** This reading allows automated control units to adjust fan speeds and pad pumps instantly
- **Carbon Dioxide and Ammonia Sensors:** These devices track air quality inside densely populated sheds to prevent respiratory irritation and secondary bacterial infections
- **Predictive Diagnostics:** Operators can analyse sudden changes in water consumption patterns, which often serve as an early warning indicator for heat stress or an impending disease outbreak before physical symptoms show in the flock

The Economics of Retrofitting: Capex vs. Opex Reality

For the average Indian poultry producer, transitioning from traditional farming to a climate-resilient framework is fundamentally a financial calculation. The primary barrier to widespread climate adaptation is the steep initial capital expenditure (Capex) required to construct or retrofit closed-system, environmentally controlled houses.

The Cost Breakdown of Modernisation

Building a state-of-the-art EC shed for a standard commercial flock size of 30,000 birds requires significant investment in structural sealing, automated feeding lines, backup diesel or solar generators, exhaust systems, and cellulose cooling pads. For independent farmers operating on thin margins, taking on such debt presents a notable risk.

However, a close examination of operational expenditures (Opex) reveals a compelling return on investment. In traditional open-sided sheds during peak summer, mortality rates can spike to 10% or higher, and the Feed Conversion Ratio (FCR) deteriorates sharply because birds consume energy simply trying to stay cool.

In contrast, EC houses keep mortality under 3% and preserve optimal FCR numbers year-round. Over a standard business horizon of three to five years, the savings from recovered bird biomass, uniform growth rates, and reduced medication requirements typically offset the initial capital costs. The challenge remains the lack of institutional credit designed for these climate-smart agricultural upgrades.

Redefining Biosecurity Architecture for Extreme Weather

Traditional biosecurity in poultry farms has focused almost exclusively on stopping the movement of physical pathogens through vehicle disinfection dips, footwear changes, and restricted visitor access. However, climate change requires a complete restructuring of farm layout and structural design.

Structural Sealing and Rodent Exclusion

When outdoor temperatures soar past 42°C, local wildlife, rodents, and wild birds seek shade, water, and food sources. Open-sided poultry sheds become a magnet for these wild vectors, drastically increasing the risk of introducing highly pathogenic avian influenza or salmonella into the commercial flock.

A climate-resilient biosecurity protocol requires completely sealed housing structures where air intake is tightly regulated through specialised cooling pad inlets covered with fine pest-exclusion meshes. This system simultaneously cools the birds and physically blocks contact with wild vectors driven inward by harsh environmental conditions.

Water Quality Sanitation Under High Heat

Another overlooked biosecurity risk is the deterioration of drinking water quality. As summer temperatures rise, water sitting in exposed overhead tanks and pipeline systems heats up rapidly. Warm, stagnant water lines create an ideal environment for bacterial biofilms to flourish.

Farmers must implement enclosed, insulated water distribution networks, execute continuous organic acid chlorination protocols, and regularly flush lines to ensure that water delivered to the birds remains cool and pathogen-free.

Nutritional and Immunological Strategies for Heat Stress Mitigation

While structural modifications offer a solid line of defence, adjusting flock nutrition provides an immediate, scalable, and highly cost-effective way to mitigate the impacts of thermal stress. Targeted dietary adjustments can help birds maintain internal homeostasis when temperatures rise.

Operational Insight: Nutritionists must re-engineer feed formulations during hot seasons, shifting from simple calorie-dense diets to highly digestible, functional nutrition profiles.

1. **Restoring Electrolyte Balance**
   Because panting induces respiratory alkalosis, replenishing lost ions through feed or drinking water is vital. Adding sodium bicarbonate, potassium chloride, and specialised ammonium salts helps rebalance blood pH and maintains osmotic balance within cellular tissues.
2. **Osmoregulation via Betaine**
   Betaine, a naturally occurring amino acid derivative, acts as a powerful osmolyte. It protects plant and animal cells from environmental stress by retaining cellular water against osmotic gradients. In heat-stressed poultry, betaine supplementation helps maintain intestinal cell structure, reduces the energy spent on ion pumping, and helps mitigate leaky gut syndrome.
3. **Antioxidant Blends to Combat Oxidative Stress**
   High temperatures trigger an overproduction of Reactive Oxygen Species (ROS) within the bird's mitochondria, causing widespread cellular damage. High-dose supplementation of Vitamin C (Ascorbic acid) and Vitamin E (Alpha-tocopherol), working in tandem with trace minerals like Selenium, neutralises these free radicals, shoring up immune defenses and protecting delicate muscle tissues from degeneration.
4. **Functional Feed Additives and Gut Health Stabilisers**

- **Phytogenics:** Plant-derived essential oils (such as thymol, carvacrol, and cinnamaldehyde) stimulate digestive enzyme secretion, improving nutrient utilisation even when total feed intake drops
- **Probiotics and Prebiotics:** Introducing beneficial live bacteria (Lactobacillus, Bacillus subtilis) paired with oligosaccharides helps maintain a healthy gut microbiome, crowding out opportunistic pathogens like Salmonella and E. coli that capitalize on heat-stressed intestinal walls

Sustainability: A Business Opportunity

Adopting climate-resilient practices should not be viewed merely as an added regulatory or operational expense. Sustainable investments frequently deliver measurable bottom-line returns through improved bird performance, lower mortality rates, reduced energy expenditures, and access to premium markets that prioritise ESG (Environmental, Social, and Governance) compliance.

The Circular Bio-Economy: Waste to Wealth

Large-scale poultry operations generate substantial volumes of waste, primarily poultry litter (manure mixed with bedding material). In traditional systems, this waste is often dumped in the open, leading to ammonia emissions, groundwater contamination, and public health complaints.

Climate-resilient operations are transforming this challenge into an asset:

- **Biogas and Biomass Conversion:** Anaerobic digestion of poultry litter produces biogas, which can be burned to generate electricity, powering the farm's exhaust fans and cooling pads. This reduces reliance on coal-heavy grid electricity
- **Organic Fertiliser Valorisation:** Processing poultry manure through rapid composting and pelletisation produces high-nitrogen organic fertilisers. These pellets can be sold to crop farmers, creating an additional income stream while restoring degraded soils

- **Solar Integration:** The expansive roofs of modern EC poultry sheds are ideally configured for industrial solar panel arrays. Generating solar power on-site aligns energy production with peak demand periods, as cooling infrastructure requires maximum electricity during the sunniest hours of the day

The Low-Carbon Protein Advantage

From an environmental standpoint, poultry holds a structural advantage over other animal proteins. Its highly efficient feed conversion ratio means it generates significantly fewer greenhouse gas emissions per kilogram of meat produced

Protein Source	Carbon Footprint (kg CO_2-eq/kg meat)
Poultry	2.2 – 3.5
Pork	5.0 – 7.5
Beef	22.0 – 38.0

compared to ruminant livestock.

These metrics position poultry as an efficient vehicle for delivering low-carbon animal protein at scale to developing economies, fitting well within international carbon reduction and climate finance frameworks.

A One Health Perspective

Looking at climate resilience through One Health lens underscores the reality that animal health, human health, and environmental integrity are completely interdependent. Building climate-hardy poultry operations yields benefits that extend far beyond farm economics.

Antimicrobial Resistance (AMR) Mitigation

When birds are chronically stressed by heat, farmers often resort to the prophylactic use of antibiotics to prevent secondary bacterial infections like Colibacillosis or Necrotic Enteritis. This practice accelerates the development of antimicrobial resistance, a major global public health threat.

By utilising EC housing, precision nutrition, and effective biosecurity, producers can maintain flock health under stressful conditions without relying on antimicrobials, safeguarding critical human antibiotics.

Zoonotic Disease Surveillance

Climate disruption shifts migration patterns and alters habitats for wild waterfowls, the primary reservoirs of Avian Influenza. Healthy, resilient domestic flocks raised in climate-controlled environments are less susceptible to viral entry and replication, forming a protective barrier against zoonotic spillover events into human populations.

As India shapes its national One Health architecture, the poultry sector must serve as a central pillar in integrated climate adaptation policies.

Policy Priorities for India's Climate-Smart Poultry Transition

Accelerating the transition to a climate-resilient poultry sector requires coordinated interventions across government ministries, financial institutions, academia, and private industry. The following policy priorities provide a roadmap for structural reform:

1. **Tailored Financial Subsidies for Green Infrastructure**
   The capital cost of transitioning from traditional open-sided sheds to modern EC systems can be prohibitive for small and mid-sized farmers. The Department of Animal Husbandry and Dairying (DAHD), in partnership with NABARD, should launch targeted capital subsidy schemes and low-interest loans to help smallholders upgrade their farm infrastructure.
2. **Weather-Indexed Livestock Insurance Instruments**
   Traditional livestock insurance models require individual carcass verification, which can be administratively difficult during mass mortality events. Introducing weather-indexed insurance—which triggers automatic payouts to registered farmers when local weather stations record temperatures above a specific threshold for consecutive days—can provide financial protection to smallholders.
3. **Public-Funded Genetic Selection Programs**
   While international genetics companies supply high-performing broiler and layer strains, these birds are typically selected for optimal environmental conditions. Government research institutes, such as the ICAR-Central Avian Research Institute (CARI), should expand funding for breeding programs focused on selecting lines that balance high productivity with natural heat tolerance and disease resistance.
4. **Digitised Local Climate Advisory Systems**
   Developing localised, mobile-based early warning networks can provide real-time alerts to poultry farmers. When meteorologists project an extreme heatwave or unseasonal humidity spike for a specific district, automated SMS alerts can prompt farmers to adjust their feeding schedules, activate cooling systems, add electrolytes to drinking water, and secure their grain stores against moisture.

Conclusion: Turning Climate Risk into Competitive Advantage

Climate change is rewriting the operational rules for poultry production in India. The question is no longer whether the industry will feel the impact, but how quickly it can pivot to minimise disruption.

The Indian poultry sector has a proven track record of rapid innovation, commercial resilience, and structural agility. By investing in climate-smart infrastructure, precision nutrition, digital tools, and an integrated One Health framework today, the industry can convert environmental risk into a sustainable, competitive advantage for tomorrow—securing affordable protein for the nation's future.

Selected References

1. *Food and Agriculture Organization (2023).Climate Change and Global Livestock Production Systems: Impacts, Vulnerabilities, and Adaptation Frameworks. Rome, Italy.*
2. *Intergovernmental Panel on Climate Change (IPCC).Sixth Assessment Report (AR6): Impacts, Adaptation, and Vulnerability. Chapter 10: Food, Fibre, and Other Ecosystem Products (2023).*
3. *World Organization for Animal Health (WOAH).Global Animal Health, Biosecurity, and Climate Change Integration Framework (2024). Paris, France.*
4. *Indian Council of Agricultural Research (ICAR).Annual Research Reports on Climate-Resilient Livestock Adaptation and Avian Physiology. New Delhi, India.*
5. *Department of Animal Husbandry and Dairying (DAHD).Basic Animal Husbandry & Poultry Statistics (Latest National Edition). Ministry of Fisheries, Animal Husbandry and Dairying, Government of India.*
6. *Lara, L. J., & Rostagno, M. H. (2013).Impact of Heat Stress on Poultry Production: Physiological Mechanisms and Cellular Responses. Animals, 3(2), 356–369.*
7. *Nawab, A., Li, G., Liu, W., Lan, R., & An, L. (2018).Heat Stress in Poultry Production: Mitigation Strategies through Nutritional and Environmental Management. Animals, 8(8), 126.*
8. *Industry Research Monograph (2026).Adapting for a Warming World: Resilience, Innovation and the Structural Transformation of Global and Indian Poultry Production Systems. New Delhi Market Insights Consortium.*

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Article

Precision Biotics: Expert Conductor of the Gut Microbiome Orchestra

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Introduction

Managing diseases, ensuring animal welfare, and meeting antibiotic-free demands are all significant concerns in the rapidly evolving fields of animal farming, like poultry. Newly arisen diseases significantly affect the poultry sector. Nowadays, intestinal health is one of the most discussed issues in the animal world. Under these circumstances, the gut microbiome significantly influences the health and productivity of chickens. Moreover, undigested proteins might evade the host's digestive processes and be used by putrefactive bacteria, resulting in toxic byproducts that could negatively impact the host's health. The intestinal microbiome of broiler chickens is crucial for several facets of gut health, such as preventing pathogen colonisation, supporting immune system development and engaging with dietary nutrients that influence digestion and absorption. To achieve this and address the complexities of the intestinal microbiome, it is crucial to combine and apply insights and methods from various fields in developing novel feed additives aimed at modifying metabolic pathways.

Precision Probiotics (PBs) or targeted microbiome metabolic modulators (MMM) have currently been selected and crafted based on their potential to improve feed efficiency, enhance animal welfare, and support enteric health. One of the strategies of using PBs to modulate core microbiome metabolic pathways by tailored oligosaccharides in in vitro systems to modulate microbiome pathways. Glycan-based PBs are less influenced by external variables and can be utilised with the main objective of promoting welfare, improving litter conditions, and enhancing air quality in poultry farms. Rather than introducing new bacteria into the gut, precision glycans are designed to activate well-conserved metabolic pathways in the existing microbes, specifically focusing on nitrogen metabolism and gut integrity. Glycobiology studies the biosynthesis, structure, and biological functions of glycans and their vital contributions.

The objective of this article is to evaluate the impact of supplementation with PBs on the growth performance of chickens and the role of PBs on the modulation of metabolic pathways.

Key Differences- Prebiotics and Precision Biotics

Synthetic glycans represent a paradigm shift in poultry microbiome management, moving from broad spectrum approaches to precision metabolic modulation. Instead of merely altering the taxonomic abundance of beneficial bacteria, precision glycans dictate what these bacteria do.

Insoluble fibers known as prebiotics provide food for the host's advantageous gut bacteria. These fibers are the main sort of prebiotic and may be found in grains, legumes, fruits, cruciferous vegetables, and other plant-based foods. Even though they have very little nutritional value, they are useful in monogastric diets because they serve a variety of crucial purposes, such as influencing the makeup of gut microbiota and encouraging intestinal movement. They promote the health of the gut microbiota in fowl. Among the most often utilised prebiotics are oligosaccharides, such as fructo-oligosaccharides (FOS), galactooligosaccharides (GOS), mannan oligosaccharides (MOS), and xylo-oligosaccharides (XOS), as well as non-starch polysaccharides (NSP).

PBs are used to treat certain illnesses using directed "teams." These biotics are carbohydrates with glycosidic linkages that interact with the metabolism of gut bacteria, lowering nitrogen excretion and hence the environmental impact of poultry. PBs are substances considered a new class of additives called MMMs, specifically utilised by host microorganisms. These can control the metabolic pathways of gut microbes and change metagenomic operations. PBs promote a higher Feed Conversion Ratio (FCR), enhance total microbiome variety, and lessen strain during intestinal issues by directing the metabolic processes of the microbiome.

Glycosylation is as Crucial to Life as a Genetic Blueprint

Glycosylation is the process where glycan molecules are covalently attached to proteins or lipids, producing products known as glycoproteins or glycolipids.This enzyme-regulated biosynthetic process is facilitated by enzymes such as glycosyltransferases. Glycosylation, which involves the attachment of sugar molecules (glycans) to proteins or lipids, mainly takes place in the endoplasmic reticulum (ER) and the Golgi apparatus. This carefully regulated, compartmentalised route is crucial for correct protein folding, stability, and function. This process is also vital for effective cell signaling mechanisms.

In birds, they are essential for cellular communication (white blood cells or leukocytes utilise their surface glycans to physically connect and interact with infected tissues or other immune cells), immune identification (chicken Immunoglobulin Y (IgY) is extensively glycosylated), digestion by glycosylating fat-soluble nutrients such as Vitamin D_3 are transformed into water-soluble forms that enhance absorption rates), and influencing how respiratory viruses (like avian influenza) invade host cells. Avian influenza virus (AIV) binds to host cells by recognising particular carbohydrate structures (glycans) that end with sialic acid. Identifying the virus typically depends on synthetic glycoproteins or sialic acid-linked nanoparticles that utilise this selective binding. It is evident that more than 3 billion years of evolution has not resulted in a free-living cell without glycosylation.

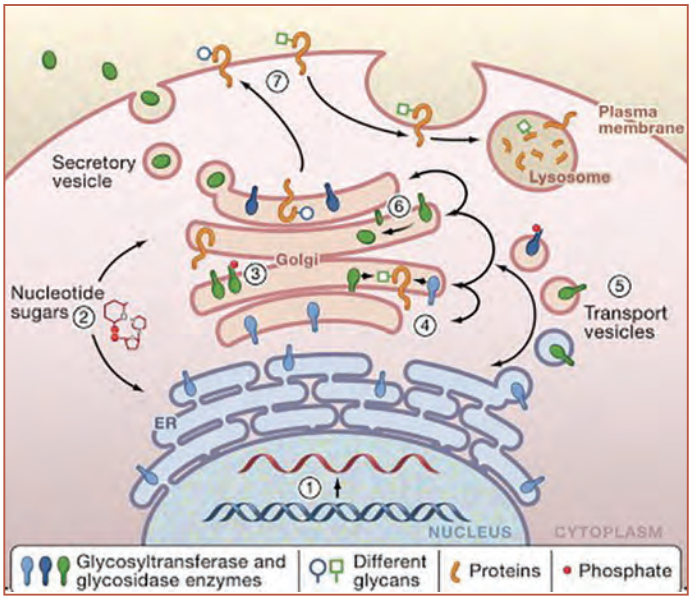


Fig. 1: Analysing the glycosylation apparatus. Glycosylation is an intricate process that encompasses numerous molecules and organelles. The glycosylation system refers to the collection of enzymes, transporters, sugar donors, and additional molecules required for the alteration of proteins or lipids through carbohydrates.

Glycans are Ubiquitous in Life System

Glycans are formed of several monosaccharides (glucose, mannose, and galactose) linked by chemical bonds. These are long, chain-like structures with a variety of forms, from long, straight chains to incredibly complex branched ones. In organisms, glycans are found attached to other molecules such as proteins and lipids and play several important biological roles. Examples of functionally important glycans include cellulose and chitin. The two classes of glycans, N-linked and O-linked, are common in eukaryotic cells, but some prokaryotic cells contain them. N- and O- linked glycans are assembled in different locations and manners within the cell. N-linked glycans are assembled on the endoplasmic reticulum, and O-linked glycans are assembled in the Golgi apparatus. N-linked glycosylation connects glycans to the nitrogen in the side chain of an asparagine (N) amino acid, and it is prevalent and essential for proper protein folding. O-linked glycosylation attaches glycans to the oxygen atoms of serine or threonine hydroxyl groups, and this alteration is crucial for structural integrity and cellular signaling. Frequently referred to as the "third alphabet of life," glycans are essential biological components alongside DNA and proteins. Glycans are essential for all life forms.

These are elongated sugar chains present on proteins, lipids (often referred to as fats), and nucleic acids, which make these biomolecules functional. Glycans are essential for the proper function of cells and proteins. In poultry science, glycans play a crucial role in the health of avian guts, immune functionality, and resistance to diseases.

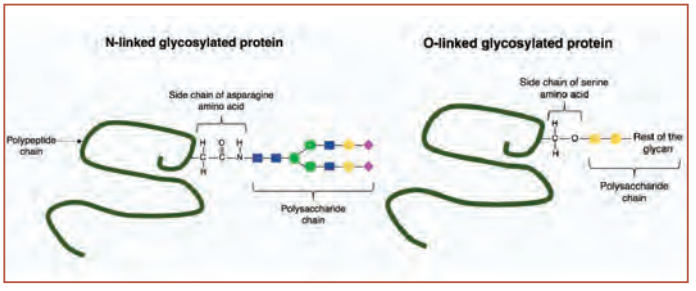


Fig. 2: Glycosylation of a polypeptide

The Concept of Precision Biotics

Traditional prebiotics feed a broad range of bacteria in the gut, but precision formulations are more targeted. They use specific types of chemical bonds and chain lengths. PBs are special carbohydrates with precise structures, made from glycosidic bonds and carefully controlled sizes. These structures are chosen to influence certain pathways in the gut microbiome. Basically, they act like precise tools to help keep the gut microbiome in balance. PBs are better than regular probiotics that support many types of bacteria because they include specially designed biomolecules such as glycans, peptides, proteins, and other active ingredients. These precision glycans are designed to promote good bacteria like bifidobacteria and lactobacilli, while reducing harmful bacteria, which helps improve gut health. PBs also help the body make more short chain fatty acids (SCFAs) and reduce the production of harmful amines from the breakdown of amino acids. When proteins are not fully digested in the lower part of the intestine, they can be broken down by harmful bacteria like Clostridium or certain Enterobacteriaceae into toxic amines such as cadaverine and histamine, and ammonia. PBs which target carbohydrate and glycan molecules, help reduce this breakdown in the caecal microbiome. These metabolites are important for maintaining the health and function of the gastrointestinal tract, supporting the growth of intestinal cells and helping manage the immune system in the gut. PBs are chemically designed complex glycans that influence specific metabolic activities in the microbiome.

Leading commercial precision biotics and molecules in the poultry market include Symphiome (engineered glycan mixture) which is a proprietary "Precision Biotic" to selectively nourish beneficial gut microbes.

Summary of the Benefits of Using Precision Biotics

The influx of glycans into the intestine, be it from endogenous or exogenous sources, is one major process that shapes the intestinal microbiome.

- The addition of PB improves weight gain and feed conversion ratio (FCR)
- Enhanced gut health and resilience
- PB supplementation notably reduced both mortality and the intensity of lesions associated with Necrotic Enteritis
- Positive alteration of the caecal microbiome, evidenced by the heightened presence of bacteria and genes linked to SCFA synthesis
- PB can, in vivo, alter the metabolic pathways of the microbiome for improved protein utilisation
- PBs enhance the resilience against coccidiosis and infectious bronchitis in broiler chickens, while in laying hens, these improve performance, mortality, and overall resilience during the peak of egg production
- Lowers environmental impact
- Boost immunity

How to Apply and What the Findings Reveal

The avian digestive system is remarkably fast; transit time from beak to cloaca can be as little as 2 to 4 hours. To be effective, precision glycans must survive the extreme initial stages of this journey. Their complex beta-glycosidic bonds make them highly resistant to endogenous enzymes. They pass through the acidic environment of the proventriculus (the true stomach) and easily survive the intense mechanical shear forces of the gizzard intact. Because the host bird lacks the specific enzymes to break these bonds, the glycans arrive in the hindgut undigested. When the precision glycans enter the caeca, they act as highly selective substrates. The conversion of glycans into SCFAs inside the caeca is an anaerobic process driven by specific bacterial enzymes. Beneficial taxa (such as

specific Bifidobacterium and Lactobacillus strains) secrete highly specialised glycoside hydrolases. Pathogenic bacteria generally lack these specific hydrolases, so they cannot utilise the glycans and are competitively excluded. The beneficial bacteria absorb the resulting simple sugars and metabolise them via glycolysis in the oxygen-depleted environment of the ceca, yielding pyruvate. Instead of oxidising pyruvate completely, the bacteria ferment it. This bacterial metabolism synthesises the three primary short chain fatty acids: Acetate (C2), Propionate (C3), and Butyrate (C4). Precision biotics, typically glycan-based, can be included in the core diet or drinking water. Recent field experiments show that using precision biotics to alter the caecal microbiome results in significantly greater weights in broilers and improved survival rates. For broilers, PBs are typically added continuously from the starter to finishing phases to enhance gut health, with application in crumbles or pellets. They are generally administered throughout the laying cycle of layers to sustain production and gut integrity. Incorporating Glycan PB into the diet at a low dosage (250 g/MT) is adequate to impact body weight gain, while a higher dosage (500 g/MT) provides further advantages regarding FCR. Dietary xylanase has been shown to enhance SCFA production in the caeca of broilers on wheat and corn-based diets, primarily due to increases in acetic acid levels and increases in both acetic and butyric acids. Acetic and butyric acids are highly effective organic acids that improve poultry gut health by lowering intestinal pH, inhibiting pathogens like E. coli and Salmonella, and promoting the growth of beneficial bacteria. Together, they optimise digestion, enhance nutrient absorption, and improve flock performance.

Microbial Cross-Feeding: The Hidden Engine

The poultry intestinal microbiome is a community which acts as a functional organ that, among other mechanisms, interacts metabolically with the host bird. These microbiome operates through metabolic cooperation, often described as cross-feeding. Some microbes specialise in breaking down complex substrates, while others depend on these breakdown products. Example: Certain Bifidobacterium strains cannot ferment inulin-type fructans directly. Instead, they utilise mono- and oligosaccharides released by primary degraders. Even SCFAs participate in this metabolic relay:

Acetate → Butyrate (dominant pathway)

Butyrate → Propionate (minor pathway)

This layered metabolism enhances fermentation efficiency and stabilises the microbial environment.

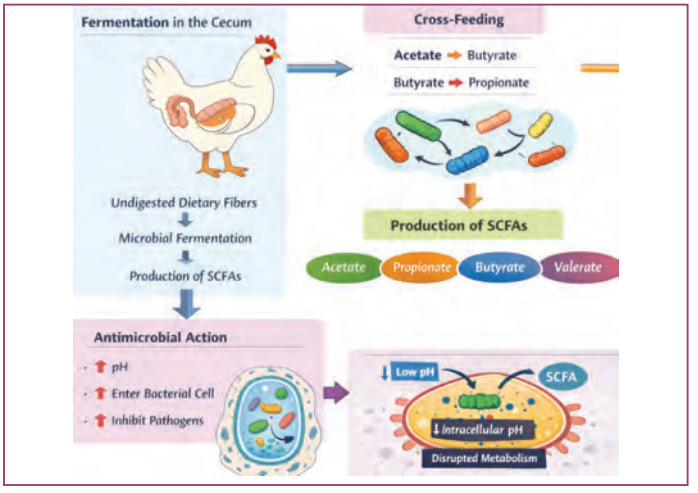


Fig. 3: In poultry production, the gut is more than a digestive organ – it's a living bioreactor where nutrition and microbiology converge. One of the most influential outputs of this system is short-chain fatty acids (SCFAs), the end products of microbial fermentation that quietly shape bird health, performance, and resilience

Multifunctional Roles of Precision Biotics Generated SCFAs

Precision biotics are microbiome metabolic modulator and operate by providing targeted substrates that only beneficial microbes can ferment. This intervention triggers several precise mechanisms within the bird's gastrointestinal tract.

Maintenance of Gut Health

Among all SCFAs, butyrate plays the most critical role in gut health:

- Butyrate is especially important as it serves as the main energy source for the cells in the colon
- Primary energy source for intestinal epithelial cells
- Enhances mucosal barrier function
- Strengthens tight junctions
- Reduces inflammation
- Inhibits abnormal cell proliferation
- Supports the growth of cells that line the intestine, known as enterocytes

SCFAs as an Energy Source

SCFAs are absorbed through the intestinal wall into the bloodstream and contribute approximately:

- 3–5% of the total energy requirements in poultry

Though modest in percentage, this energy contribution is biologically significant, especially under optimised feeding strategies

Protein Metabolism Shift

- Glycan-based nutritional feed additives engineered to selectively alter the metabolic functions of the gut microbiome
- Redirecting microbial pathways towards significantly optimise protein metabolism
- Improving nutrient absorption and animal welfare
- Reduce nitrogen and ammonia emissions
- Improve the environmental footprint of commercial operations

Intestinal Barrier Protection

- Glycosylated proteins (mucins) form the viscous gel lining the bird's intestinal tract
- This layer acts as a physical and chemical barrier against pathogenic invasion
- Decreases toxic metabolic byproducts to mitigate the inflammatory response and uphold the integrity of the gut wall
- Prevent "leaky gut" and stopping harmful bacteria from escaping the gut lumen into surrounding tissues
- Precision biotics stimulate the production of mucosal immunoglobulin A (IgA), bolstering local immunity by upregulating cytokines, which in turn stimulate B-cells to produce secretory Immunoglobulin A (sIgA). This sIgA acts as a crucial first line of defense, neutralising pathogens and maintaining microbiota homeostasis at local mucosal barriers. Secretory (sIgA) and mucosal IgA are closely related, but they are not exactly the same thing.

Reducing Intestinal Ammonia Production

- PBs are rich in carbon but completely devoid of nitrogen. When these glycans reach the hindgut, they trigger rapid proliferation of beneficial saccharolytic (sugar-fermenting) bacteria, such as Bifidobacterium and Lactobacillus. Because these bacteria require both carbon and nitrogen to synthesise

their own cellular proteins and reproduce, they are forced to scavenge nitrogen from their environment. They actively pull highly toxic ammonia (environmentally friendly) directly from the gut lumen, converting it into harmless bacterial biomass

- Essentially, the ammonia is "locked up" inside the bacterial cells, which are eventually excreted in the faeces, preventing the ammonia from volatilising into the air or being absorbed into the animal's bloodstream
- Ammonia in the gut and litter is largely generated when the enzyme urease breaks down urea (or uric acid). Urease is primarily produced by pathogenic and putrefactive bacteria, such as Clostridia and various Proteobacteria
- Precision glycans operate by competitive exclusion. By disproportionately favoring the growth of beneficial, non-urease-producing bacteria, they competitively starve out the urease-producing populations
- Furthermore, the acidic environment created by SCFA production is hostile to these putrefactive bacteria and directly inhibits the optimal functioning of any urease enzymes that are present.

Lowering Gut pH

- PBs produce short-chain fatty acids (SCFAs), such as butyric and lactic acids, which lower intestinal pH
- This environment limits the growth of ureolytic (ammonia-producing) bacteria
- The resulting lower pH creates an acidic environment that prevents the colonization and proliferation of pathogenic bacteria, such as Campylobacter.

Immune Balance in The Body

- SCFAs can inhibit the production of pro-inflammatory cytokines and reduce inflammatory responses, which is essential for maintaining the immune balance of the body
- By interacting directly with the mucosal immune system and Toll-like receptors (TLRs- pathogen recognition proteins which trigger innate immune responses), PBs stimulate the production of secretory Immunoglobulin A (sIgA)
- This enhances the innate and adaptive immune defenses against pathogens such as Salmonella and Eimeria.

Antibody Function

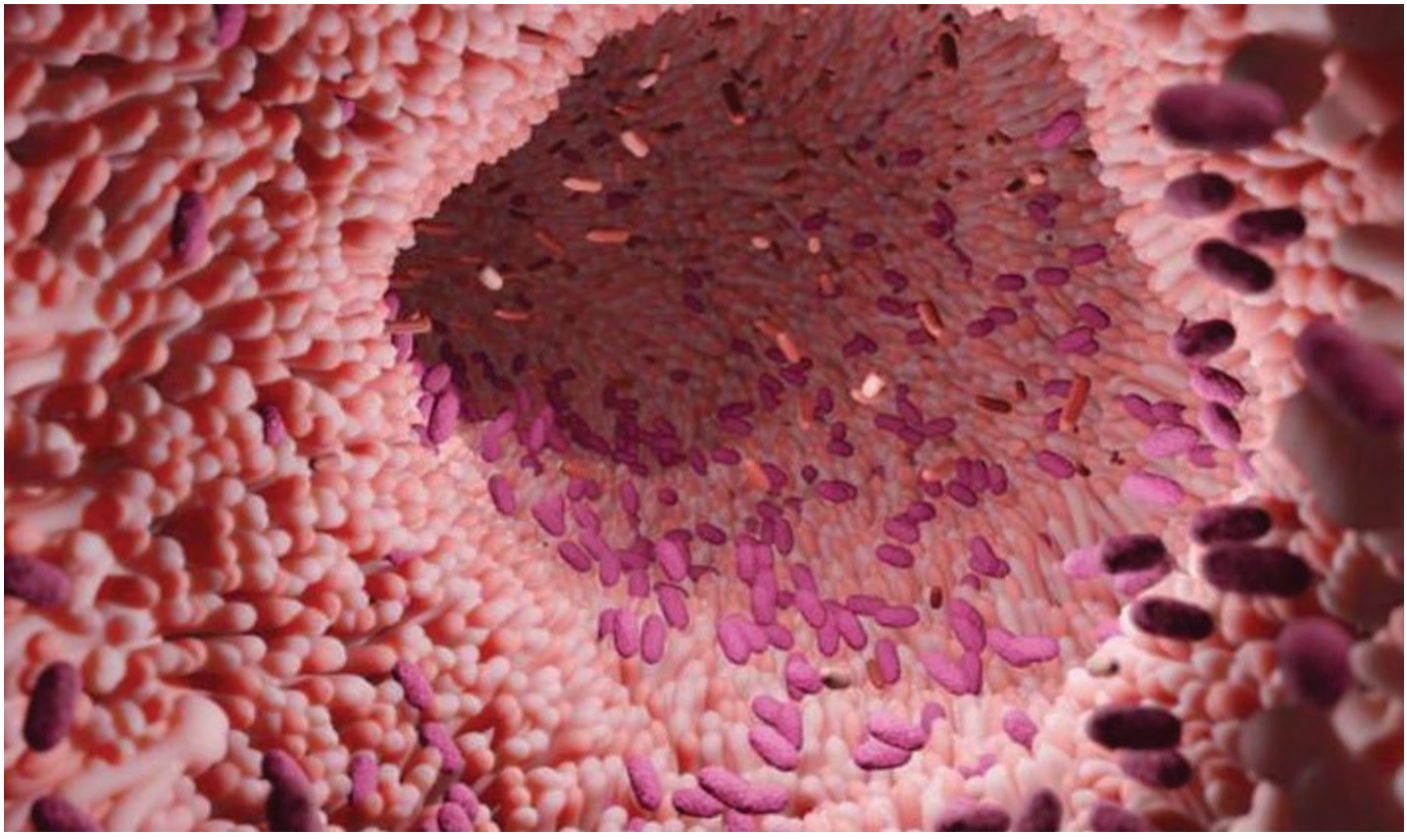
- Primary antibody in poultry IgY (concentrated in egg yolks) is highly glycosylated
- IgY provides safe passive immunity against pathogens like E. coli and Clostridium perfringens
- Combined with precision biotics, which boost short-chain fatty acids, IgY effectively replaces antibiotics

Impoved FCR

- Poultry receiving precision glycans (PBs) exhibited an improved feed conversion, that could be attributed to enhanced gastrointestinal tract function
- Clear improvement in the gut functionality with a conserved intestinal structure
- Lower undigested feed
- Better gut health with significantly increased goblet cell count in the PBs fed groups at time points of 28 and 50 weeks
- Goblet cells produce mucin and can make a favourable environment for commensal microbiota

Eggshell Membrane Defence

- By optimising the absorption of calcium, phosphorus, and essential amino acids, glycans help maintain shell integrity and internal egg quality over much longer laying cycles



- Delaying the typical age-related decline
- Beneficial bacteria enhance the absorption of crucial minerals like calcium, magnesium, and sodium, which are vital for forming thick, break-resistant eggshells
- The glycosylated composition of the eggshell membrane, known as ovomucin, serves as a natural barrier against viruses and bacteria, effectively preventing pathogens from accessing the embryo.

Dietary Supplementation of Glycans Reduces Damage Intestine

- Truncated or impaired O-glycan synthesis severely weakens the mucus layer, exposing the intestine to bacterial penetration and chronic inflammation
- Glycans reduces the damage on intestine, increasing goblet cell counts and villi length

Standard Manufacturing Pathways

Getting natural polysaccharides is important. These come from plants including marine algae by-products, like a rabinoxylans, beta-glucans, and other polysaccharides found in plants and yeast cells. The raw polysaccharides are then broken down using enzymes, such as beta-glucanases and xylanases, to make shorter chains called oligosaccharides. Currently, engineered microbial strains (such as specialised E. coli, yeast, or specific lactic acid bacteria) are cultivated in large-scale industrial fermenters. These microbes are metabolically programmed to synthesise specific complex glycans or exopolysaccharides. The fermentation broth is then harvested, and the target glycans are separated, purified. This helps improve how well they are digested in the gut. Trade mark product Symphiome is made through chemical processes to ensure the glycan chains have the exact length and bonding structure, so they can reach the lower part of the poultry's gut without breaking down. The mixture is then filtered and cleaned using methods like centrifugation and chromatography, which results in a concentrated glycan product. These purified glycans are turned into dry additives through processes like spray drying or micro encapsulation to make them survive the harsh conditions of feed processing. Finally, the product is added to poultry feed in specific amounts. In Symphiome, the finished glycan product is blended into pre-mixes or complete poultry feeds, typically dosed at commercial application rates (e.g., 900 g to 1 kg per metric ton of feed).

Mode of Action of Glycans

Engineered glycan mixtures are manufactured specifically to target metabolic outputs rather than just shifting bacterial populations. When introduced into the feed, these precision glycans boost specific metabolites. They serve as substrates that selectively increase the production of beneficial short-chain fatty acids (SCFAs) like butyrate and propionate. They trigger microbial pathways by optimising nitrogen use in the gut and significantly reduce the production of ammonia, which improves both gut histology and the air quality in the rearing environment.

Precision glycans selectively influence specific bacterial groups by serving as tailored fermentation substrates. Different bacterial species have distinct glycan preferences, allowing for precise control over microbial populations. Precise structural features of carbohydrates and their recognition is possible bygut microbe surface receptorsor glycan-binding proteins (GBPs) on microbial surfaces. Precision glycans also interact with host cell epithelial cell receptors. Functional binding outcomes are microbiome modulation and metabolic pathway regulation.

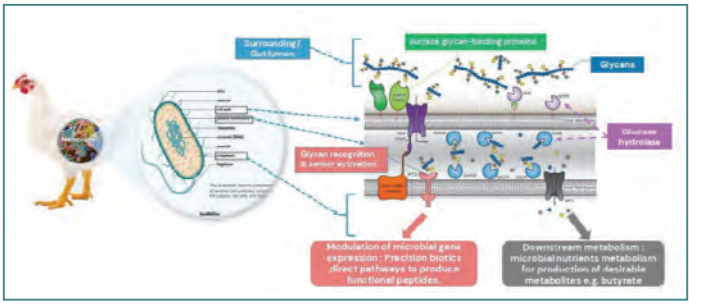


Fig. 4: In order to control their own metabolic processes, microbes identify glycan structures in their surroundings

Numerous extracellular enzymes can be produced by the microbiota, and their synthesis can vary based on environmental cues. Glycan receptors found on the surfaces of bacteria and other members of the microbial community recognise glycans as they enter the digestive tract. This recognition leads to changes in the microbiome's enzyme production. For example, glycans can enhance buty rate production without impacting the synthesis rates of other short-chain fatty acids.

Conclusions

Glycans, whether they come from inside the body or from outside, go into the intestine and play an important role in shaping the microbes that live there. The use of precision glycans helps bring out the best in the natural abilities of bird breeds and brings financial benefits to the industry. Synthetic glycans have been tested for many uses, including as possible vaccines against important gut bacteria. In general, it can be said that precision glycans are a good and practical tool to help improve poultry egg production, even in tough conditions like free-range farming. Advanced commercial products use specially made glycan chains that are designed to fit exactly with the sugar receptors on the cell walls of helpful bacteria. This ensures only the right microbes can use them.

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Article

Is No Antibiotic Ever Programme in Poultry Sustainable?

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Introduction

There is a scientific evidence that the use of antibiotics in food-producing animals is contributing to the antibiotic resistance issues that are relevant to human medicine. This is in spite of wider recognition that antibiotic resistance in humans is caused by antibiotic use in humans and not from food-producing animals. Trends in consumer preference like buying antibiotic free (ABF) products are based largely on perception rather than scientific facts. Therefore, a new trend started to produce Antibiotic Free Chicken (AFC) in recent years and "No Antibiotics Ever" (NAE) in poultry is a rapidly growing, market-driven, and consumer-demanded approach aimed at reducing antimicrobial resistance (AMR), with NAE products growing from 3% to over 52% of U.S. broiler production (2014–2021). While it improves public health perception, NAE presents sustainability challenges including higher mortality, reduced feed efficiency, and higher costs due to stricter management, such as lower stocking densities and increased downtime.

Hence, this article is to discuss the pros and cons on the production of such chicken in future and is going to be sustainable in future.

What is NAE Programme?

The "No Antibiotics Ever" (NAE) Programme, also known as animals/poultry "Raised Without Antibiotics" (RWA), is an animal production standard ensuring that livestock have never been administered antibiotics at any point in their life cycle. This movement is primarily driven by consumer demand for more natural foods and concerns over antimicrobial resistance (AMR) in human medicine.

Arguments for Sustainability

- **Public Health:** Reducing antibiotic use is critical for mitigating antimicrobial resistance (AMR), which is a major global threat to human health
- **Consumer Demand:** There is a high and growing market preference for NAE products, with many consumers willing to pay a premium
- **Industry Adoption:** More than 50% of the U.S. broiler industry has successfully transitioned to NAE programmes
- **Natural Alternatives:** Innovations in probiotics, prebiotics, organic acids, and phytogenics (plant extracts) are increasingly effective at supporting gut health without antibiotics

Challenges to Sustainability

- **Animal Welfare Concerns:** Removing all antibiotics can lead to higher rates of painful diseases like necrotic enteritis and coccidiosis, resulting in increased mortality and suffering
- **Environmental Impact:** NAE production is often less efficient, requiring more feed, water, and land to produce the same amount of meat. This can lead to a larger carbon footprint and more waste
- **Economic Viability:** Production costs are typically 20% higher due to slower growth rates, higher mortality, and the need for more expensive management practices
- **Recent Backsliding:** Some major producers, like Tyson Foods and Chick-fil-A, have recently moved away from "No Antibiotics Ever" to "No Antibiotics Important to Human Medicine" to better manage bird health and supply chain costs

Sustainability in NAE poultry programs include:

The No Antibiotic Ever (NAE) programme in poultry is not entirely sustainable under standard farming conditions, creating a complex trade-off where public health benefits come at the cost of higher environmental burdens and animal welfare risks. While highly successful at mitigating global antimicrobial resistance, eliminating all antibiotics reduces production efficiency, requiring more land, feed, and water to produce the same amount of meat. [1, 2, 3]

To evaluate its long-term viability, the NAE model must be analysed across three core sustainability pillars: [1]

1. Environmental Sustainability (The Carbon Footprint Challenge)

The restriction of all antibiotics significantly lowers overall operational efficiency. This creates a ripple effect that directly increases the environmental footprint of poultry production: [1, 2]

- **Lower Feed Efficiency:** NAE birds generally have higher feed conversion ratios. They require more feed to reach market weight
- **Resource Depletion:** More grain must be grown to feed the birds, which accelerates land use and heavily increases water consumption

- **Increased Waste:** Because birds eat more and live longer, they generate substantially more manure, complicating ecological disposal
- **Higher Emissions:** The combined drop in efficiency leads to an overall larger carbon footprint per kilogram of meat produced [1, 2, 3, 4]

2. Economic and Operational Viability

Transitioning from traditional methods to a successful NAE pipeline requires intense, expensive structural shifts: [1]

- **Lower Stocking Densities:** Farmers must reduce the number of birds per house to limit stress and disease transfer, reducing output per square foot
- **Longer Downtimes:** Commercial facilities require extended downtime between flocks to thoroughly clean and sanitize housing
- **Steep Cost of Alternatives:** Farmers rely heavily on expensive alternative supplements like probiotics, prebiotics, organic acids, and essential oils to maintain gut health
- **Niche Pricing:** The added cost of production is passed on to the consumer. This positions NAE poultry as a high-value niche market item rather than a low-cost global food solution [1, 2, 3, 4, 5]

3. Animal Health and Welfare

The strict "Never" protocol presents a unique ethical paradox regarding animal care: [1]

- **Increased Disease Severity:** NAE flocks are highly susceptible to costly intestinal illnesses like necrotic enteritis and severe coccidiosis
- **Welfare Pressures:** If a flock falls ill, veterinarians face immense pressure. Treating sick birds with antibiotics means losing the premium NAE market label. This reality can occasionally lead to delayed treatments and compromised animal welfare [1, 2, 3, 4, 5]

The Middle Path: Smart Stewardship

Due to these multi-layered challenges, several massive poultry producers have shifted away from strict NAE programs. Instead, they choose Responsible Antibiotic Use or "No Medically Important Antibiotics" (NMIA) models. This strategy permits the use of animal-only antibiotics (such as ionophores) to maintain gut health and prevent bird suffering. Concurrently, it fully protects human medicine by keeping critical human antibiotics entirely out of the food supply. [1, 2, 3, 4, 5]

- **Production Challenges:** NAE programs often face increased risks of disease, particularly coccidiosis and necrotic enteritis, due to the absence of prophylactic antibiotics
- **Environmental & Economic Impact:** Lower feed efficiency and slower growth rates mean more feed, water, and land are required to produce the same amount of meat, which may result in a higher carbon footprint and lower economic efficiency
- **Management Strategies:** Successful NAE programs rely on enhanced biosecurity, improved sanitation, reduced stocking density, increased downtime between flocks, and the use of alternatives like probiotics, prebiotics, and phytomolecules
- **Consumer Demand:** Despite higher prices, NAE products have gained significant market traction, with sales growing to $5.6 billion by 2021
- **Future Outlook:** While NAE reduces the risk of AMR, it necessitates a balance between animal welfare, production efficiency, and environmental sustainability

Operational Challenges & Management

Raising animals without antibiotics is more difficult and requires more intensive management:

- **Biosecurity & Hygiene:** Stricter sanitation and "downtime" between flocks are necessary to prevent bacterial buildup
- **Nutrition:** Producers often use natural supplements like probiotics, prebiotics, organic acids, and essential oils (e.g., oregano or thyme) to support gut health

- **Environment:** Success depends on lower stocking densities (fewer animals per barn) and better ventilation to reduce stress

Sustainable Alternatives to Antibiotics

To make NAE programmes viable, the industry is adopting "holistic" management practices:

- **Nutraceuticals:** Using probiotics, prebiotics, organic acids, and essential oils to support gut health and immunity
- **Enhanced Biosecurity:** Strict protocols for hatchery cleanliness, water sanitation, and visitor access to prevent disease introduction
- **Phytogenic Additives:** Plant-based compounds like phytomolecules (e.g., extracts from herbs) are showing promise in preventing pathogen overgrowth without triggering resistance

Recent Trends (2024–2026)

While the program grew to cover over 50% of the U.S. broiler market by 2021, there has been a recent shift in the industry:

- **Policy Reversals:** Major companies like Tyson Foods and Chick-fil-A recently announced moves away from NAE toward "No Antibiotics Important to Human Medicine" (NAIHM)
- **Reasoning:** These shifts aim to balance bird welfare with consumer needs, as allowing certain non-human antibiotics can help manage common diseases like coccidiosis more effectively while still protecting human health
- **Current Certifications:** For consumers seeking the strictest standards, independent certifications like the NSF "Raised Without Antibiotics" mark provide verified assurance

Best Managemental Practices

We have to re-establish and strictly follow a well-designed set of best management practices (BMPs). These practices include:

- Well-developed biosecurity program
- Well-managed vaccination program
- BMPs documented and in use
- Excellent nutrition program (clean and safe ingredients [corn, soybeans], probiotics, prebiotics, enzymes, organic acids, essential oils, etc.)
- Consistent, high-quality feed (don't let broilers run out of feed)
- Finely tuned breeder health program.

Many experts now advocate for a holistic approach that prioritises the judicious use of antibiotics—using them only to treat sick animals rather than for growth promotion. This "Reduced Antibiotics" model is often seen as a more sustainable balance between bird health, environmental impact, and consumer safety.

Many poultry farmers judiciously use antibiotic and strictly follow withdrawal periods as follows:

Poultry Antibiotic Withdrawal Periods Table

The following safety intervals are generally established by regulatory bodies like the European Union, FAO/WHO, and national pharmacopoeias.

Antibiotic Class	Active Ingredient	Meat Withdrawal Period (Broilers)	Egg Withdrawal Period (Laying Hens)
Tetracyclines	Oxytetracycline	4 – 7 days	3 – 5 days
	Chlortetracycline	5 days	1 – 7 days
	Doxycycline	7 – 21 days	Do not use in active layers
Penicillins	Amoxicillin	1 – 3 days	7 days
Fluoroquinolones	Enrofloxacin	5 – 9 days	Do not use in active layers
	Ciprofloxacin	6 – 23 days	Do not use in active layers
Macrolides	Erythromycin	3 – 11 days	3 – 11 days
	Tylosin	1 – 8 days	1 – 3 days
	Tylvalosin	5 – 13 days	5 – 8 days
Lincosamides	Lincomycin	5 – 13 days	5 – 9 days
Pleuromutilins	Tiamulin	5 – 7 days	0 – 5 days
Aminoglycosides	Gentamicin	14 – 21 days	Do not use in active layers

Read Product Labels: Look specifically at the exact product brand packaging, as withdrawal times vary significantly based on the concentration and route of administration (water-soluble)

Conclusion

The sustainability of "No Antibiotics Ever" (NAE) programmes in poultry is a complex trade-off between public health benefits and environmental or economic costs. While NAE reduces the risk of antimicrobial resistance (AMR), it often results in a larger carbon footprint due to decreased production efficiency.

References

1. H.M. Cervantes and, L.R. McDougald †(2023) Raising broiler chickens without ionophore anticoccidials Journal of Applied Poultry ResearchVolume 32, Issue 2,

2. Is No Antibiotics Ever (NAE) Poultry Production Sustainable? The Mississippi State University Extension Service P3371.

3. Review article Antibiotic-free poultry production: Is it sustainable? Journal of Applied Poultry Research Volume 24, Issue 1, 1 March 2015, Pages 91-97

4. T.J. Applegate, V. Klose, T. Steiner, A. Ganner, G. Schatzmayr Probiotics and phytogenics for poultry: Myth or reality?J. Appl. Poult. Res., 19 (2010), pp. 194-210.

*5. RameshBahadur Bist * †, Keshav Bist ‡, Sandesh Poudel §, Deepak Subedi *, Xiao Yang *, Bidur Paneru *, Sudhagar Mani §, Dongyi Wang †, Lilong Chai (2024) Sustainable poultry farming practices: a critical review of current strategies and future prospects 2024, Poultry Science. Volume 103, Issue 12, December 2024, 104295*

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JUNE -2026

Aviagen INDIA

Northern Region

COMPANY: Sampoorna Feeds
FARMER NAME: Mr. Parwinder Singh

JUNE-2026	Top #1
Farm Type	Open House
State	PUNJAB
Chicks Placed	5,022
Mean Age	33
Avg Body Wt	2,560
FCR	1.33
cFCR	1.20
Livability%	94.6
Daily Gain	77.6
EPEF	551

Eastern Region

COMPANY: IB Group
FARM NAME: SBR Farm

JUNE-2026	Top #1
Farm Type	Closed House
State	BIHAR
Chicks Placed	12,544
Mean Age	39
Avg Body Wt	2,803
FCR	1.50
cFCR	1.32
Livability%	97.9
Daily Gain	71.9
EPEF	468

Central Region

COMPANY: IB Group
FARMER NAME: Mr. Balveer Singh

JUNE-2026	Top #1
Farm Type	Closed House
State	MADHYA PRADESH
Chicks Placed	9,700
Mean Age	40
Avg Body Wt	2,829
FCR	1.46
cFCR	1.28
Livability%	97.2
Daily Gain	70.7
EPEF	469

South Region

COMPANY: IB Group
FARMER NAME: Mr. Manjunatha K

JUNE-2026	Top #1
Farm Type	Closed Shed
State	KARNATAKA
Chicks Placed	18,290
Mean Age	36
Avg Body Wt	2,636
FCR	1.36
cFCR	1.22
Livability%	95.3
Daily Gain	73.2
EPEF	512

June 2026 -Top PERFORMANCE BY AREA

Area	Chicks Placed	Mean Age(Days)	BW	FCR	cFCR(2Kg)	Livability%	Daygain	EPEF
North EC House	9,095	36	2,399	1.41	1.32	92.6	66.4	436
North Open House	5,022	33	2,560	1.33	1.21	94.6	77.6	552
East EC House	12,544	39	2,803	1.50	1.33	97.9	71.9	468
East Open House	1,015	40	2,663	1.55	1.40	95.9	66.6	411
Central EC House	9,700	40	2,829	1.47	1.28	97.2	70.7	469
Central Open House	5,389	35	2,367	1.44	1.36	95.6	68.6	455
South EC House	18,290	36	2,636	1.36	1.22	95.3	73.2	512
South Open House	2,998	35	2,273	1.49	1.43	96.5	64.9	420

June 2026 -Top 10 FIELD PERFORMANCE

Flock	Farm Type	State	Chicks Placed	Mean Age	BW	FCR	cFCR	Livability%	Day Gain	EPEF
Flock 1	OPEN HOUSE	PUNJAB	5,022	33	2,560	1.33	1.21	94.6	77.6	552
Flock 2	OPEN HOUSE	PUNJAB	9,856	36	2,653	1.36	1.21	93.3	73.4	504
Flock 3	CLOSED HOUSE	KARNATAKA	18,290	36	2,636	1.36	1.22	95.3	73.2	512
Flock 4	OPEN HOUSE	SOUTH BENGAL	810	35	2,311	1.30	1.23	95.8	66.0	488
Flock 5	OPEN HOUSE	PUNJAB	8,624	32	2,163	1.27	1.23	95.2	67.2	503
Flock 6	OPEN HOUSE	PUNJAB	4,972	33	2,292	1.30	1.24	93.2	70.2	503
Flock 7	OPEN HOUSE	PUNJAB	2,213	36	2,140	1.28	1.25	95.1	59.4	442
Flock 8	OPEN HOUSE	PUNJAB	6,865	34	2,407	1.34	1.25	95.3	70.7	503
Flock 9	OPEN HOUSE	RAJASTHAN	2,920	45	2,802	1.44	1.26	84.7	62.3	367
Flock 10	OPEN HOUSE	PUNJAB	8,497	35	2,510	1.38	1.27	91.4	72.1	477

Article

Use of Bacteriocins in Broiler Production

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Abstract
The shift toward antibiotic-free poultry production has intensified the search for effective, non-toxic growth promoters. Bacteriocins, a class of ribosomally synthesised antimicrobial peptides produced by bacteria, offer a targeted approach to managing gut health and enhancing growth without contributing to widespread antimicrobial resistance.

Understanding Bacteriocins
Bacteriocins are ribosomally synthesised antimicrobial peptides produced by bacteria, particularly lactic acid bacteria (LAB). They are potent against a range of Gram-positive and Gram-negative pathogens and are increasingly studied as alternatives to antibiotic growth promoters (AGPs) in poultry production due to rising concerns over antimicrobial resistance (AMR) and antibiotic residues in meat.

In broiler production, bacteriocins are being explored for their ability to improve gut health, enhance feed efficiency, modulate the intestinal microbiota, and reduce pathogen load.

Mechanism of Action
The Mechanism of Action (MoA) of bacteriocins is diverse, but most function by targeting the bacterial cell envelope. Unlike traditional antibiotics, which often interfere with internal metabolic processes, bacteriocins typically act like "molecular needles" that puncture or disrupt the structural integrity of the target pathogen.

1. Cell Wall Targeting and Binding
Before a bacteriocin can destroy a cell, it must find a "docking station."

Adsorption: Bacteriocins carry a positive charge (cationic), which attracts them to the negatively charged surface of the target bacteria (anionic phospholipids).

Specific Binding: Many bacteriocins, such as Nisin, bind to Lipid II, an essential precursor for peptidoglycan synthesis. By "sequestering" Lipid II, the bacteriocin effectively halts the construction of the bacterial cell wall, leading to cell death.

2. Pore Formation (The Primary Kill Mechanism)
This is the most common MoA for Class I and Class II bacteriocins in poultry applications.

Insertion: Once bound to the membrane, the hydrophobic parts of the bacteriocin insert themselves into the lipid bilayer.

Channel Creation: Several bacteriocin molecules aggregate to form a stable transmembrane pore.

Efflux of Vital Ions: These pores allow the uncontrolled leakage of essential intracellular components like Potassium (K^+) ions, ATP, and amino acids.

Dissipation of Proton Motive Force (PMF): The loss of ion gradients destroys the cell's ability to produce energy, leading to rapid lysis (bursting) of the pathogen.

3. Intracellular Interference (Non-Pore Forming)
Some bacteriocins penetrate the cell to disrupt internal "machinery" without necessarily bursting the membrane:

Nuclease Activity: Certain bacteriocins act as DNA-ases or RNA-ases, degrading the genetic material of the target cell.

Protein Synthesis Inhibition: They can interfere with the ribosomes, preventing the bacteria from creating the proteins it needs to survive or replicate.

Biochemical Classification
Class I: Lantibiotics (Modified Peptides)
These are chemically defined by the presence of lanthionine (Lan) and beta-methyllanthionine (MeLan). These residues are formed through the dehydration of serine and threonine, followed by a Michael-type addition of a cysteine thiol.

- **Type A (Linear/Amphipathic):** These have a net positive charge. They act primarily by disrupting bacterial membrane potential through pore formation.
  - Example: Nisin A, Subtilin
- **Type B (Globular/Neutral):** These are smaller and either neutral or negatively charged. They exert their effect by inhibiting specific enzyme functions (e.g., cell wall synthesis)
  - Example: Mersacidin

Class II: Non-Lantibiotics (Small, Unmodified)
These do not contain lanthionine rings but often contain disulfide bridges (formed between two cysteine residues) which provide structural stability.

- **Class IIa (Pediocin-like):** Characterised by a highly conserved N-terminal sequence: -Tyr-Gly-Asn-Gly-Val-Xaa-Cys-. This is often referred to as the "pediocin box"
  - Mechanism: They bind to the mannose phosphotransferase system (Man-PTS) on the target cell
- **Class IIb (Two-peptide):** These require the formation of a heterodimer (two separate peptide chains) to be active
  - Example:Lactococcin G
- **Class IIc (Circular):** These are biochemically unique because their N-terminal and C-terminal are linked by a peptide bond, making them highly resistant to proteolytic enzymes

Class III: Large Protein Bacteriocins
These are defined by their high molecular weight (> 30 kDa) and complex tertiary

protein structures. Unlike the small peptides in Classes I and II, Class III molecules are heat-labile (destroyed by heat).

- **Subclass IIIa (Bacteriolysins):** These act as enzymes that hydrolyse the peptidoglycan layer of the bacterial cell wall (e.g., Lysostaphin)
- **Subclass IIIb (Non-lytic):** These inhibit growth without bursting the cell, often by disrupting membrane potential or interfering with nutrient uptake

Impact on Broiler Production Performance

Recent longitudinal studies (2024–2026) indicate that while bacteriocins may not always mirror the rapid weight gain of traditional AGPs in sterile environments, they excel in challenge conditions (e.g., Eimeria or Clostridium outbreaks).

A. Growth Metrics & Feed Efficiency

Body Weight Gain (BWG): Supplementation with Bacillus-derived bacteriocins has shown an increase in final body weight by 3.2% to 5.1% compared to negative controls in challenged flocks.

Feed Conversion Ratio (FCR): Bacteriocins improve nutrient utilisation by reducing the metabolic burden of subclinical infections. Improvements in FCR typically range from 0.03 to 0.07 points.

Microbiome Modulation: Quantitative PCR data shows a significant increase in caecal Lactobacillus counts ($P < 0.05$) and a concurrent decrease in Enterococcus and coliform counts at 35 days of age.

B. Gut Histomorphology

The primary "performance engine" of the broiler is the intestinal villi. Bacteriocin inclusion correlates with:

Villus Height (VH): Increases of 12–15% in the jejunum.

Crypt Depth (CD): Reduction in depth, signalling lower enterocyte turnover and energy conservation.

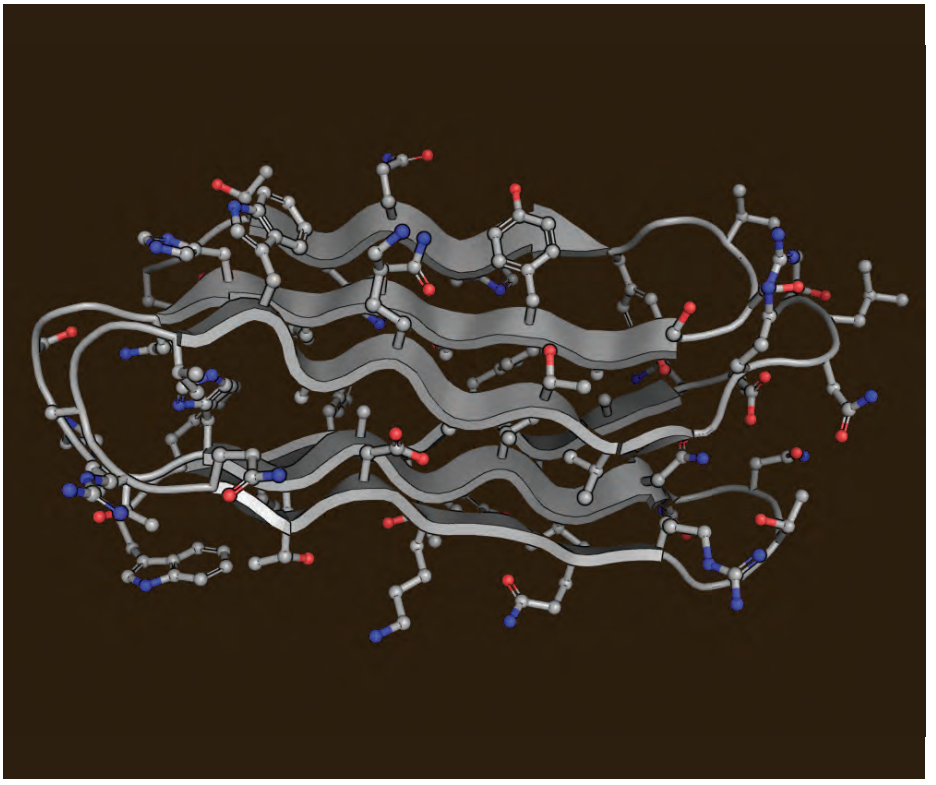
Current Challenges in Implementation

Despite their potential, several "translational bottlenecks" prevent universal adoption in the poultry sector:

Proteolytic Degradation: As proteinaceous molecules, bacteriocins like Nisin are often inactivated by protease enzymes (pepsin, trypsin) in the upper GI tract before reaching the ileum and caecum.

Pelleting Instability: High-temperature steam conditioning (> 85°C) during feed pelleting can denature the tertiary structure of Class III bacteriocins.

Regulatory & Cost Hurdles: The cost of purifying bacteriocins for feed remains higher than synthetic antibiotics. Furthermore, regulatory frameworks in various regions are still evolving to distinguish between "probiotics" and "purified peptides."



Future Prospects (2026 and Beyond)

The "Strategic Future" of bacteriocins lies in advanced delivery and bio-engineering:

- **Microencapsulation & Nanotechnology:** Utilising lipid-based or polymer coatings to protect peptides from gastric acidity and ensure "timed release" in the hindgut
- **In-Situ Production:** Using LFM (Live Feed Microbes)—probiotics engineered or selected for high bacteriocin yield—eliminating the need for expensive purification
- **Synergistic "Hurdle" Cocktails:** Combining bacteriocins with organic acids or essential oils to create a multi-target antimicrobial effect that prevents the development of resistance

Conclusion

Bacteriocins represent a sophisticated, "surgical" alternative to traditional antibiotics. By specifically targeting pathogens like Clostridium perfringens while preserving the commensal microbiota, they offer a dual benefit of disease prevention and growth promotion. While delivery stability remains a technical challenge, the transition toward sustainable, residue-free broiler production in 2026 makes bacteriocins an indispensable tool for the modern poultry veterinarian and researcher.

References:

Dai, Z., L. Shang, F. Wang, X. Zeng, H. Yu, L. Liu, J. Zhou, & S. Qiao (2022). Effects of antimicrobial peptide microcin C7 on growth performance, immune and intestinal barrier functions, and cecal microbiota of broilers. Frontiers in Veterinary Science, 8, 813629.

Daneshmand, A., H. Kermanshahi, M. H. Sekhavati, A. Javadmanesh, & M. Ahmadian (2019). Antimicrobial peptide, cLF36, affects performance and intestinal morphology, microflora, junctional proteins, and immune cells in broilers challenged with E. coli. Scientific Reports, 9(1), 14176.

Gao, S., Q. Zhang, C. Liu, H. Shen, & J. Wang (2023). Effects of maggot antimicrobial peptides on growth performance, immune function, and cecal flora of yellow-feathered broilers. Frontiers in Veterinary Science, 10, 1156964.

Hu, F., X. Gao, R. She, J. Chen, J. Mao, P. Xiao, & R. Shi (2017). Effects of antimicrobial peptides on growth performance and small intestinal function in broilers under chronic heat stress. Poultry Science, 96(4), 798–806. https://doi.org/10.3382/ps/pew379

Liu, T. T., Y. Ma, S. H. Chen, J. G. Wang, & H. Shen (2025). Effects of dietary supplementation with Periplaneta americana-derived antimicrobial peptides (PA-AMPs) on growth performance, immune function, and gut health in yellow-feathered broilers. Poultry Science, 105, 105671.

Mamjoud, A., Zirah, S., Biron, E., Fliss, O., &Fliss, I. (2025). In Vitro Insights into Bacteriocin-Mediated Modulation of Chicken Cecal Microbiota. International Journal of Molecular Sciences, 26(2), 755. https://doi.org/10.3390/ijms 26020755

Article

Elucidating AGP Mechanisms of Action: A Blueprint for Developing Next-Generation Alternatives

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The Global Pivot: Navigating the Post-AGP Landscape

The global poultry industry is currently undergoing a fundamental transformation that transcends simple regulatory adherence. For decades, Antibiotic Growth Promoters (AGPs) were the cornerstone of production efficiency; however, the strategic landscape has shifted towards a precision physiological model. Transitioning away from AGPs is no longer merely a response to a regulatory burden, but a critical evolution necessary for maintaining global competitiveness. Producers who move beyond traditional antibiotics are not just complying with the law— they are securing their position in a market where "clean" production is the new baseline for commercial viability.

The Five Drivers of Change

The shift away from traditional AGPs is mandated by several critical factors:

- Consumer Demand for Clean Meat: Modern consumers are increasingly sophisticated and demand protein raised without traditional antibiotics
- Export Market Access: Major global regions, including the EU, Middle East, and South Asia, now enforce strict "Zero Tolerance" policies regarding AGP use
- Antibiotic Efficacy and AMR: The preservation of antibiotic efficacy for human and veterinary medicine is a global priority to combat Antimicrobial Resistance (AMR)
- Regulatory Bans: We are seeing a progressive global phase-out of critical substances, such as Colistin and Bacitracin Methylene Disalicylate (BMD) etc.
- Elimination of Withdrawal Periods: Transitioning to alternatives eliminates the legal "withdrawal period" required before processing, greatly enhancing farm logistical efficiency

To innovate the future, we must first master the history. We cannot effectively replace AGPs until we understand exactly why they were so successful for so long.

The "Unquestionable Results" of Traditional Growth Promoters

The success of AGPs was never in doubt because the results were measurable on the balance sheet. For several decades, the poultry industry has relied on AGPs to deliver consistent production results, specifically in improving Feed Conversion Ratios (FCR), enhancing nutrient utilisation, and ensuring effective disease control. These benefits collectively contribute to better litter quality, carcass quality, and overall farm profitability.

The Big Question

We have seen these results for decades, but do we actually understand the science of how they were achieved?

Traditional Model

The traditional "Textbook Model" of AGPs assumed they worked entirely through microflora management: killing pathogens to reduce microbial "nutrient theft" and toxins, resulting in a thinner intestinal wall and enhanced nutrient uptake. Modern genomic and physiological evidence has presented several paradoxes that render this model obsolete:

Paradox Category	Traditional Expectation	Scientific Reality
The Dosology Disconnect	AGPs function by bactericidal action against pathogens in the gut	Doses used for growth promotion are significantly below the Minimum Inhibitory Concentration (MIC) required to kill bacteria
The Spectrum Paradox	Antibiotics with distinct targets (e.g., Gram-positive vs. Gram-negative) should produce different growth outcomes	Antibiotics with completely different antimicrobial spectra often yield identical growth enhancement results
The Cross-Species Paradox	AGPs target specific microbiota compositions unique to the host species	The same AGPs are effective in both pigs and poultry, despite these species possessing vastly different intestinal microbiota
The Ineffective Paradox	Any antibiotic that significantly alters the gut microbiota should promote growth.	Many antibiotics cause massive shifts in microbiota composition but fail to produce any measurable growth enhancement.

The Eubiosis Trap: The industry often pursues "eubiosis"—a theoretical microbial balance—as a strategic goal. However, "eubiosis" is frequently a marketing construct rather than a biological reality. The exact composition of a "perfect" microbiota is unknown and completely undefined. Furthermore, genomic evidence confirms that major microbial shifts occur naturally during growth phases regardless of intervention. Relying on microflora management alone is a strategic trap; this realisation, coupled with the global imperative for Antimicrobial Resistance (AMR) stewardship, is driving the industry toward "Total AGP Replacers." The goal is not merely to eliminate antibiotics to meet consumer demand for "clean meat," but to ensure the preservation of antibiotic efficacy for human and veterinary medicine by mitigating the selection pressure that creates resistant pathogens.

Advanced Mechanism of Action: Host-Centric Physiological Modulation

The new scientific consensus indicates that AGPs work primarily as physiological modulators of the bird rather than simple bactericides.

A. Immune Pacification and Anti-Inflammation

AGPs act as potent anti-inflammatory agents. At sub-therapeutic

doses, they are selectively taken up by and accumulate inside local gut inflammatory cells (e.g., macrophages and heterophils). They down-regulate pro-inflammatory cytokines (IL-1, TNF-alpha) at the source, cooling the "inflammatory fire". This modulates the gut immune system to a quiescent resting state, redirecting metabolic energy that would have been wasted on inflammation back into growth and production.

B. The Nrf2 Pathway and Physical Barrier Protection

Sub-therapeutic doses of certain antibiotics (e.g., BMD, Tetracyclines) trigger a mild production of Reactive Oxygen Species (ROS). This acts as a cellular stress signal that releases Nrf2 (Nuclear factor erythroid 2-related factor 2) from its tether (KEAP1). Nrf2 then moves into the nucleus to initiate the transcription of critical antioxidant enzymes like Superoxide Dismutase (SOD), Catalase, and Glutathione Peroxidase (GSH-Px). These endogenous antioxidants protect the structural integrity of the gut wall by shielding tight junction proteins (Claudins and Zonula Occludens-1), thereby preventing "Leaky Gut Syndrome".

C. Bile Salt Hydrolase (BSH) Inhibition

Certain AGPs physically bind to and inhibit the BSH enzyme produced by bacteria like Clostridium perfringens. In an antibiotic-free environment, high BSH production leads to unconjugated bile acids, which impairs fat absorption. AGPs preserve the Conjugated Bile Acid (CBA) pool, ensuring optimal lipid digestion and absorption.

D. Mitochondrial Hormesis and the "Cellular Vaccine"

AGPs cause a small, temporary slowdown in mitochondrial energy (ATP) production. This mild disruption triggers the Mitochondrial Unfolded Protein Response (UPRmt) and the production of mitokines. These signals permanently raise the bird's systemic threshold for future immune and inflammatory responses, acting as a form of cellular "vaccination" that optimises cell health. This occurs within the "Hormetic Zone", where low-level stressors act as beneficial signals for intestinal resilience.

Anti-Virulence Mechanisms: Disrupting Gut Pathogens

When AGPs interact with bacteria, they do so by disarming them/reduce their virulence rather than eradicating them.

- Quorum Sensing (QS) Inhibition: Pathogens like C. perfringens use QS to sense population density via autoinducers. AGPs disrupt the synthesis or binding of these signals, forcing bacteria to act as isolated individuals rather than a coordinated army, preventing synchronised attacks on gut tissue
- Toxin Gene Downregulation: Sub-lethal AGP concentrations stall bacterial ribosomes, altering mRNA stability. This suppresses the transcription of plc genes, directly reducing the production of alpha-toxin and NetB toxin, which are the primary drivers of Necrotic Enteritis
- Impairment of Adhesion and Motility: AGPs cause flagellar paralysis (turning off genes for bacterial "propellers") and fimbrial mutilation (disabling the "velcro" hooks used for anchoring). Lacking these, pathogens are safely swept out of the gut by normal peristalsis

The Challenge of Alternatives: Searching for Consistency

Many tools have been trialed to replace AGPs, primarily focusing on "Eubiosis" (gut balance). These include Probiotics, Prebiotics, Organic Acids, Enzymes, Bacteriophages etc, However, the central frustration of modern veterinary science is that "variable results are the norm." Most alternatives fail because they only address one side of the dual-action mechanism. A "Total AGP Replacer" must be efficient, consistent, and reproducible.

The future lies in Phytobiotics—specialised plant-based compounds that target multiple pathways simultaneously. Key ingredients in the innovator's toolkit include:

Botanical Source	Primary Active Compound
Garlic (Allium sativum)	Allyl Sulphide Compounds, S-Allyl Cysteine, S-Allyl Marcaptocysteine
Turmeric (Curcuma longa)	Curcumin and Curcuminoids
Thyme (Thymus vulgaris)	Thymol, Carvacrol, P-Cymene, G-Terpinene, and other phenolic compounds
Cinnamon (Cinnamomum zeylanicum)	Cinnamaldehyde
Indian Barberry (Berberis aristata)	Berberine
BSH Inhibitors	Natural Compounds

Molecular Targets

The active compounds of Garlic, Turmeric, Thyme, Cinnamon and Indian Barberry can exhibit all the functions of AGP which includes the immune pacifiers, Nrf2 regulators, mitochondrial hormesis, BSH inhibition and also reduces the virulence of the bacteria by inhibiting the quorum sensing and also downgrade the toxin and mobility genes

Berberine employs multiple molecular mechanisms to inhibit C. perfringens spore germination (interfering with germinating receptors and blocking Ca-DPA efflux) and vegetative growth (inhibiting DNA replication, RNA transcription, and protein synthesis).

Our Product Soultion

PhyGuard AR is a next-generation phytogenic solution developed by the Rossari Biotech R&D division. It serves as a comprehensive, viable alternative to traditional Antibiotic Growth Promoters (AGPs) in poultry production.

By utilising a proprietary, synergistic blend of bioactive botanical extracts—including Garlic, Turmeric, Thyme, Cinnamon, and Indian Barberry—PhyGuard AR replicates the complete biological efficacy of AGPs. This advanced formulation shifts the therapeutic paradigm away from a narrow "kill-only" antimicrobial mechanism. Instead, it adopts a host-centric, multi-modal approach.

And because PhyGuard AR targets a vast array of essential proteins and enzymes simultaneously rather than a single specific target, it is incredibly difficult for bacteria to evolve resistance.

This strategic shift ensures the consistent, reproducible performance metrics required for modern, intensive, antibiotic-free production cycles, directly supporting global mandates for clean meat production.

References

1. Miyakawa, M.E.F., Casanova, N.A. and Kogut, M.H., 2024. How did antibiotic growth promoters increase growth and feed efficiency in poultry?. Poultry science, 103(2), p.103278.

2. Niewold, T.A., 2007. The nonantibiotic anti-inflammatory effect of antimicrobial growth promoters, the real mode of action? A hypothesis. Poultry science, 86(4), pp.605-609.

3. Geng, W. and Lin, J., 2016. Bacterial bile salt hydrolase: an intestinal microbiome target for enhanced animal health. Animal health research reviews, 17(2), pp.148-158.

4. Naeem, M., 2026. Combating necrotic enteritis in poultry through nutritional interventions: a review of alternatives to antibiotics. Animal Diseases, 6(1), p.16.

5. Yu, Q., Lepp, D., MehdizadehGohari, I., Wu, T., Zhou, H., Yin, X., Yu, H., Prescott, J.F., Nie, S.P., Xie, M.Y. and Gong, J., 2017. The Agr-like quorum sensing system is required for pathogenesis of necrotic enteritis caused by Clostridium perfringens in poultry. Infection and Immunity, 85(6), pp.10-1128.

6. Keyburn, A.L., Bannam, T.L., Moore, R.J. and Rood, J.I., 2010. NetB, a pore-forming toxin from necrotic enteritis strains of Clostridium perfringens. Toxins, 2(7), pp.1913-1927.

7. Fathima, S., Hakeem, W.G.A., Shanmugasundaram, R. and Selvaraj, R.K., 2022. Necrotic enteritis in broiler chickens: a review on the pathogen, pathogenesis, and prevention. Microorganisms, 10(10), p.1958.

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Article

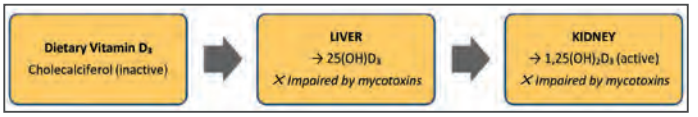
Mycotoxin-Induced Hepatic and Renal Stress Limits Vitamin D Activation

Team Avitech

Vitamin D is one of the most critical nutrients influencing skeletal development, eggshell quality, immunity, hatchability, and overall productivity in poultry. However, the biological effectiveness of dietary Vitamin D depends on its successful conversion into active metabolites through hepatic and renal hydroxylation. Under commercial production conditions, mycotoxin exposure, among other stressors, can impair liver function and compromise this activation process, resulting in functional Vitamin D insufficiency despite adequate dietary supplementation.

Conventional dietary Vitamin D_3 (cholecalciferol) is biologically inactive when consumed. Before it can exert a physiological effect, it must undergo two sequential hydroxylation reactions: first in the liver, where it is converted to 25-hydroxycholecalciferol [$25(OH)D_3$], and then in the kidney, where it is further converted to 1,25-dihydroxycholecalciferol [$1,25(OH)_2D_3$], the biologically active form that binds to Vitamin D receptors and initiates cellular responses. This pathway depends entirely on healthy liver and kidney function, is metabolically time-intensive, involves conversion-associated nutrient losses, and becomes markedly less efficient under physiological stress.

As a result, the amount of Vitamin D formulated into feed does not necessarily reflect the amount ultimately available to the bird in active form.



Two sequential, organ-dependent steps stand between feed and biologically active Vitamin D and both are vulnerable to mycotoxin damage

The Activation Pathway

These risks are compounded by the nature of mycotoxin contamination itself. Mycotoxins are heat-stable and survive pelleting and feed processing, so they are not eliminated in the mill. Commercial feed ingredients commonly carry more than one mycotoxin simultaneously, and the resulting performance losses are frequently subclinical eroding productivity well before any visible disease appears and often being misattributed to management or formulation inconsistencies. The following sections examine how specific mycotoxins disrupt the Vitamin D activation pathway, and how a bioactive Vitamin D source can offset that risk

01 The Science

Mycotoxin Effects on Vitamin D Metabolism

Mycotoxins are toxic secondary metabolites produced by fungi belonging primarily to the genera Aspergillus, Fusarium, and Penicillium. Due to their heat stability and resistance to feed processing, they remain one of the most persistent challenges in poultry nutrition. Subclinical exposure has been associated with reduced feed efficiency, poor nutrient utilisation, compromised bone mineralisation, inferior eggshell quality, reduced hatchability, increased susceptibility to disease, and poor flock uniformity. The challenge intensifies when multiple mycotoxins occur together a situation commonly observed in commercial feed ingredients. Among the organs affected, the liver is particularly vulnerable, and it is also the first and most critical site of Vitamin D activation.

Mycotoxin	Organ(s) Targeted	Effect on Vitamin D Metabolism
Aflatoxins	Liver	Oxidative stress, hepatocellular damage, suppressed hepatic enzymes
Ochratoxin A	Liver + Kidney	Effects both activation organs simultaneously
Fumonisin	Liver / bile flow	Impaired bile flow reduces absorption of fat-soluble Vitamin D
Trichothecenes (T-2, DON)	Liver	Impaired hepatic protein synthesis, inflammatory damage

As liver function declines under this toxic burden, the efficiency of Vitamin D activation decreases correspondingly. Birds may, therefore, experience reduced availability of active Vitamin D despite receiving adequate dietary supplementation, a condition best described as functional Vitamin D insufficiency: Vitamin D is present in the diet but cannot be efficiently activated and utilised by the bird.

The consequences of this insufficiency are often progressive and difficult to diagnose. They include reduced bone mineralisation and increased incidence of tibial dyschondroplasia and rickets, poor eggshell quality and shell strength, reduced hatchability and chick quality, impaired calcium and phosphorus utilisation, reduced immune competence, poor growth performance, and reduced flock uniformity. In many commercial operations, these issues are attributed to management or nutritional inconsistencies while the underlying limitation in Vitamin D activation goes unrecognised.

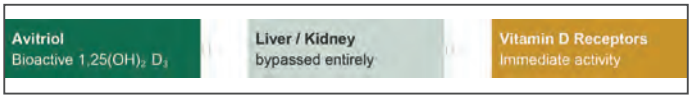
The Takeaway

Adding more dietary cholecalciferol does not fix a damaged activation pathway. If the liver cannot convert it, the extra Vitamin D_3 is simply unused - the bird needs the active metabolite delivered directly.

02 The Solution

Avitriol– Plant-Based Bioactive Vitamin D_3

Avitriolis a natural phytogenic feed supplement containing 1,25-dihydroxycholecalciferol [$1,25(OH)_2D_3$], the metabolically active form of Vitamin D_3, in plant-derived glycosidic form. Unlike conventional Vitamin D sources, Avitriol is already present in its active form and interacts directly with Vitamin D receptors without requiring prior activation in the liver or kidney. Because it bypasses both organs, its performance does not depend on hepatic health making it particularly relevant for flocks under mycotoxin pressure, disease challenge, or intensive production stress.



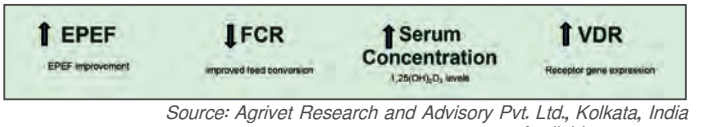
No activation steps. No organ dependence. No conversion losses.

Avitriol is already present in its active form; birds do not need to wait for hepatic and renal conversion before receiving Vitamin D activity supporting a rapid biological response and immediate nutritional support. It also removes the metabolic load that conventional Vitamin D sources place on the liver and kidney, organs that may already be challenged by mycotoxins, disease pressure, oxidative stress, or intensive production. The final active metabolite is delivered directly, Avitriol eliminates the conversion-associated losses that occur at each hydroxylation step in conventional metabolism.

The glycosidic form of Avitriol also enables a controlled, gradual release of the active metabolite, supporting consistent biological activity over time, while the product retains strong stability through pelleting and feed manufacturing preserving efficacy from feed mill to feeder.

03 Trial Evidence in Broilers

Avitriol benchmarked against 25-OH D_3 and α-OH D_3



Source: Agrivet Research and Advisory Pvt. Ltd., Kolkata, India
Available on request

Birds receiving Avitriol also showed significantly higher antibody titres against Newcastle Disease Virus than control and partially activated Vitamin D groups — evidence of stronger immune resilience under commercial conditions.

Broilers	Layers	Breeders
Skeletal development & bone strength	Improved egg production	Improved hatchability & chick quality
Lower tibial dyschondro-plasia incidence	Stronger eggshell quality	Stronger reproductive performance
Better growth & feed efficiency	Better laying persistency	Better maternal immunity transfer

Modern poultry production faces multiple challenges that can compromise nutrient utilisation, with mycotoxin-induced hepatic stress representing one of the most significant yet often overlooked factors affecting Vitamin D metabolism. While conventional Vitamin D supplementation depends heavily on efficient liver and kidney function, Avitriol delivers a fundamentally different approach: as a plant-based source of bioactive $1,25(OH)_2D_3$, it bypasses metabolic activation pathways, eliminates conversion-associated losses, imposes no metabolic burden on the liver and kidney, and provides immediate biological activity. In an era where maximising nutrient efficiency is essential for profitability and sustainability, Avitriol ensures that birds receive not just Vitamin D, but the active Vitamin D they need to achieve optimal skeletal health, immunity, productivity, and overall performance.

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Article

Role of Eggs in Combating Malnutrition In india

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Introduction

Malnutrition continues to be a major health challenge in India, affecting millions of children and women despite ongoing interventions. Recent global estimates indicate that India accounts for one of the highest burdens of child malnutrition in the world, with approximately 37 million children under five years suffering from stunting and over 21 million affected by wasting (*FAO, 2025*). Micronutrient deficiencies further magnify the problem. Recent estimates suggest that over 50% of women in India are anaemic, indicating widespread deficiencies of essential nutrients such as iron and vitamins (*Kuppusamyet al., 2024; UNICEF, 2024*). In addition, about 12% of the population remains undernourished, and nearly 42.9% cannot afford a healthy diet, showing serious gaps in nutritional accessibility and food quality (*Down To Earth, 2025*). One of the primary reasons for this persistent nutritional burden is inadequate dietary diversity and low intake of protein rich food. Diets in many Indian households remain predominantly cereal and carbohydrate based, which may meet caloric needs but often lack essential amino acids and nutrition required for optimal growth, immunity, and cognitive development. Eggs emerge as a simple, affordable, and nutritionally rich food that can play a crucial role in reducing malnutrition. Their rich composition of high quality protein and essential nutrients makes them an effective dietary intervention to bridge nutritional gaps and improve the health status of the Indian population.

Nutritional Value of Eggs

Eggs are recognised as one of the most nutrient dense foods and are recommended in Indian dietary guidelines as a valuable source of protein and essential nutrients. A single egg (≈50g) provides approximately 66-70 kcal of energy, 6-6.5g of protein, and about 5g of fat, making it a compact and efficient source of nutrition (*ICMR-NIN, 2017*). The protein present in eggs contains all essential amino acids in optimal proportions and exhibits high digestibility, making it a reference protein for human nutrition (*USDA, 2023*). In addition to macronutrients, eggs are rich in essential micronutrients required for growth and development. They provide vital amounts of vitamin A, vitamin B complex and vitamin D, along with minerals such as iron, phosphorus, magnesium, selenium, calcium and zinc, many of which are commonly deficient in Indian diets (*ICMR-NIN, 2020*). Eggs are also an important source of choline (~140mg per egg), which plays a critical role in brain development and cognitive function, particularly in children (*USDA, 2023*). Eggs have a very high biological value (around 94), meaning their protein is efficiently utilised by the human body. Furthermore, eggs contain bioactive compounds such as lutein and zeaxanthin, which contribute to eye health and antioxidant protection (*Réhault-Godbertet al., 2019*).

Table: Nutritional composition of whole egg (per 100 g edible portion)

Sl. No.	Nutrient	Amount
1.	Energy	155 kcal
2.	Protein	12.6 g
3.	Total Fat	10.6 g
4.	Carbohydrates	1.1 g
5.	Calcium	56 mg
6.	*Phosphorus*	198 mg
7.	Iron	1.75 mg
8.	Zinc	1.29 mg
9.	Potassium	138 mg
10.	Sodium	142 mg
11.	Selenium	30.7 µg
12.	Vitamin A	160 µg
13.	Vitamin D	2.0 µg
14.	Vitamin E	1.05 mg
15.	Vitamin K	0.3 µg
16.	Vitamin B1	0.04 mg
17.	Vitamin B2	0.457 mg
18.	Vitamin B3	0.075 mg
19.	Vitamin B5	1.53 mg
20.	Vitamin B6	0.17 mg
21.	Vitamin B12	1.11 µg
22.	Choline	294 mg

Role of Eggs in Growth, Child Nutrition and Maternal Health

Eggs play a key role in supporting physical growth, child nutrition, brain development, immune function and maternal health due to their rich nutrient composition. Evidence from recent studies suggests that regular consumption of eggs promotes children's physical growth, resulting in notable improvements in both height and weight, and emphasising their importance as a

complementary food in early years (*Larson et al., 2024*). Similarly, randomised controlled trials have shown that introducing eggs as a complementary food in infants aged 6-9 months can positively influence growth indicators and nutritional status (*Ricci et al., 2023*). Eggs are increasingly being integrated into the public nutrition schemes of the country, such as the Mid-day meal scheme and the Integrated Child Development Services (ICDS), where eggs are associated with increased intake of nutrients, school attendance, and nutritional outcomes for children (*Chakrabarti et al., 2021*). With respect to maternal health, eggs provide essential nutrients such as iron and choline, which are vital during pregnancy and lactation for supporting foetal growth, reducing the risk of low birth weight, and improving maternal nutritional status (*ICMR-NIN, 2020*). Recent studies also suggest that maternal egg consumption is associated with improved dietary quality and may positively influence infant feeding practices and early child development outcomes (*Wen et al., 2025*). Hence, promoting egg consumption across different life stages can improve overall health outcomes in India.

Eggs as an Affordable Source of Nutrition

Eggs are widely regarded as one of the most affordable and accessible sources of quality nutrition in India, particularly for low and middle-income populations. Despite recent price fluctuations, the cost of eggs typically ranges between Rs 7-8 per unit in urban markets, making them notably cheaper than most animal based protein sources, such as fish, chicken and dairy products (*Business Standard, 2026*). Eggs are widely available across both rural and urban areas, require minimal preparation, palatable and are culturally accepted in many regions, making them an ideal dietary component for improving nutritional intake (*Ritchie et al., 2018*). Global nutrition reports emphasise that improving access to affordable nutrient rich foods, including eggs, is critical in addressing malnutrition, especially in populations that cannot afford diversified diets. In the Indian context, where a significant proportion of the population struggles to meet recommended dietary protein intake, eggs offer a scalable and sustainable solution for enhancing nutritional security. Economically, eggs require less investment to produce compared to other animal proteins, allowing small-scale farmers to generate income while keeping prices low for consumers (*Scudiero et al., 2023*). Additionally, their long shelf life under proper storage reduces food waste, further enhancing their cost-effectiveness as a dietary option. Their inclusions in regular diets cansurely improve protein intake and reduce the nutrient deficiencies among the masses.

Barriers to Egg Consumption in India

Despite their proven nutritional benefits, egg consumption in India faces several barriers that limit their widespread adoption. Cultural and religious practices, particularly among strict vegetarians and certain religious communities often restrict or completely avoid eggs, reducing their inclusion in diets. Financial limitations also influence dietary choices; even though eggs are comparatively inexpensive, households with lower incomes often opt for cheaper carbohydrate-heavy foods rather than options like eggs. Misconceptions about cholesterol content and perceived health risks further discourage consumption, especially among women and the elderly (*Iannotti et al., 2017*). Also, uneven supply chains and inadequate cold storage infrastructure in India result in inconsistent availability and concerns about food safety, which limit regular consumption (*Arora et al., 2023*).

Conclusion

Eggs are a powerful yet underutilised tool in addressing malnutrition in India, offering a unique combination of protein, vitamins and minerals that support good health, child growth, and overall nutritional well-being. Beyond their nutritional benefits, they are affordable, accessible, widely available, convenient and culturally accepted, making them a practical solution for improving diets across diverse populations. By promoting awareness, integrating eggs into school and community feeding programs, and strengthening distribution and storage systems, several problems in consumption can be overcome. Embracing eggs as a daily dietary component has the potential to appreciably reduce stunting, nutrient deficiencies, transforming public health outcomes and encouraging a healthier, more productive population across India.

References

Arora, M., Kumar, R. and Bangar Raju, T (2023). Identification of issues in the cold chain of Indian frozen food. International Journal of Logistics Economics and Globalisation, 10(1): 1-22.

Chakrabarti, S., Scott, S. P., Alderman, H., Menon, P. and Gilligan, D. O. (2021).

Intergenerational nutrition benefits of India's national school feeding program. NatureCommunications, 12: 4248.

Food and Agriculture Organization of the United Nations (2025). The state of food security and nutrition in the world 2025: Safeguarding food security and nutrition in times of economic downturns. FAO.

Goel, V. (2026, January 2). All you need to know about rising egg prices across major Indian cities. Business Standard. https://www.business-standard.com/india-news/why-egg-prices-rising-india-major-cities-explainer-delhi-mumbai-126010200168_1.html.

Iannotti, L. L., Lutter, C. K., Stewart, C. P., Gallegos Riofrío, C. A., Malo, C., Reinhart, G., Palacios, A., Karp, C., Chapnick, M., Cox, K. and Waters, W. F. (2017). Eggs in Early Complementary Feeding and Child Growth: A Randomized Controlled Trial. Pediatrics, 140(1): e20163459.

Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) (2017). Indian food composition tables (IFCT 2017). ICMR-NIN.

Indian Council of Medical Research (ICMR)-National Institute of Nutrition (NIN) (2020). Nutrient requirements for Indians (RDA and EAR). ICMR-NIN.

Kuppusamy, P., Prusty, R. K. and Khan, S. A. (2024). Assessing the prevalence and predictors of anemia among pregnant women in India: findings from the India National Family Health Survey 2019-2021. Current Medical Research and Opinion, 40(1): 51-58.

Larson, E. A., Zhao, Z., Bader-Larsen, K. S., and Magkos, F. (2024). Egg consumption and growth in children: A meta-analysis of interventional trials. Frontiers in Nutrition, 10: 1278753.

Réhault-Godbert, S., Guyot, N. and Nys, Y. (2019). The golden egg: Nutritional value, bioactivities, and emerging benefits for human health. Nutrients, 11(3): 684.

Ricci, H., Faber, M., Ricci, C., Kruger, H. S., Malan, L., Nakiranda, R., Visser, M. and Smuts, C. M. (2023). Effects of egg as an early complementary food on growth of 6- to 9-month-old infants: a randomised controlled trial. Public health nutrition, 27(1): e1.

Ritchie, H., Reay, D. and Higgins, P. (2018). The impact of global dietary guidelines on climate change. Global Environmental Change, 49: 46-55.

Scudiero, L., Tak, M., Alarcón, P.and Shankar, B. (2023). Understanding household and food system determinants of chicken and egg consumption in India. Food Security, 15: 1231-1254.

Shagun. (2025, July 28). India has highest rate of wasting in the world, despite 30% decrease in undernourishment since 2006: UN food security and nutrition report.Down To Earth. https://www.downtoearth.org.in/food/india-has-highest-rate-of-wasting-in-the-world-despite-30-decrease-in-undernourishment-since-2006-un-food-security-nutrition-report.

U.S. Department of Agriculture (USDA) (2019). FoodData Central: Eggs, whole, raw, fresh. https://fdc.nal.usda.gov.

U.S. Department of Agriculture (USDA) (2023). FoodData Central: Eggs, whole, raw, fresh. https://fdc.nal.usda.gov.

United Nations Children's Fund (UNICEF) (2024). The state of the world's children 2024: Child survival and nutrition. https://www.unicef.org/reports/state-of-worlds-children/2024.

Wen, X., Mohammed, F., Giancarlo, E. M., Botchway, A., Albert-Ducasse, D., Ritchie, I. and Rideout, T. C. (2025). Association Between Maternal Egg Consumption During Pregnancy and Breastfeeding Initiation and Duration. Nutrients, 17(23): 3710.

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Article

Born Exposed: Mycotoxins in Breeder Feed Biomonitoring

Team Innovad

Key Takeaways & Proven Results

- Vertical Mycotoxin Transfer Proven: Vertical transfer reduces performance by impacting early growth, resilience, uniformity, and survival
- Measurable Results: Reducing chronic breeder exposure deliveries significant returns: broiler body weight increased significantly by 7%, and breeder mortality was reduced by 50%
- Early Protection: Protecting breeders protects broilers, ensuring healthier, stronger, better-performing chicks
- Biomonitoring Necessity: Only blood biomonitoring can measure vertical transfer; feed analysis cannot show what truly reaches the embryo

Exposure Begins Before Hatch

Several mycotoxins, including aflatoxin B1, deoxynivalenol, zearalenone, fumonisins and emerging Alternaria toxins such as tenuazonic acid, have been detected in eggs and embryonic tissues when hens ingest contaminated diets. This confirms that exposure begins before hatch, as toxins circulating in the breeder hen are deposited directly into the yolk or albumen. This mechanism, known as vertical transfer, is much speculated about but still underestimated in broiler production.

Feed analysis has long been the standard approach for assessing mycotoxin risk in broiler production. However, research now shows that this method provides only a partial picture. Exposure does not begin when chicks start consuming their diet, it starts much earlier. The embryo is already exposed during its most vulnerable developmental stage, when detoxification systems are immature and even low levels of toxins can have disproportionate biological effects.

Importantly, vertical transfer does not pose a food-safety concern for humans. The concentrations detected in eggs or embryos remain below regulatory thresholds. Its true significance lies elsewhere: understanding that mycotoxin exposure in broiler production starts in the breeder feed, long before chicks reach the farm or ingest their first feed.

Only Blood Can Detect Mycotoxin Exposure Before First Feed

Innovad's Biomonitoring+ program has made it possible to analyse more than 300 blood samples from day-old chicks (DOC) that had not consumed any feed. Despite having no dietary exposure, over 75% of these samples contained detectable mycotoxins or metabolites. This finding fundamentally changes our understanding of early exposure: chicks are not starting clean, they are starting already exposed.

Blood biomonitoring reveals what feed analysis cannot: the actual, biologically absorbed toxin load that reaches the embryo. Across multiple farms, the same compounds detected in breeder hens also appear in their day-old chicks, often at comparable trace concentrations. This breeder-chick correlation demonstrates a consistent pattern: toxins circulating in the hen are transferred into the egg and reach the embryo throughout development. Feed analysis alone cannot uncover this phenomenon. Only blood analysis can reveal whether the breeder truly absorbed these compounds and whether they crossed to her progeny.

In short, vertical transfer is the rule, not the exception, and blood biomonitoring is the only tool capable of detecting this early-life exposure before chicks ever access their first feed.

Damage Before Day One: The Toxic Cost of Vertical Transfer

Vertical transfer ensures that the embryo begins life already exposed to the mycotoxins circulating in the breeder hen. Although the concentrations detected in day-old chicks are often low, the chick is uniquely vulnerable: its liver, kidneys and antioxidant defences are still developing, leaving it with very limited capacity to detoxify or eliminate contaminants. As a result, even modest maternal exposure can trigger disproportionate biological and performance effects during early development.

1. Impaired Development and Early Growth

Mycotoxin exposure during embryogenesis disrupts normal development, affecting organ formation and overall vitality at hatch. These setbacks lead to lower hatchling weight and slower bodyweight gain in the first 7-14 days — a key predictor of final flock performance. These effects are driven by underlying changes in liver development, reduced metabolic capacity and increased oxidative stress in embryonic tissues.

2. Weakened Immunity and Resilience

Vertical transfer compromises early immune development, reducing IgA, IgG and IgY, impairing lymphoid organ maturation and weakening innate immune defences. Embryonic exposure to deoxynivalenol and zearalenone also reduces antioxidant enzyme activity, increasing vulnerability to post-hatch stressors. As a result, chicks start life with a compromised and immature immune system, making them far more prone to pathogens, dysbiosis, vaccine failures and early-age stress (heat, transport) before their own immunity becomes stable and fully functional.

3. Altered Intestinal Function and Feed Efficiency

Mycotoxins reaching the embryo impair villi formation, tight-junction integrity and enzyme expression, limiting early nutrient absorption. Compromised tight-junction integrity is particularly critical, as it increases intestinal permeability, facilitates bacterial translocation across the gut barrier, and predisposes chicks to secondary problems caused by opportunistic pathogens such as Enterococcus. Studies show a consequent deterioration in feed conversion (FCR) in progeny originating from contaminated breeders.

Table 1: Toxic effects of vertical transfer on embryonic and early-life development

Toxic Effect	Biological Impact	Performance Consequence
Impaired organ and metabolic development	Liver lesions, reduced hepatic enzymes, disrupted lipid metabolism, increased oxidative stress	↓ Hatchling vitality, early BW gain
Higher embryonic mortality & reduced hatchability	Increased late-stage embryo death, compromised viability of hatched chicks	↓ Hatchability, ↑ early mortality
Immunotoxicity in early life & Reduced antioxidant capacity	Lower IgA/IgG, smaller lymphoid organs, impaired innate immunity; Oxidative stress, reduced activity of antioxidant enzymes, increased lipid peroxidation	↑ Disease susceptibility, poor vaccine response; ↓ Resilience, higher sensitivity to stress
Altered intestinal development	Impaired villi development, weaker tight junctions, reduced digestive enzyme expression, increased intestinal permeability and bacterial translocation	↓ Nutrient absorption, FCR ↑, poor uniformity, susceptibility to opportunistic pathogens

4. Reduced Viability and Uniformity

Exposure in ovo increases late embryo mortality and reduces hatchability. Surviving chicks often hatch with variable degrees of impairment, resulting in poorer flock uniformity, a key driver of processing efficiency. Higher early mortality and culls have also been linked to embryonic aflatoxin, deoxynivalenol and zearalenone exposure.

Vertical transfer becomes the first limiting factor of broiler performance, before feed formulation, farm management or health programs can influence outcomes.

A Trial Confirmed It: Lower Maternal Toxins Mean Better Chick Performance

To evaluate the practical relevance of vertical transfer and the effectiveness of reducing systemic exposure in breeders, a controlled field study was performed using commercial broiler breeders and their progeny. The 1-month trial compared a control group with a group receiving Novin technology incorporated into the breeder diet (2 lb/T of feed).

At the start of the study, both groups showed a similar systemic contamination profile, with tenuazonic acid as the predominant circulating toxin. At one month, supplemented breeders showed substantially reduced tenuazonic acid levels compared to controls (3.8 ppb vs 6.1 ppb). This represents a 38% lower toxin concentration in breeder blood (Table 2). This clear downward shift demonstrates that the nutritional strategy reduced the toxin load circulating in the breeders, capturing an improvement that feed analysis alone cannot reveal.

Although the tenuazonic acid levels detected were far below those associated with acute toxicity, they are consistent with chronic exposure, which is known to negatively affect health status and performance in breeders. The lighter toxic burden represented by the observed 38% reduction in circulating tenuazonic acid, translated into a clear biological benefit: breeder mortality was reduced by 50% compared with the control group. This highlights how even moderate decreases in chronic exposure can markedly improve flock resilience.

Table 2: Blood mycotoxin levels in breeders at day 0 and day 30 in control and supplemented groups

Timepoint	Control Breeders	Breeders consuming Novin (2 lb/T)
Day 0	Tenuazonic acid (av = 6.2 ppb) Alternariol (Traces) DON-sulfate (av = 1,963)	Tenuazonic acid (av = 6.3 ppb) Alternariol (Traces) DON-sulfate (av = 1,192)
Day 30	Tenuazonic acid (av = 6.1 ppb) Beauvericin (Traces)	Tenuazonic acid (av = 3.8 ppb) (38% Reduction)

Progeny Performance Results (Figure 1 Data)

Reducing the maternal toxin burden translated directly into better early performance of the progeny. Chicks originating from breeders with lower systemic exposure showed clear advantages from the first days of life:

- Day 0 Weight: Control: 48.6g vs. Novin: 48.9g
- Day 7 Weight: Control: 205.9g vs. Novin: 220.3g (Significantly heavier by 7%, p=0.004)
- Day 14 Weight: Control: 561.1g vs. Novin: 581.8g (4% higher body weight)

The group from breeders consuming Novin consumed slightly more feed, but FCR remained identical between groups, indicating that the additional growth did not come at the cost of efficiency. Taken together, these results show that lowering the toxin load in breeders has immediate, measurable benefits for their progeny — improving early growth and maintaining feed efficiency during the most vulnerable phase of the broiler cycle.

Conclusion: Test, Treat, Track

Vertical transfer is a widespread and underestimated source of mycotoxin exposure in broiler production. Blood biomonitoring is the only tool capable of detecting this early-life exposure, revealing that many chicks begin life already carrying toxins absorbed by the breeder. Even moderate maternal contamination can impair development, resilience and early performance. Reducing the toxin burden in breeders lowers vertical transfer and delivers measurable benefits for both breeders and their progeny. Strengthening broiler performance therefore begins by controlling exposure at the breeder level.

Biomonitoring+ Program Details

Don't assume. Detect. On time. Blood holds the answers.
Fact: 82% of farms had mycotoxins in animal blood that were completely missed in feed.

The Biomonitoring+ Program uses Myco-Marker, an advanced LC-MS/MS method, to detect up to 36 mycotoxins including metabolites and emerging toxins like DON-sulfate and alternariol — from a single drop of blood onto an FTA card.

- Detects systemic mycotoxin exposure
- Tracks cumulative, real-time toxin burden
- Predicts herd health for precise mycotoxin management

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Article

New Paradigm of Food Production: A Concept for Poultry Food Safety

Team ABTL

Nutrinomics, is the merging of the nutrition and health economics disciplines to assess the impact of nutrition on animal health and disease and to illustrate the health and economic aspects of specific changes in the daily nutrition and nutrition recommendations through the lens of cost effectiveness.

Context and Industry Need

The poultry industry today operates under unprecedented pressure. Producers are expected to deliver rapid growth rates, efficient feed conversion, and consistent meat quality, all while ensuring food safety and compliance with increasingly stringent regulatory frameworks. This balancing act has become more complex with the global transition away from antibiotic growth promoters (AGPs), which for decades served as the cornerstone of intensive poultry production.

The withdrawal of AGPs is not merely a regulatory adjustment; it reflects a global public health imperative. Mounting concerns over antimicrobial resistance (AMR) have made the indiscriminate use of antibiotics in livestock unsustainable. Resistant bacterial strains threaten both human and animal health, undermining the effectiveness of critical medicines. Beyond resistance, the persistence of antibiotic residues in poultry meat poses direct risks to consumers, eroding trust in food safety and creating reputational challenges for producers. As a result, the poultry sector is under pressure to adopt sustainable, residue-free alternatives that can deliver comparable or superior performance outcomes.

At the same time, the gastrointestinal tract (GIT) of poultry has emerged as a focal point for innovation. The GIT is not only the primary site of nutrient assimilation but also a critical hub for immune function and microbial balance. Maintaining a stable and diverse gut microbiome is essential for optimal growth, disease resistance, and overall productivity. Disruptions in gut ecology can lead to poor feed utilisation, increased susceptibility to pathogens, and higher mortality rates. Thus, modern feed solutions must go beyond simple nutrient supplementation; they must actively support gut integrity, microbial harmony, and immune resilience.

Consumer expectations further amplify the industry's need for innovation. Today's market demands poultry products that are not only safe and residue-free but also produced under sustainable and ethical conditions. Producers must, therefore, integrate advanced feed technologies that align with global food safety priorities while enhancing operational efficiency.

Against this backdrop, the synergistic use of Lysozyme, Glucose Oxidase, and Bile salts represents a promising paradigm. Together, these agents offer a natural, scientifically validated alternative to AGPs. By combining enzymatic antimicrobial action, controlled oxidative defence, and enhanced nutrient digestion, this triad addresses the dual challenge of productivity and safety. It ensures that poultry producers can meet consumer demands, regulatory requirements, and performance targets simultaneously. In doing so, the combination positions itself as a cornerstone of next-generation poultry nutrition an innovation that elevates food safety while driving sustainable growth.

Integrated Mechanistic Depth

Lysozyme

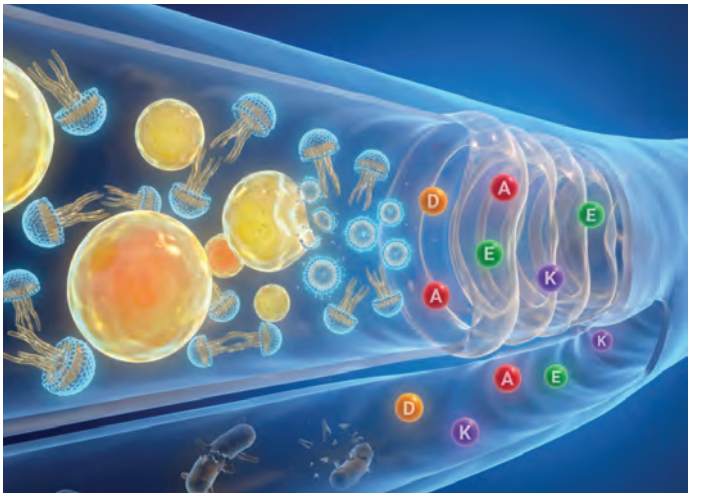
- **Gram-Positive Susceptibility:** Lysozyme cleaves β1,4 glycosidic bonds in peptidoglycan, lysing Gram-positive pathogens (Clostridium perfringens)
- **Gram Negative Modulation:** While Gram-negative bacteria are less susceptible due to their outer membrane, Lysozyme destabilizes these membranes, increasing vulnerability
- **Benefit:** Reduced pathogen load and toxin production; protection of beneficial Gram-positive flora

Glucose Oxidase

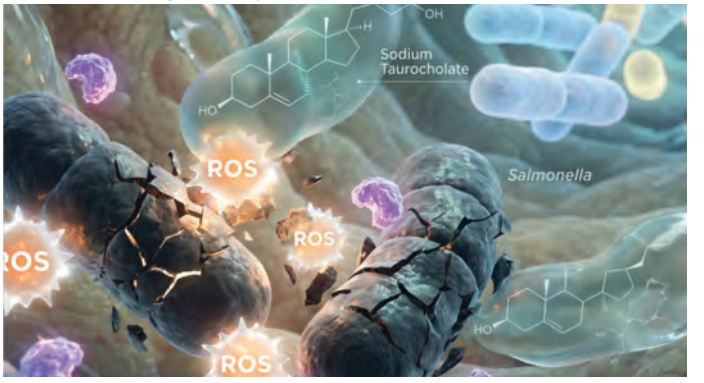
- **Controlled ROS Generation:** Converts glucose into gluconic acid and H_2O_2. The H_2O_2 produces reactive oxygen species (ROS) that damage pathogens. Importantly, ROS levels are controlled to avoid oxidative damage to host tissues
- **Anaerobic Shift:** Oxygen consumption fosters anaerobic conditions, favouring beneficial flora
- **Benefit:** Suppression of harmful bacteria, promotion of beneficial microbiota, and improved gut resilience

Sodium Taurocholate

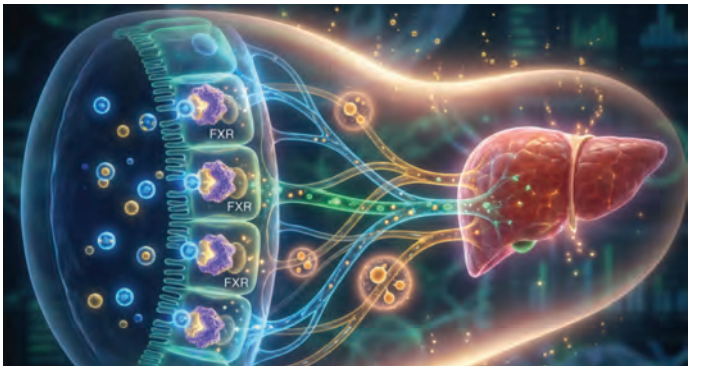
1. **Fat Emulsification**
   Sodium Taurocholate is a conjugated bile salt that mimics the natural bile acids secreted by the liver. Its amphipathic structure allows it to emulsify dietary fats into micelles, dramatically improving the solubilisation and absorption of lipids and fat-soluble vitamins (A, D, E, and K). This enhanced nutrient uptake reduces undigested feed in the lower intestine, depriving pathogens of substrate and improving feed conversion efficiency.



2. **Antimicrobial Activity Against Gram-Negative Bacteria**
   Beyond its digestive role, bile salts such as taurocholate exert direct antimicrobial effects, particularly against Gram-negative bacteria.
   - **Membrane Disruption:** Taurocholate destabilises the outer membrane of Gram-negative bacteria (e.g., E. coli, Salmonella spp.), increasing permeability and susceptibility to lysis
   - **Synergy with Lysozyme & ROS:** By weakening the protective lipid bilayer, taurocholate enhances the effectiveness of lysozyme and reactive oxygen species (ROS) generated by glucose oxidase
   - **Microbiome Modulation:** This selective pressure reduces pathogenic Gram-negative populations while sparing or even supporting beneficial commensals, contributing to a balanced gut ecosystem



3. **Bile Salt Signalling (Advanced Mechanism)**
   Taurocholate is not only a digestive aid but also asignalling molecule. It can activate the Farnesoid X Receptor (FXR) in the gut-liver axis, influencing lipid metabolism, bile acid homeostasis, and systemic energy regulation. This signalling may contribute to improved metabolic health and meat quality in poultry.



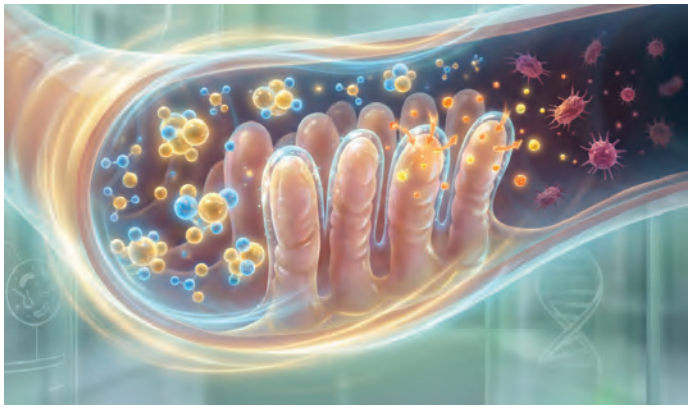
4. Integrated Benefits

- Enhanced Nutrient Uptake: Better absorption of fats and vitamins supports growth and immunity
- Reduced Pathogen Load: Direct antimicrobial action against Gram-negative bacteria complements enzymatic and oxidative mechanisms
- Improved Growth and Meat Quality: By combining digestive efficiency with pathogen suppression, taurocholate contributes to higher productivity and safer poultry products

When combined with Lysozyme and Glucose Oxidase, Sodium Taurocholate amplifies product's triple-mode mechanism:

- Weakens Gram-negative bacteria, making them more susceptible to lysozyme and ROS
- Reduces undigested feed, starving pathogens and lowering enteric disease risk
- Enhances nutrient assimilation, directly translating into improved feed conversion and growth

Thus, taurocholate serves as both a nutritional enhancer and a microbiome modulator, bridging digestive physiology with antimicrobial defence.



Synergistic Integration

Together, these mechanisms rebalance the microbiota, reduce inflammation, strengthen epithelial barriers, and improve nutrient assimilation creating a resilient gut ecosystem that supports both performance and safety.

Integrated Synergy and Outcomes

When combined, Lysozyme, Glucose Oxidase, and Bile salts create a synergistic triad that transforms poultry gut health:

- Pathogen Suppression: Dual enzymatic and oxidative mechanisms, amplified by bile salt membranedisruption
- Microbiome Balance: Favouring beneficial anaerobessuch as Lactobacillus & Bifidobacterium
- Nutrient Efficiency: Improved digestion and absorption, reducing feed wastage and enhancing growth
- Immune Strength: Elevated antibody levels, stronger epithelial barriers, and reduced stress markers
- Meat Quality: Higher HDL, lower triglycerides, and improved carcass composition

These outcomes validate the synergistic action of the three components in driving both productivity and food safety.

Strategic Outlook

The integration of lysozyme, glucose oxidase, and bile salts represents a next-generation feed strategy for poultry. It aligns with global food safety priorities, regulatory trends, and consumer expectations for sustainable, residue-free meat.

Strategic Benefits

- Residue-free alternative to AGPs
- Enhanced productivity and profitability
- Improved animal welfare and reduced stress
- Compliance with global regulatory frameworks
- Market differentiation through safer, higher-quality poultry products

In summary, the synergistic combination of Lysozyme, Glucose Oxidase, and Bile salts offers a scientifically validated, natural pathway to sustainable poultry production. By uniting antimicrobial defence, oxidative control, and digestive enhancement, this triad creates a resilient gut ecosystem ensuring food safety, productivity, and consumer trust in the post-antibiotic era.

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Block the mycotoxin impact

Escent

Detoxifies with multifunctional approach to counteract stress in the context of TOXIC CONTAMINANTS

TOP Mycotoxins detected in Poultry Blood

World		Asia-Pacific		*India*	
Tenuazonic acid	68%	Tenuazonic acid	38%	*Tenuazonic acid	66%
Enniatin B1	62%	Deoxynivalenol	28%	Ochratoxin A	48%
Enniatin B	54%	Ochratoxin A	24%	Alternariol	48%
Ochratoxin A	54%	Beauvericin	14%	Citrinin	18%
Beauvericin	30%	Enniatin B	14%	Fumonisins	16%
Zearalenone	24%	Aflatoxin	10%	Aflatoxin B1	9%

Mode of action/Comosition	Escent
Detoxification technology *Bioactive flavonoids/yeast*	✓
Liver and metabolism support *Selection of plant extracts*	✓
Immunity/Gut support *Inactivated yeast & yeast cell wall*	✓
Reduce oxidative stress *Natural antioxidants*	✓
Kidney health support *Reno-protective complex*	✓

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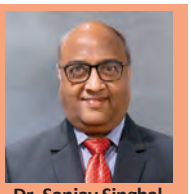
Article

Ciprofloxacin in Modern Poultry Production

Dr. Kishor Gedam
Product Manager-Therapeutics

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Chief Operating Officer

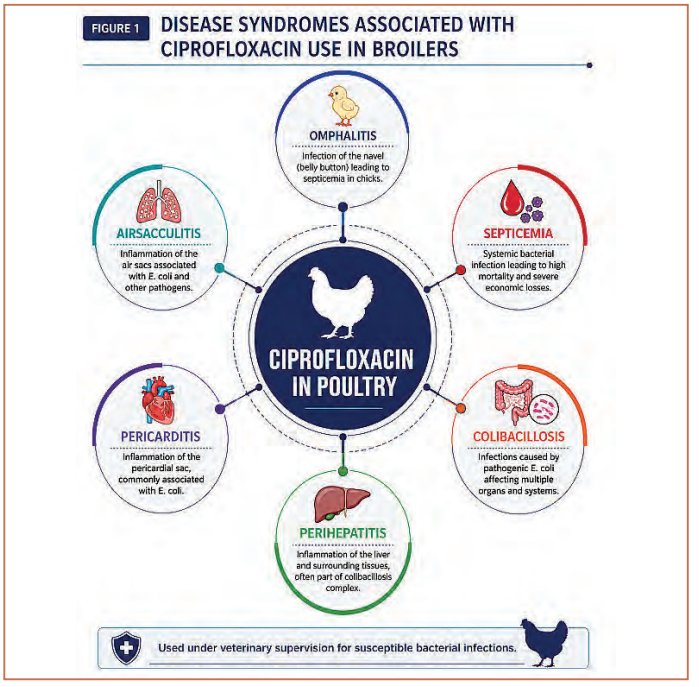
Stallen South Asia Pvt. Ltd

The Economic Impact of Bacterial Diseases in Poultry

Bacterial infections continue to impose significant economic losses throughout the poultry value chain. Among the most important bacterial disease syndromes encountered in broiler production are:

Colibacillosis, Omphalitis and yolk sac infections, Airsacculitis, Pericarditis, Perihepatitis, Septicemia and Secondary bacterial respiratory infections.

Escherichia coli remains one of the most frequently isolated bacterial pathogens associated with these conditions. The first week of life is particularly critical, as early chick mortality associated with bacterial infections can have long-term consequences on flock performance.

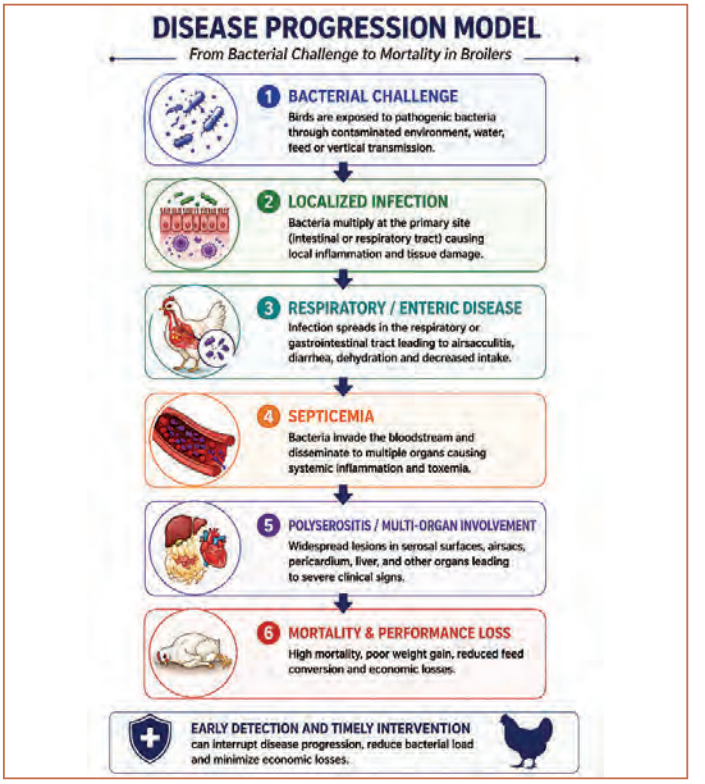


Why Rapid Intervention Matters

The progression of bacterial infections in poultry can be remarkably rapid.

What begins as localised bacterial colonisation may quickly develop into respiratory involvement, systemic septicemia, polyserositis, and ultimately mortality. As disease progresses, treatment becomes increasingly difficult and production losses become more severe.

The success of antimicrobial therapy often depends not only on antimicrobial selection but also on the speed with which effective treatment is initiated.



Ciprofloxacin as a Solution

The ideal antimicrobial for modern poultry production should possess:

- Rapid bactericidal activity
- Broad-spectrum efficacy against susceptible bacterial pathogens
- Excellent tissue penetration
- Systemic distribution
- Practical administration characteristics

Ciprofloxacin possesses many of these attributes. As a second-generation fluoroquinolone, ciprofloxacin exerts its antibacterial activity through inhibition of bacterial DNA gyrase and topoisomerase IV, resulting in concentration-dependent bacterial killing.

Unlike bacteriostatic agents that inhibit bacterial growth, ciprofloxacin rapidly reduces bacterial populations when adequate tissue concentrations are achieved.

Pharmacokinetic studies have demonstrated favourable oral

absorption, broad tissue distribution, and effective systemic exposure following administration in broiler chickens.

These characteristics make ciprofloxacin particularly suitable for bacterial infections involving respiratory tissues, serosal surfaces, and internal organs.

Clinical Applications in Broiler Production

Although ciprofloxacin is often associated with colibacillosis, its clinical utility extends beyond a single disease condition.

Its use may be considered in susceptible bacterial infections associated with:

- Colibacillosis
- Colisepticemia
- Omphalitis
- Yolk sac infections
- Airsacculitis
- Pericarditis
- Perihepatitis
- Secondary bacterial respiratory infections
- Septicemic disease complexes

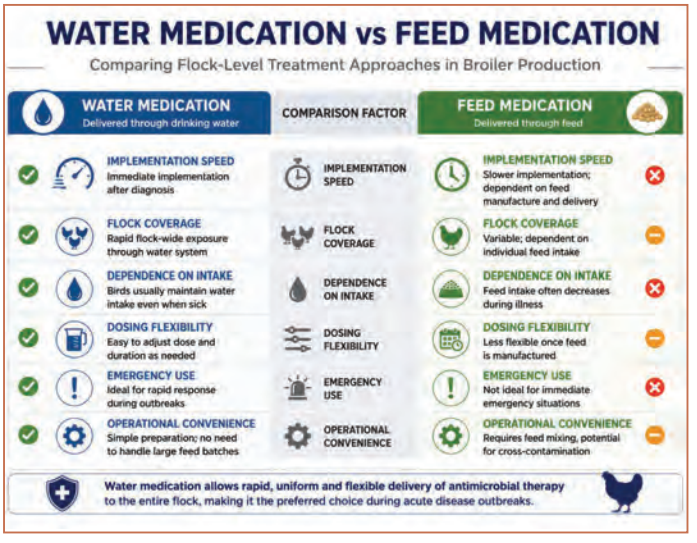
The broad tissue distribution achieved following oral administration allows ciprofloxacin to reach multiple target sites commonly affected during systemic bacterial infections.

Why Route of Administration Influences Treatment Success

"In modern broiler production, therapeutic success depends not only on antimicrobial efficacy but also on the speed, uniformity, and reliability of drug delivery."

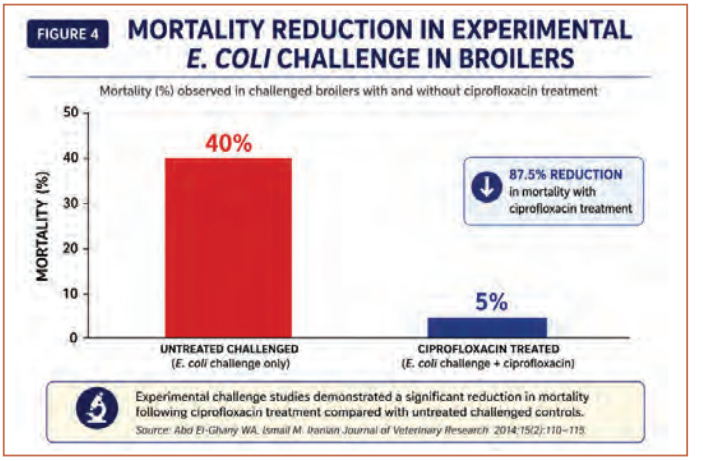
Experimental Evidence Supporting Clinical Use of Ciprofloxacin: Several studies have demonstrated the effectiveness of ciprofloxacin in controlling susceptible bacterial infections.

In an experimental E. coli challenge model, ciprofloxacin-treated broilers demonstrated significantly lower mortality, reduced bacterial recovery, improved clinical recovery, and superior production performance compared with untreated challenged birds.



Mortality Reduction in Experimental E. coli Challenge

These findings reinforce the importance of rapid intervention and effective antimicrobial therapy during bacterial disease outbreaks.



Conclusion

Modern poultry production requires both effective antimicrobial therapy and efficient delivery systems to successfully manage bacterial disease challenges.

Ciprofloxacin combines concentration-dependent bactericidal activity, favourable pharmacokinetic characteristics, broad tissue distribution, and suitability for drinking-water administration, making it an important therapeutic option in the management of susceptible bacterial infections in broilers.

When combined with rapid diagnosis, appropriate administration, and responsible antimicrobial stewardship, ciprofloxacin continues to play a valuable role in contemporary poultry health management.

Furthermore, oral liquid formulations can enhance the practicality of water medication programs through improved ease of handling, rapid dispersion, and greater operational convenience under commercial production conditions.

References

- *Abd El-Ghany WA, Ismail M. Iranian Journal of Veterinary Research. 2014;15(2):110–115.*
- *Brown SA. Fluoroquinolones in Animal Health. Journal of Veterinary Pharmacology and Therapeutics. 1996;19:1–14.*
- *Billah MM et al. Determination of the presence and pharmacokinetic profile of ciprofloxacin in broiler chickens after oral administration. Journal of Antibiotics.*
- *Ivanova S et al. Pharmacokinetics of ciprofloxacin in broiler chickens. Macedonian Veterinary Review.*

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CEAH Bengaluru: Building Animal Husbandry Ecosystem

Centre for Excellence in Animal Husbandry (CEAH) aims to become a one-stop destination for knowledge, innovation and capacity building for all stakeholders in animal agriculture. **IPR** travels to the sprawling 642 acres multidisciplinary Hessarghatta campus on the outskirts of Bengaluru and meet **Dr. Mahesh P.S., Joint Commissioner, Government of India and Director, CEAH** for a firsthand experience

India's livestock and poultry industries are at a defining moment. Growing demand for quality animal protein, advances in production technologies, increasing focus on biosecurity, evolving disease challenges, and the push for sustainable farming are reshaping the sector like never before. As the industry becomes more sophisticated, one factor is emerging as the key driver of future growth—a skilled workforce equipped to turn scientific knowledge into practical, on-farm solutions.

It is against this backdrop that the Centre for Excellence in Animal Husbandry (CEAH), Bengaluru, was established by the Government of India. Envisioned as the country's premier academy for animal husbandry, CEAH is more than just another training institution. It is a national platform designed to foster learning, innovation and professional excellence across the livestock value chain.

CEAH promotes a collaborative, multidisciplinary approach to capacity building. By bringing together expertise from different branches of animal husbandry under one roof, it creates an environment where knowledge is shared across disciplines and translated into practical skills that can benefit farmers, veterinarians, entrepreneurs and industry professionals alike.

Nestled within the expansive Hessarghatta campus on the outskirts of Bengaluru, CEAH was formally established in March 2023 under the Department of Animal Husbandry & Dairying (DAHD), Ministry of Fisheries, Animal Husbandry and Dairying. The academy was conceived as part of the Government of India's Mission Karmayogi initiative, which seeks to strengthen the capabilities of public institutions through continuous learning, leadership development and technical excellence.

One of CEAH's defining strengths is its integrated structure. Instead of creating a new standalone institute, the academy brings together the expertise and infrastructure of five well-

established national organisations located within the 642-acre Hessarghatta campus:

- Central Poultry Development Organisation & Training Institute (CPDO&TI)
- Central Frozen Semen Production & Training Institute (CFSPTI)
- Central Cattle Breeding Farm (CCBF)
- Animal Quarantine and Certification Services (AQCS)
- Regional Fodder Station (RFS)

The livestock sector is no longer driven solely by experience and conventional farming practices. Today's veterinarians, extension officers, entrepreneurs and farm managers are expected to keep pace with rapid developments in precision livestock farming, genetics, disease surveillance, nutrition, animal welfare, digital technologies and global quality standards. Continuous learning has become an essential part of professional success.

Recognising this shift, CEAH has adopted a training model that blends classroom learning with extensive practical exposure.This allows trainees to see modern livestock management practices in action and understand how scientific principles are applied in real-world situations.

CEAH conducts Comprehensive Refresher Programmes (CRPs), specialised technical courses, orientation programmes, internships, leadership development workshops and customised training modules for government departments and organisations. Rather than following a one-size-fits-all approach, each programme is carefully structured to address the specific requirements of its participants.

The curriculum also evolves in response to emerging industry priorities. This ensures that participants leave the academy with knowledge that is both current and directly relevant to the challenges facing the sector today.

While poultry remains a major focus, one of CEAH's greatest strengths lies in its integrated approach to animal husbandry. The academy recognises that the future of livestock development cannot be viewed in silos. Dairy, poultry, cattle breeding, fodder management, animal health and biosecurity are all interconnected, and progress in one area often depends on advancements in another. This multidisciplinary perspective gives participants a broader understanding of the livestock ecosystem.

Such a holistic outlook is becoming increasingly relevant as India moves towards integrated livestock production systems. Today's professionals are expected not only to excel in their area of expertise but also to appreciate how different disciplines work together to improve productivity, sustainability and profitability across the value chain.

Recognising that professional development should not be confined to the classroom, CEAH has embraced digital platforms to expand its outreach. Webinars, online expert lectures, interactive discussions and podcast series now complement its on-campus training programmes, making quality learning accessible to professionals across the country.

These digital initiatives bring together scientists, policymakers, successful entrepreneurs and industry leaders to share their experiences and perspectives on emerging challenges and opportunities. Topics range from entrepreneurship and innovation to animal health, breeding, nutrition and evolving industry trends.

As India's livestock sector continues to grow, the need for skilled professionals has never been greater. Government initiatives aimed at improving disease surveillance, enhancing genetic resources, strengthening fodder security, promoting entrepreneurship and advancing climate-resilient livestock production all depend on one critical factor—a well-trained workforce capable of translating policy into action.

In this context, institutions like CEAH serve a much larger purpose than conducting training programmes. Its multidisciplinary

framework also aligns closely with national priorities such as the One Health approach, responsible use of antimicrobials, biosecurity, climate resilience and sustainable livestock development. As these issues gain prominence, the academy's role in preparing future-ready professionals is expected to become even more significant.

A Valuable Resource for the Poultry Industry

For India's poultry sector, CEAH represents an important centre of knowledge and technical expertise. The presence of the Central Poultry Development Organisation & Training Institute (CPDO&TI) within the academy provides access to decades of experience in commercial poultry production, hatchery management, breeder operations, incubation technology, poultry nutrition, biosecurity and backyard poultry development.

As the poultry industry embraces automation, precision management and higher production efficiencies, the need for continuous skill development has become more critical than ever. Producers are also navigating growing expectations around food safety, antimicrobial stewardship, animal welfare and environmental sustainability. Meeting these expectations requires a workforce that is well trained and equipped with the latest scientific knowledge.

CEAH serves as an important bridge between government institutions, research organisations and the commercial poultry industry. By creating opportunities for knowledge exchange and practical learning, the academy helps accelerate the adoption of best management practices across the sector. Its strong focus on hands-on demonstrations enables participants to move beyond theory and develop the confidence to implement new technologies and management strategies on commercial farms.

For the poultry industry, this opens up valuable opportunities for collaboration in areas such as hatchery management, breeder production, disease prevention, automation, processing, value addition, food safety, sustainability and workforce development. Such partnerships ensure that training remains aligned with evolving industry requirements while creating a stronger bridge between research, policy and commercial production.

As technology advances and production systems become increasingly sophisticated, closer interaction between government institutions and industry will be essential for faster adoption of innovations and wider dissemination of best management practices.

As the country's demand for safe, sustainable and high-quality animal protein continues to rise, institutions like CEAH will play an increasingly important role in ensuring that India's livestock sector remains competitive, resilient and globally relevant. By investing in people as much as in technology, CEAH is helping lay the foundation for a stronger, smarter and more sustainable future for Indian animal husbandry.


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A-2

Interview with Dr. Mahesh P. S., Joint Commissioner, Government of India and Director, CEAH

IPR **CEAH has emerged as a key institution for advancing livestock development in India. What is your vision for CEAH over the next five years?**

Dr. Mahesh CEAH was established as a consortium of five premier institutions under the Ministry of Fisheries, Animal Husbandry and Dairying, bringing together expertise in poultry, cattle breeding, fodder development, animal quarantine, and certification services. Over the next five years, our vision is to position CEAH as India's leading Centre of Excellence for Animal Husbandry.

Our focus will be on capacity building, innovation, technology adoption, and entrepreneurship. We want CEAH to become a destination where stakeholders from government, industry, academia, and farming communities can witness best-in-class practices and access world-class training.

Key initiatives include establishing an incubation ecosystem for livestock startups, strengthening cattle breeding programs through sex-sorted semen and embryo transfer technologies, promoting fodder innovation and silage management, and facilitating exports through our animal quarantine and certification network. Ultimately, CEAH aims to be a catalyst in transforming India's livestock sector into a globally competitive industry.

IPR **Skill development is critical for the future of livestock farming. What initiatives has CEAH taken to train farmers, veterinarians, and industry professionals?**

Dr. Mahesh India has strong expertise at both the top and grassroots levels, but there is a significant skill gap in the middle segment, particularly in areas such as automation, hatchery management, feed milling, and modern farm operations.

To bridge this gap, CEAH is partnering with organisations such as industry associations, dairy bodies, and livestock sector stakeholders to offer specialised skill development programs. We see ourselves as a facilitation platform where associations can utilise our infrastructure to conduct practical, industry-oriented training programs.

In addition to technical skills, we are promoting entrepreneurship and business model development across poultry, dairy, sheep and goat farming, and piggery. We are also exploring the establishment of a dedicated Livestock Skill Council to develop curricula, certification programs, and digital learning modules aligned with the objectives of Skill India and Startup India.

IPR **Precision livestock farming, artificial intelligence, and digital monitoring systems are gaining traction globally. How do you see these technologies shaping Indian animal agriculture?**

Dr. Mahesh Animal agriculture is now a major contributor to India's agricultural economy, accounting for nearly one-third of the sector's value and growing at a much faster pace than conventional agriculture.

Technology will play a transformative role in managing scale and improving efficiency. Real-time data collection is already becoming common in integrated poultry and dairy operations. Artificial intelligence and machine learning will soon be used for predictive analytics, market forecasting, body weight monitoring, hatchery management, disease surveillance, and quality assessment of meat, milk, and eggs.

Leading universities and technology companies are increasingly interested in livestock applications of AI. As the sector scales up, digitalisation and precision farming will become essential for improving productivity, sustainability, and profitability.

IPR **Collaboration between academia, government, and industry is essential for innovation. Can you share some successful partnerships that have delivered tangible outcomes?**

Dr. Mahesh Collaboration is at the heart of CEAH's approach. We actively work with universities, industry associations, government agencies, international organisations, and private companies.

One of our most significant achievements is the Indo-Dutch Centre of Excellence for Dairy Training, which emerged through extensive collaboration between Indian and Dutch stakeholders. We are also working with organisations such as FAO, universities across India, and several international institutions.

What makes CEAH unique is that it acts as a bridge connecting government, academia, industry, and farmers. This integrated approach helps translate innovation into practical outcomes and ensures that knowledge reaches the end user.

IPR **What opportunities do you see for young entrepreneurs and startups in the animal husbandry ecosystem, and how can CEAH support their growth?**

Dr. Mahesh The opportunities are enormous. Many people still perceive livestock farming only in terms of eggs, milk, or meat. However, this is a multi-billion-dollar industry with opportunities across production, processing, technology,

logistics, retail, and services.

Several successful startups in dairy and poultry have demonstrated the sector's potential. Today, investment capital is available, technology is accessible, and market demand is growing.

CEAH supports entrepreneurs through mentorship, networking, incubation support, knowledge sharing, and exposure to successful business models. We have built our approach around three pillars: Information, Innovation, and Inspiration. Our goal is to help aspiring entrepreneurs convert ideas into successful enterprises.

IPR **As India strives to strengthen food security and nutrition, what role do livestock and poultry sectors play in achieving these national goals?**

Dr. Mahesh The discussion today must move beyond food security to nutritional security. India has made significant progress in ensuring food availability, but protein deficiency remains a major concern.

Livestock products such as eggs, milk, meat, and fish are among the most affordable and accessible sources of high-quality protein. CEAH strongly advocates a "Protein Revolution" to complement the Green Revolution that transformed India's food production decades ago.

Our message is simple: protein should become a daily nutritional priority. Whether from animal or plant sources, adequate protein intake is essential for health, growth, productivity, and national development. Through awareness programs, capacity building, and stakeholder engagement, CEAH aims to promote better nutrition across the country.

IPR **The Indo-Dutch Centre of Excellence for Dairy Training at CEAH is a significant initiative. What is the vision behind this collaboration?**

Dr. Mahesh This initiative is the result of extensive collaboration between India and the Netherlands and aims to strengthen dairy training, technology adoption, and capacity building.

The Centre will focus on five key areas: sustainable smallholder dairy models, integrated dairy ecosystems, advanced milk testing laboratories, cheese production and value addition, and world-class training programs.

The objective is to bring international best practices to Indian dairy farmers, entrepreneurs, and professionals while making advanced training accessible and affordable within India.

IPR **What key training programs and outcomes are envisaged under the Centre, and how will they contribute to a future-ready dairy sector?**

Dr. Mahesh CEAH is developing a comprehensive training ecosystem supported by digital platforms, including a "Book My Training" portal that will allow participants to select programs based on their interests and requirements.

Our offerings will include comprehensive refresher programs, subject-specific technical courses, customised industry workshops, and international collaboration programs. We also conduct specialised training for bankers, government officials, veterinarians, and industry professionals.

The ultimate objective is to create a globally competitive, technologically advanced, and sustainable livestock and dairy sector. CEAH aims to become a one-stop destination for knowledge, innovation, and capacity building for all stakeholders in animal agriculture.

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We all experience mood dips, from mid-afternoon slumps to that restless, foggy feeling after a poor night's sleep. But what if the answer to better emotional balance isn't in your coffee cup or social feed, but your protein diet?

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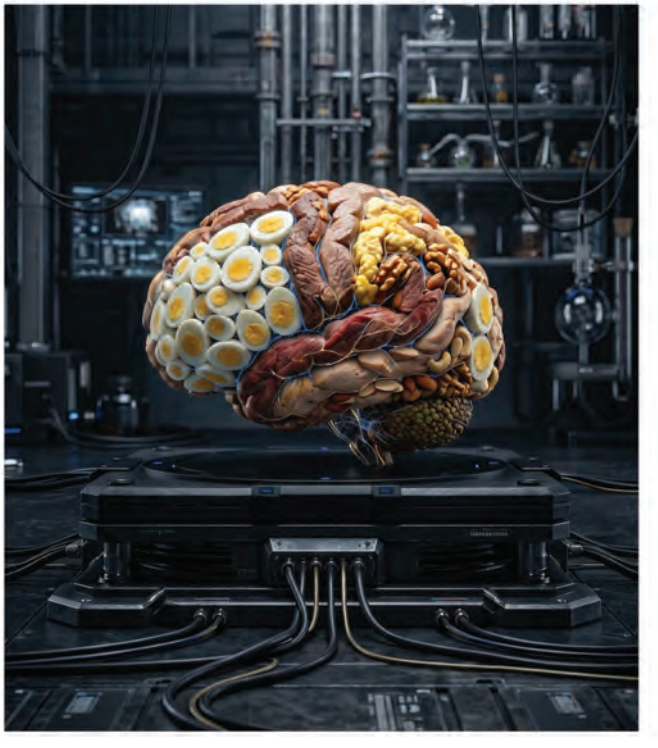
The Protein Connection: How Amino Acids Lift Your Mood

Proteins are made up of amino acids, some of which are essential building blocks for brain chemicals that regulate your mood:

Tryptophan is a precursor to serotonin, the neurotransmitter responsible for feelings of wellbeing and emotional calm.

Tyrosine helps produce dopamine and norepinephrine, which are tied to motivation, focus, and alertness.



Without enough of these amino acids, your brain can't synthesise these "feel-good" chemicals efficiently. And here's the catch—your body can't store or produce all amino acids on its own. You have to get them from what you eat.

That's where complete protein sources, like chicken & eggs come in. They deliver all the essential amino acids your brain and body need to function at their best.

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The World Happiest Country rankings and their Daily Protein Consumption

Sr. No	Countries	Happiness Score	Daily Protein Consumption per capita
01	Finland	7.7	123 g
02	Iceland	7.5	151 g
03	Denmark	7.5	113 g
04	Costa Rica	7.4	75 g
05	Sweden	7.3	70 g

Emotional well-being is a fundamental pillar of our overall health, directly affecting our quality of life, daily choices, and eating habits. Often, our psychological state influences the way we eat, while at the same time, our diet has the power to shape our mood.

Understanding this interaction can help us adopt healthy habits that promote both physical and mental balance.

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PFI Engages Haryana Government to Advance Poultry Sector Reforms

A delegation from the Poultry Federation of India (PFI), led by President Ranpal Dhanda, held a series of high-level meetings with the Government of Haryana to discuss policy reforms aimed at strengthening the state's poultry sector. The delegation met Shri Mahipal Dhanda, Hon'ble Education Minister, Government of Haryana, along with senior government officials, to address key issues affecting poultry farmers and promote a more progressive, industry-friendly regulatory environment.

Among the major discussions was a meeting with Vinay Pratap Singh, IAS, Commissioner, on revisiting certain Pollution Control Board guidelines that do not reflect the practical realities of poultry farming. The delegation also met Shri Vedpal, Chairman, Market Committee, and urged the abolition of the 1% market fee on maize and bajra imported from other states, as well as the 2% market fee on eggs and spent layer birds. PFI emphasised that

these measures would lower production costs, improve farmer competitiveness and encourage investment and employment across the poultry value chain.

The Federation welcomed the positive response from the Minister and senior officials, expressing confidence that continued government-industry collaboration will enhance ease of doing business, improve farmer livelihoods and support the sustainable growth of Haryana's poultry sector.

NATIONAL

CLFMA of India and PDFA Unite Dairy Farmers and Feed Industry to Promote Sustainable Livestock Nutrition

The Compound Livestock Feed Manufacturers Association (CLFMA) of India, in collaboration with the Progressive Dairy Farmers Association (PDFA), organised a Dairy Farmers Meet in Ludhiana to promote scientific dairy farming, sustainable livestock nutrition and stronger industry-farmer collaboration. The event brought together dairy farmers, veterinarians, academicians, researchers and feed industry leaders to exchange practical knowledge and discuss emerging opportunities for the sector.

The morning session at Guru Angad Dev Veterinary & Animal Sciences University (GADVASU) focused on improving herd health, productivity and farm profitability through science-based nutrition and management. Experts highlighted transition cow management, dry cow nutrition, metabolic health and modern dairy production practices. Inaugurating the programme, CLFMA Chairman Divya Kumar Gulati emphasised the importance of scientific feeding, continuous farmer education and industry-academia partnerships.

The evening session at a city hotel centred on feed manufacturing, ingredient innovation and market trends. Technical presentations covered the use of DDGS as an alternative feed ingredient and developments in oils and oilcakes, followed by a panel discussion on feed industry challenges, including raw material availability, feed affordability, quality standards and emerging technologies. The event concluded with networking sessions that reinforced collaboration across the dairy and livestock value chain to drive sustainable growth and improved farmer livelihoods.

IPR Espresso

Egg Prices Surge to Record High in Odisha as Chicken Mortality Squeezes Supply

The surge comes amid a sharp increase in exports of Indian eggs, particularly to Gulf, African and other Asian markets, where demand has strengthened amid the ongoing strife.

Egg prices in the state have hit an all-time high of Rs 9 a piece, fuelled by strong domestic and export demand and supply disruptions due to heat-induced chicken mortality this summer.

Traders said they are procuring eggs from poultry farms at around Rs 7.15 to Rs 7.20 a piece while wholesale prices have risen to Rs 8.5 per egg, translating to Rs 255-Rs 260 per tray of 30. The retail price, which was Rs 7 per egg till end of June, has now climbed to Rs 9.

Poultry farmers blamed price hike of maize and soybean meal, aggravated by the ongoing West Asia conflict and ethanol demand along with unprecedented mortality of chicken during this summer for lower egg production.

The reopening of schools has further boosted consumption. The state now supplies eggs three times a week, on Mondays, Wednesdays and Fridays, to more than 57 lakh students under the supplementary nutrition component of the PM POSHAN (mid-day meal) scheme. Since 1st April, 2025, students of Classes IX and X have also been brought under the programme, expanding institutional demand.

Fisheries and Animal Resources Development Minister Gokulananda Mallik said the price rise was the result of multiple demand and supply factors. "The demand for eggs has increased significantly within Odisha and outside the state. Production was affected due to the large-scale death of poultry birds in the harsh summer this year, leading to availability crunch," he said.

Egg exports to foreign countries have also increased recently, adding pressure on the supply chain. The government is now focusing on increasing egg production capacity to meet the rising demand, Mallik said.

He announced an additional Rs 10 crore subsidy for the poultry sector to expand production capacity and stabilise prices over the medium term. The average production of eggs in the state is around 1.20 crore per day while the daily demand is about 1.40 crore leaving a gap of 20 lakh.

Meanwhile, food inflation has broadened be-yond eggs. Prices of almost all vegetables, except potatoes, have risen by Rs 15-Rs 20 per kg over the past fortnight following incessant rainfall that has damaged crops in several parts of the state and disrupted supply.

Indian Egg Prices Crack New Record As Heat, Feed Costs Bite

Egg prices have climbed to an all-time high in Namakkal, India's largest egg-producing hub, as a prolonged summer, lower production and soaring feed costs tighten supplies. This comes amid robust demand.

Industry stakeholders say the supply-demand mismatch could keep prices elevated in the coming weeks, while warning that shortages of key poultry feed ingredients such as soybean meal and maize pose a longer-term challenge.

The National Egg Coordination Committee (NECC) revised the farm-gate procurement price to a record Rs. 6.65 per egg on 13th July, surpassing the previous high of Rs. 6.40 recorded on 23rd December last year. Since 16th July, NECC has maintained the procurement price at Rs. 6.80 in Namakkal. Eggs are retailing at up to Rs. 8 apiece in many markets and Rs. 8.50-9 in parts of Kerala.

Up to 1 Lakh Poultry Shops to Remain Shut in Tamil Nadu as Chicken Sales Suspended

Chicken supply in Tamil Nadu and Puducherry is likely to take a hit as a federation of poultry traders' associations announced an indefinite suspension of broiler sales across Tamil Nadu and Puducherry from 31st July, protesting a certain feeding practice followed by poultry producers.

The Tamil Nadu Poultry Traders Federation formally passed a resolution to this effect during an emergency consultative meeting held here on recently.

Federation State President Durairaj stated that poultry farmers have refused to implement feed-control regulations, causing significant financial loss and hygiene issues for both consumers and vendors.

The primary grievance of the traders is that poultry producers are feeding birds right up to the time they are dispatched to the market in order to artificially inflate their weight. As a result, between 100 and 200 grams of undigested feed and water remain in the chicken's stomach at the time of purchase, traders claim.

"When the chicken is butchered and cleaned, this undigested feed and waste spill over, contaminating the meat," Durairaj alleged. They also pointed out that consumers are being unfairly forced to pay meat prices for the weight of this undigested feed.

To resolve the issue, the federation has demanded that producers withhold feed for at least 15 hours before dispatching the birds for sale. Furthermore, traders have urged the state government and the animal husbandry department to urgently intervene and enforce standard operating procedures (SOPs) on poultry-rearing and feed practices.

The federation also acknowledged the severe disruption this will cause, noting that restaurants and the general public will be significantly affected. Apologising for the inconvenience, the federation maintained that they have no other alternative but to call for the shutdown to ensure hygienic practices.

Due to the strike, an estimated 60,000 to 1,00,000 retail poultry shops are expected to remain shut. The protest has also received solidarity and support from allied traders' associations in neighbouring Kerala.

27th World Poultry Congress 2026 Concludes on a High Note

The 27th World Poultry Congress (WPC 2026), organised by the World's Poultry Science Association (WPSA), was held at the Metro Toronto Convention Centre, Canada, from 13th to 17th July 2026. Recognised as the world's foremost poultry science event, the congress brought together delegates from over 55 countries, including scientists, veterinarians, researchers, academicians, industry leaders, policymakers and students. The comprehensive scientific programme explored key issues such as genetics, nutrition, disease prevention, animal welfare, sustainability, precision farming, poultry processing and global food security. Through technical sessions, poster presentations and a vibrant exhibition, WPC 2026 showcased the latest research and innovations while fostering international collaboration. The

congress reinforced the importance of science-driven solutions to address emerging challenges in poultry production, including climate resilience and disease management. It also provided invaluable networking opportunities with global experts and industry stakeholders. As WPC 2026 concluded successfully, the global poultry community now looks forward to the 28th World Poultry Congress in Tokyo, Japan, in July 2030.

Brazil Bans Foie Gras Production and Sales under New Law

Brazil's President Luiz Inacio Lula da Silva recently signed a law to ban the sale and production of the French delicacy foie gras in the South American country, citing animal cruelty.

France considers foie gras — traditionally made from fattened duck and goose livers — part of its culinary heritage, but animal rights activists have condemned the practice of force-feeding ducks or geese to enlarge their livers.

U.S.-based advocacy group Pro-Animal Future commended the new law, saying it would make Brazil the first country in Latin America to ban foie gras production and sales.

Globally, 20 countries have banned foie gras production, while India and China have banned importing the delicacy. China has, however, a foie gras industry that rivals France's.

"It's amazing that this covers both sale and production because (Brazil) is taking a very hard stance against a cruel industry," said Natalie Fulton, Pro-Animal Future's media and content lead.

Brazil's foie gras production is tiny. The ban on sales will effectively end imports of the luxury food from France.

When Brazil's lawmakers approved the ban in April, French diplomats stepped up pressure on Lula to veto the bill, according to a Brazilian diplomat who spoke on condition of anonymity.

"The argument was that their production does not involve animal cruelty, that it is a cultural issue, and so on," the Brazilian diplomat said. "But there was no chance of (a veto) … It was approved unanimously by Congress."

The French embassy in Brasilia and the France-Brazil Chamber of Commerce declined to comment.

France is in no position to make demands of Brazil, the Brazilian diplomat added, citing French obstruction to the approval of an EU-Mercosur trade agreement signed in January after 25 years of negotiations.

France saw that deal as an opportunity to increase foie gras exports to Brazil, the source said.

After Brazil's Congress approved the ban, French foie gras industry association CIFOG said in a statement on its website that the law would breach the EU-Mercosur deal.

While a European Union report published in 2022 found that foie gras production respected animal welfare rules, Brazilian animal rights activists have questioned those findings.

"What constitutes 'good treatment' can be pretty relative, right? I don't know what they mean by 'good treatment,' but for animal welfare organizations, there is no wellbeing involved," Marina Lacorte, food systems campaign manager at welfare group World Animal Protection, said of foie gras production.

INTERNATIONAL

South Korea Targets US Eggs under Government Import Scheme

South Korea's government is subsidising egg imports through a price stabilisation programme that reimburses private importers for air and sea freight and domestic repackaging costs, making imports commercially viable, according to the USDA Foreign Agricultural Service.

Under the programme, private importers must first win a competitive bidding process run by the Korea Agro-Fisheries and Food Trade Corporation before becoming eligible for reimbursement through the Agricultural and Fishery Products Price Stabilization Fund.

Korean importers are targeting US-origin eggs, citing ample US supply capacity and competitive prices. The USDA noted that table egg imports effectively only occur when government support is in place.

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IB Group Marks New Milestone

IB Group, one of India's leading integrated protein companies, recently commenced pre-operations at its state-of-the-art ABIS Chicken Processing Plant in Pugurupalli, Andhra Pradesh.

The facility was inaugurated by the Hon'ble Chief Minister of Andhra Pradesh, N. Chandrababu Naidu, who attended the programme as the Chief Guest. Describing the facility as a significant milestone for the state, the Chief Minister said the project would contribute to industrial development, attract investment and create employment opportunities.

As part of the programme, the Hon'ble Chief Minister handed over appointment letters to eight selected local youth, marking the beginning of new employment opportunities for the region's young workforce. The initiative reflects IB Group's commitment to promoting local employment and contributing to the economic development of the communities in which it operates.

The event was attended by Bahadur Ali, Managing Director, IB Group; Tanaz Aziz, Director – HR; and senior company officials, including Junaid Qazi, Project Head; Ajit Mani, HR Head; Saurabh Nagpal, Broiler Integration Head; and Prateek Kumar, Sales Head. Public representatives, industry stakeholders, poultry farmers and distinguished citizens were also present.

Addressing the gathering, Bahadur Ali said that the state-of-the-art processing facility has been developed with modern technology and in accordance with stringent quality standards and international food safety norms. The plant will have a processing capacity of 12,000 birds per hour.

He further stated that the project would provide fresh momentum to the poultry industry in Andhra Pradesh by creating better market opportunities for local farmers and generating significant employment. The facility is also expected to contribute to the state's industrial growth and strengthen the rural economy.

ABIS Pro, IB Group's traceable chicken brand, is committed to providing consumers with safe, high-quality and reliable protein products. The establishment of the ABIS chicken processing plant in Andhra Pradesh marks an important milestone in the company's growth journey, further strengthening IB Group's presence in South India and supporting the larger vision of building a stronger and more sustainable protein ecosystem in India.

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