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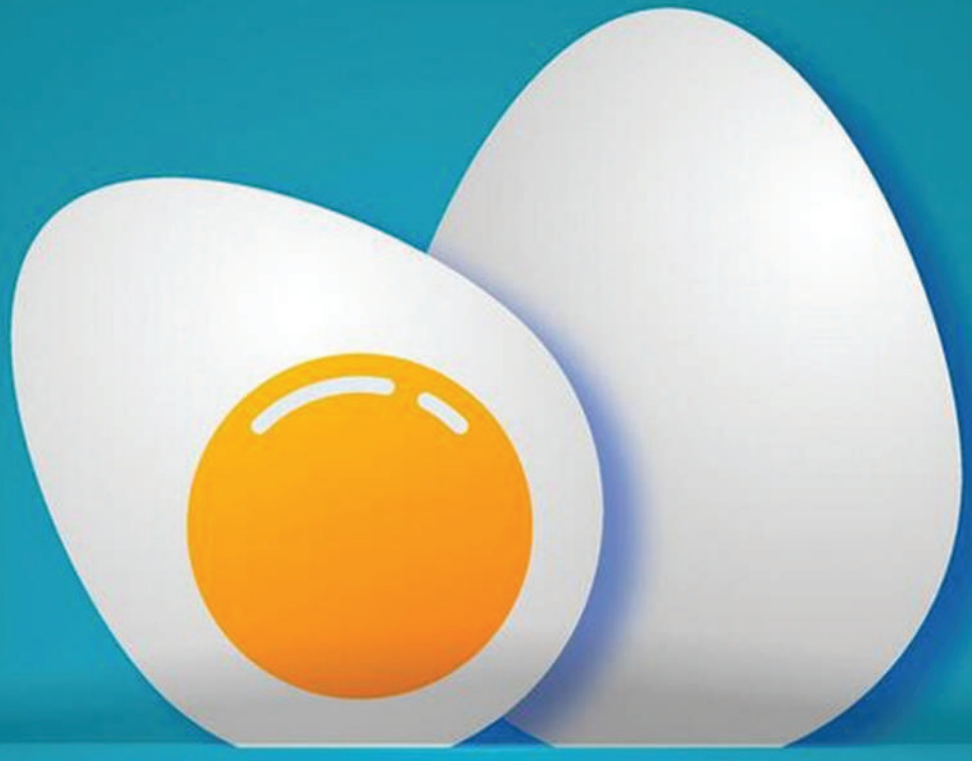
THE MAGAZINE OF INDIAN POULTRY INDUSTRY | MAY 2026



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Designed by Hushframe Ideas Pvt. Ltd.

Edited and Published by G.N. Ghosh from 57-B, Townshend Road, Kolkata-700025 and printed by G.N. Ghosh at Salmoli Publication, 57-B, Townshend Road, Kolkata - 700025

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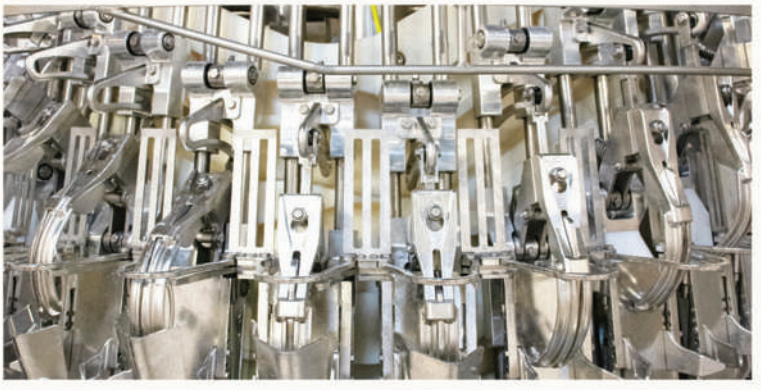

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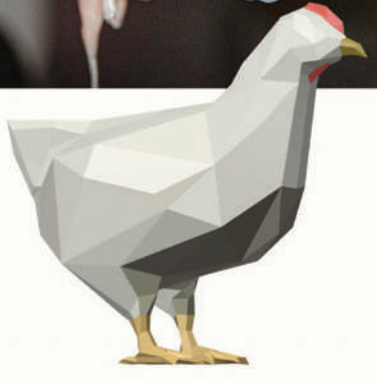

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HEATWAVES, EL NIÑO & INDIA'S PROTEIN FUTURE

G. N. Ghosh
Managing Editor

As India battles one of its harshest heatwaves in recent years, the poultry sector is confronting a challenge far larger than seasonal discomfort. Across several states, soaring temperatures have affected bird performance, feed consumption, egg production, hatchability, and farm economics. The situation becomes even more concerning in the backdrop of emerging El Niño conditions, which scientists associate with prolonged dry spells, weaker monsoons, and above-normal temperatures across South Asia.

Yet, this climate crisis is not merely a production story. It is also a nutrition story.

For decades, India's poultry sector has quietly powered one of the country's most important public health transformations — the scaling up of affordable protein through eggs. The humble egg has played a decisive role in reducing malnutrition, improving child growth, and supporting school enrolment across states.

This is precisely why climate resilience in poultry is now a national nutritional imperative. When heatwaves disrupt poultry production, the consequences extend beyond farms and markets. They affect the affordability and accessibility of one of India's most efficient protein sources. For millions of children dependent on egg-based mid-day meals and Anganwadi nutrition programmes, any disruption in supply or price escalation can directly impact nutritional outcomes.

The poultry industry must, therefore, prepare for a future where climate volatility becomes the norm. Investments in climate-smart housing, precision cooling, water conservation, renewable energy integration, and heat-resilient production systems are no longer optional. Equally critical is policy recognition that poultry is not just an agricultural commodity sector, but a cornerstone of India's protein security.

India produces over 138 billion eggs annually, yet the nation still consumes far below global nutritional recommendations. In a warming world shaped increasingly by El Niño-linked disruptions, safeguarding poultry production means safeguarding affordable nutrition itself. The challenge before the industry is, therefore, not only to adapt but to ensure that the egg continues to remain within reach of every Indian plate, even in the face of climate uncertainty.

Research Abroad

The Roslin Institute: AI Tool Supports Breeding for Bone Health in Chickens

Automated X-ray analysis could enable large-scale breeding for stronger bones and reduced fractures in egg-laying hens.

An Artificial Intelligence (AI) tool could help improve the welfare of chickens by predicting bone strength quickly and without the need for invasive testing, research has shown.

Researchers at the Roslin Institute have developed the automated tool that analyses X-ray images to estimate strength in leg bones, as an overall indication of skeletal health.

It offers an improvement on current methods, which are slow and labour-intensive, typically relying on manually analysing X-ray images or physically testing bones post-mortem from flock birds.

The tool is based on widely used AI systems adapted for this task, and can be implemented with standard computing infrastructure, making it accessible for use in breeding programs.

Researchers sought to assess the issue of bone damage, particularly in laying hens. Fractures can occur as a result of the physical demands of egg production and movement in housing systems, highlighting skeletal health as a key welfare priority.

The AI model works by identifying the chicken's tibia bone from an X-ray image. It then analyses patterns in the image to predict how strong the bone is likely to be.

Developed using more than 900 X-ray images, the tool showed a strong correlation with bone strength measured using standard manual tests. It also outperformed manual scoring of X-rays, while requiring far less time and labour.

Because the method uses image data alone, predictions can be generated quickly once the system is trained, potentially enabling large-scale assessment of bone strength.

While the current study used post-mortem samples, the team aims to apply the method to images from live birds in future, which would further increase its practical value.

Researchers found that the measurements taken by the AI tool closely matched the underlying genetics of bone strength, meaning the tool could be used to identify birds or family lines with stronger bones and guide breeding decisions.

The poultry breeding industry relies on assessing large numbers of birds to guide selection decisions, but practical limitations mean some important traits are difficult to measure routinely.

By providing a rapid, non-invasive and scalable way to assess bone strength, the tool could help address this gap and support efforts to reduce fractures in commercial flocks.

This research was published in Poultry Science, in collaboration with commercial partners Lohmann Breeders, Germany. The work was supported by the Roslin Foundation and the Foundation for Food and Agricultural Research Grant.

Campylobacter Survival In Poultry Litter

Campylobacter is a major food-borne pathogen commonly associated with poultry production environments, where litter can serve as a persistent source of contamination for birds. This study evaluated the survival of Campylobacter jejuni in poultry litter under varying moisture and temperature conditions. Litter samples (≤8% moisture) were adjusted to three moisture levels (15%, 20%, and 30%) and held at three temperatures: 4°C (39°F), 42°C (107°F) and 50°C (122°F). The study design had a total of nine treatments based on moisture-temperature combinations.

A ciprofloxacin-resistant C. jejuni marker strain was inoculated into 300 grams of poultry litter for each treatment to achieve an initial concentration of 8 log CFU/g for a bench-top study. Following inoculation, poultry litter was held under microaerobic conditions using 2-gal ziptop bags at different temperature/moisture conditions. For each treatment, 10 grams of litter was sampled three times at 8 hours, 16 hours, 24 hours, 36 hours, and 48 hours. Samples were enumerated on Campy Cefex agar after incubation at 42°C (107°F) for 48 hours under microaerobic conditions.

The results showed that Campylobacter survived only in the samples stored at 4°C (39°F) for 8, 16, and 24 hours, regardless of moisture content. However, at 36 and 48 hours, counts were below the limit of detection (<CFU/g). Campylobacter was not detected at any other temperature or time point. Since Campylobacter was not recovered from any samples stored at 42°C (107°F) or 50°C (122°F), these treatments were excluded from statistical modelling, and a generalised linear model was applied to assess differences among the 4°C (39°F) samples only. It was found that for each 1% increase in moisture at 4°C (39°F), Campylobacter were 1.005 (0.96 - 1.046; 95% CL) times as likely to be detected in litter (p=0.80).

These findings demonstrate that Campylobacter experiences rapid die-off in litter under all tested conditions, especially at elevated temperatures. Overall, the study highlights how quickly Campylobacter loses viability in litter, underscoring its limited ability to survive in the environment out-side the host. Findings from this work provide insights into pathogen persistence under diverse on-farm conditions and may support improved litter management strategies to reduce Campylobacter prevalence in poultry production systems.

(Excerpts of a presentation by Kassim Sulleyman and colleagues at Auburn University, US, during the 2026 International Poultry Scientific Forum)

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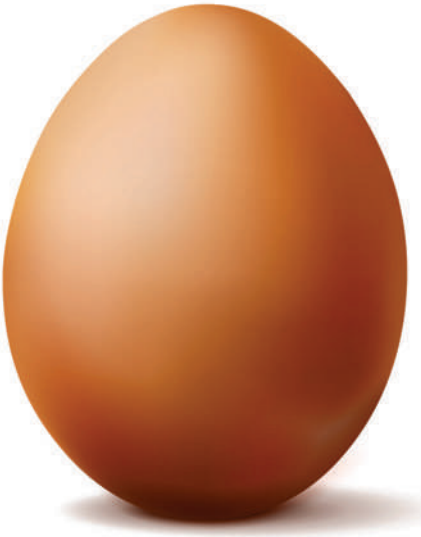

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Indian Research

Effect of Aloe Vera (Aloe barbadensis) Supplementation on The Performance of Chicken Layers

D.C. Yadav*, S.K. Chhikara, D.S. Bidhan, Vishal Sharma, Sandeep, Man Singh and Narender Singh

Lala Lajpat Rai University of Veterinary & Animal Sciences, Haryana
Email: dipinchander@luvas.edu.in

Present investigation was undertaken to study the effect of aloe vera supplementation on production performance, egg quality, gut morphology, haemato-biochemical parameters, nutrient digestibility, and expression of genes and cost of production in the chicken layers. For this study a total of two hundred and twenty-five chicken layers of twenty-two weeks of age were randomly divided in to five dietary treatment groups consisting of three replications having fifteen birds in each replication i.e. T0 (basal diet without antibiotics- negative control group), T1 (basal diet with antibiotic- control group), T2 (1 % aloe vera), T3 (2 % aloe vera) and T4 (3 % aloe vera). The entire duration of study was divided into ten periods of fourteen days each. Egg production was recorded daily and thereafter egg weights and feed consumption at the end of each fortnight and cumulatively (1 to 10 periods) were taken to determine the percent hen day egg production, egg weight, egg mass production, feed conversion ratio and egg quality parameters. There was non-significant effect of dietary supplementation of aloe vera on body weight of layers observed at four-week intervals in comparison to the control (with antibiotic) and negative control (without antibiotic) groups, respectively throughout the twenty weeks experimental period. There was significant ($P<0.05$) difference in the average feed consumption (g/hen/day) values on supplementation of aloe vera in the diet of layers. There was no significant ($P<0.05$) difference in hen day and hen housed egg production in groups fed different dietary levels of aloe vera as compared to antibiotic (control) group. Aloe vera at the inclusion level of 1% can efficiently be utilised in the diet of layers as a replacement to antibiotics in order to avoid harmful effects associated with use of antibiotics in the diet of layers. The feed conversion ratio in terms of feed intake (kg) per dozens of egg production was significantly ($P<0.05$) lower in the control and 1% aloe vera supplemented groups as compared to the negative control group. Thus, 1% aloe vera supplementation has positive effect on feed conversion efficiency in laying hens. The dietary inclusion of aloe vera reported a trend of improvement in villi height, villi width and crypt depth in duodenum, jejunum and ileum portions of gastro-intestinal tract of layers. From the results of the present investigation, it can be concluded that the dietary supplementation of aloe vera in the layers has significant effect on feed intake, egg weight, egg mass production, improved feed conversion ratio, egg shape index, Haugh unit, prominent positive effect on egg quality in terms of egg yolk cholesterol, HDL and LDL, better gut morphology and immune system of layers. The cost of feeding incurred per dozens of egg production on dietary supplementation of aloe vera is negligible keeping in consideration the benefits associated with this. Thus, based on the present findings, it can be recommended that 1% aloe vera can be supplemented in the diet of layers as a replacement to antibiotics.

Indel Polymorphism of Prolactin Gene in Indegenous Siruvidai, Peruvidai, Kadaknath And Exotic Rhode Island Red Breeds

A Prasanth*, Pachipala Radha Satya, Sagar, D., Gandhimathi, B., Vasanthi and R. Richard Churchil

Department of Poultry Science, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu
Email: aprasanth77@gmail.com

Siruvidai and Peruvidai are the indigenous chicken ecotypes of Tamil Nadu and Kadaknath is a recognised Indian breed from Madhya Pradesh. The indigenous breeds are known for broodiness character involving prolactin hormone. The promotor region of prolactin (PRL) gene in chicken is reported to have a 24 bp indel polymorphism at varying allelic frequencies among the breeds.

A study was conducted to determine the frequency of indel polymorphic alleles in three indigenous breeds namely, Siruvidai, Peruvidai and Kadaknath in comparison with Rhode Island Red, an exotic breed of American class. Thirty blood samples were collected from the four breeds/ ecotypes and the DNA was extracted using standard protocol. The blood samples of Siruvidai were collected from Ariyalur district and that of Peruvidai from Dindigul district of Tamil Nadu, the home tracts of the respective ecotypes. The blood samples of Kadaknath and RIR were collected from the Poultry Research Station, TANUVAS. The 130/154 bp indel polymorphic region of promotor region of prolactin hormone was amplified by polymerase chain reaction (PCR) and the genotyping was carried out by agarose gel electrophoresis. The genotype frequency of DD, ID and II observed in Siruvidai and Peruvidai ecotypes of Tamil Nadu were 0.37, 0.40 & 0.23 and 0.67, 0.23 &0.10 respectively. The corresponding values for Kadaknath was 0.53, 0.37 & 0.10 respectively and that of RIR was 0.87, 0.13, and 0.00 respectively. The frequency of 'D' and 'I' alleles were 0.57 and 0.43 respectively in Siruvidai, 0.78 and 0.22 respectively in Peruvidai, 0.72 and 0.28 respectively in Kadaknath and 0.93 and 0.07 in RIR. The Chisquare analysis revealed that the gene and genotype frequencies of Prolactin indel polymorphic alleles were in Hardy Weinberg Equilibrium in Siruvidai, Kadaknath and RIR; whereas, these frequencies deviated from Hardy Weinberg Equilibrium in Peruvidai chicken.

The study revealed that the frequency of 'D' allele, which is responsible for the broodiness character was higher in indigenous breeds/ ecotypes. The extremely high frequency of 'D' allele in RIR could be due to the breeding history of intense closed flock inbreeding of the flock for many generations.

Source: 39th Annual Conference & Symposium of IPSACON 2024

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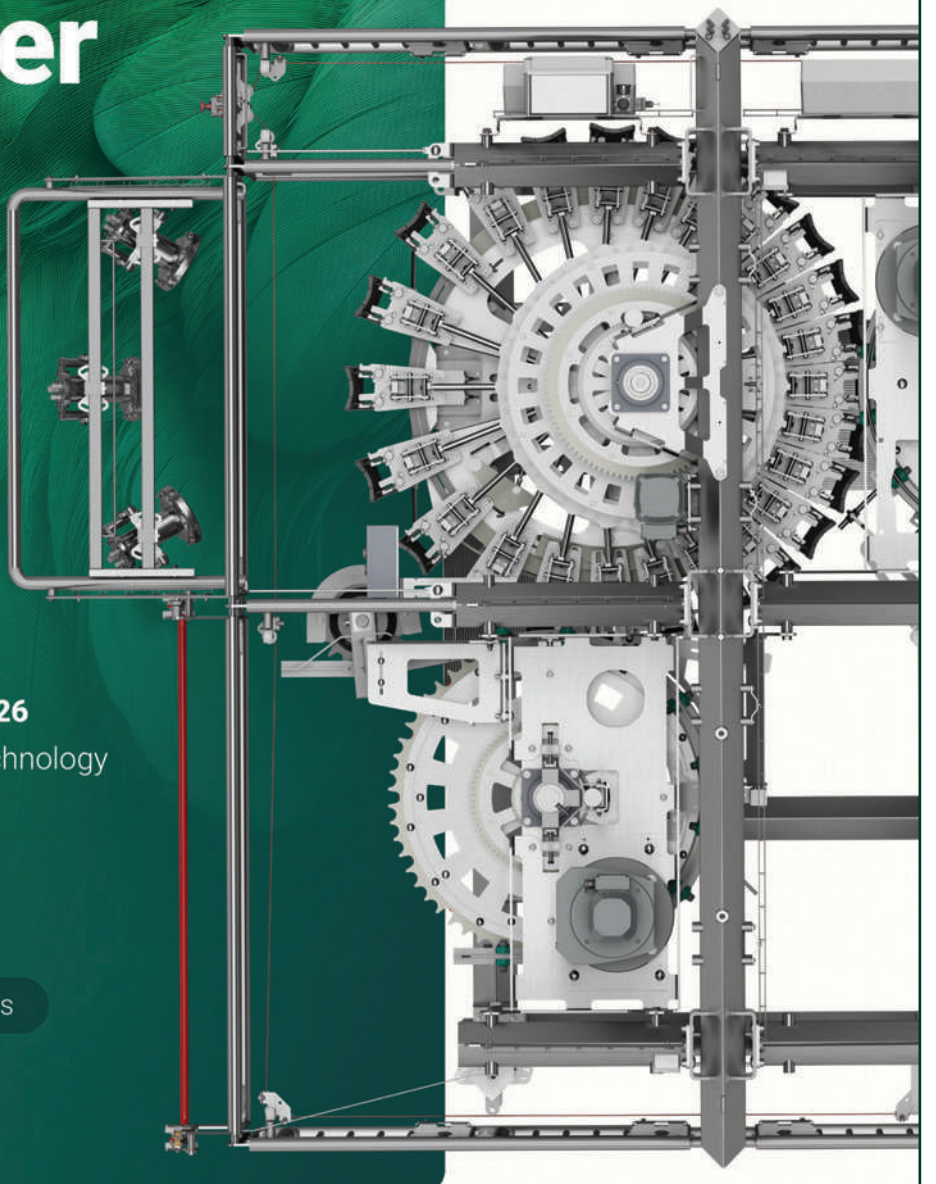

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Article

A Century Old Ranikhet Disease (RD) Still a Nightmare in Poultry

Prof. R. N. Sreenivas Gowda
Former and Founder VC, KVAFSU, Bidar,
Former Director, IAH & VB, Bangalore,
Former Prof & HOD,
Dept. of Pathology, Veterinary College UAS, Bangalore

Introduction

Newcastle disease (ND), often referred to in India as Ranikhet disease, remains a catastrophic threat to the poultry industry due to its high mortality rates (up to 100% in unvaccinated flocks) and its ability to infect both commercial and backyard poultry. It is caused by virulent strains of Avian Paramyxovirus Type-1 (APMV-1), which attack the respiratory, digestive, and nervous systems. This poultry disease is having one hundred years history in Asian countries including India (1926-2026), Ranikhet Disease (RD)named after Ranikhet, a place in Himachal range-Uttarakhand, Almora district of North India, where it was first reported in 1926.

The Indian Veterinary Research Institute (IVRI) played a key role in studying the disease and developing a vaccine. It was simultaneously identified in Java, Indonesia (Kraneveld, 1926), then shortly after it was identified in Newcastle-upon-Tyne, England, in 1926 (Doyle, 1927). Since then it is known as Newcastle Disease (ND) globally. With all research and development of preventive vaccines available even today, it is a nightmare in this country.

Origin and Name

1. **Initial outbreak:** The disease was first identified in India in 1926 in Ranikhet, Uttarakhand, in the Himachal area, in the northern part of the country. This is where the name "Ranikhet disease" comes from, and it is still widely known by this name in India
2. **Worldwide discovery:** At the time of the Ranikhet outbreak, similar cases were simultaneously being identified in other parts of the world. The first documented outbreak occurred in Java, Indonesia, in 1926, followed by another in Newcastle-upon-Tyne, England, in 1927. This gave rise to the international name "Newcastle disease"
3. **A global spread:** The virus was likely transported via shipping from Southeast Asia to different parts of the world, leading to a rapid global spread
4. Despite being a century-old problem, Ranikhet disease continues to cause significant economic losses for India's poultry farmers through high mortality rates and decreased egg production
5. **Endemic status:** The disease is considered endemic in India, meaning it is constantly present within the poultry population. This results in recurring in several poultry growing areas od our country

Why the Disease Remains a Threat in India?

1. **Endemic infection:** Ranikhet disease is endemic throughout India, with frequent outbreaks in states like Uttar Pradesh, Maharashtra, West Bengal, and Tamil Nadu
2. **Backyard poultry vulnerability:** Backyard poultry farms are particularly susceptible due to a lack of proper vaccination and biosecurity measures, leading to a constant circulation of the virus
3. **Vaccine challenges:** Despite routine vaccination in commercial poultry, outbreaks still occur. Research shows that conventional vaccines (like Genotype-II strains) may not provide sufficient protection against new, evolving, and more virulent genotypes of the virus, such as Genotype-XIII
4. **Uncontrolled outbreaks:** Recent outbreaks highlight the ongoing challenges. For example, severe outbreaks were reported in Haryana and other regions in early 2025, leading to thousands of poultry deaths. Factors contributing to these outbreaks include new virulent strains, poor biosecurity, and cold weather
5. **High-density farming:** In commercial operations, high bird densities can accelerate the airborne transmission of the virus between flocks
6. **Circulating genotypes:** Studies show that different genotypes of the virus are circulating in India. Some studies have revealed the persistence of older genotypes, such as Genotype IV, which were thought to have died out decades ago. Other studies have identified newer virulent genotypes that may evade existing vaccines, contributing to outbreaks
7. **Biosecurity issues:** Poor biosecurity measures, such as lapses in sanitation, can lead to the spread of the virus in different states

Aetiology

Caused by avian paramixovirus type I (APMV-1), which belongs to the family Paramyxoviridae of the genus Avulavirus, sub-family Paramyxovirinae, family Paramyxoviridae, a highly contagious viral disease.

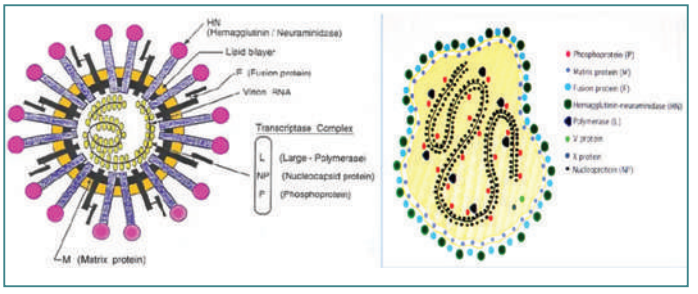

Fig. 1: Structure of ND virus

The enveloped virus has a negative sense single-stranded genome of approximately 15 kb which codes for six proteins including an RNA directed RNA polymerase (L), hemagglutinin ± neuraminidase (HN) protein, fusion (F) protein, matrix (M) protein, phosphoprotein (P) and nucleoprotein (N). Transcription occurs in the 3' to 5' direction with decreasing amounts of protein resulting with each subsequent gene (Fig. 1). Replication of a positive sense intermediate genome also is synthesised by the NDV polymerase. Cleavage of a precursor F0 to the F1 and F2 products is necessary for viral spread to other cells. The F and HN surface glycoproteins are the principal antigens that elicit a protective immune response (Fig:1).

Pathotypes

The Incubation period is 4-6 days and the clinical signs appear in birds infected with NDV vary widely and are dependent on factors such as: the virus, the host species, age of host, infection with other organisms, environmental stress and immune status. In some circumstances infection with the extremely virulent viruses may result in sudden, high mortality with comparatively few clinical signs. This has resulted in the grouping of viruses into five "pathotypes" on the basis of the predominant signs in affected chickens (Beard and Hanson, 1984):

1) **Viscerotropic velogenic:** Viruses responsible for disease characterised by acute lethal infections, usually with haemorrhagic lesions in the intestines of dead birds
2) **Neurotropic velogenic:** Viruses causing disease characterised by high mortality which follows respiratory and neurological disease, but where gut lesions are usually absent
3) **Mesogenic:** Viruses causing clinical signs consisting of respiratory and neurological signs, with low mortality
4) **Lentogenic:** Viruses causing mild infections of the respiratory tract
5) **Asymptomatic enteric:** Viruses causing avirulent infections in which replication appears to be primarily in the gut

This virus classified into three pathotypes based on their virulence: lentogenic strains (less virulent), mesogenic strains (moderately virulent), and velogenic strains (more virulent) (Fig. 2). Velogenic strains can be divided into a neurotropic form, associated with neurological and respiratory signs and a viscerotropic form related to intestinal lesions.

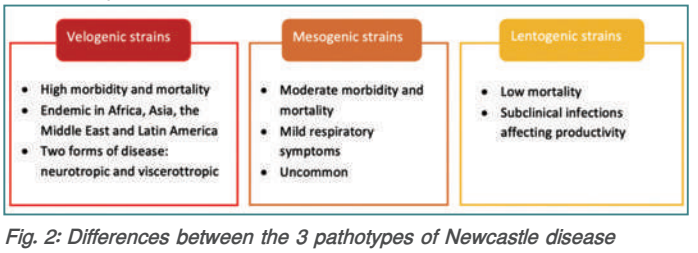

Fig. 2: Differences between the 3 pathotypes of Newcastle disease

The virulence of an NDV strain is crucial in determining its pathogenicity in poultry. This includes its preference for specific tissues or organs, its ability to evade the host's immune system, and how efficiently it replicates within the host.

Velogenic Viscerotropic Newcastle Disease (VVND) is the most severe form of Newcastle Disease, a highly contagious and often fatal viral infection in poultry. It is characterised by lesions in the gastrointestinal tract and high mortality rates, with symptoms including respiratory distress, depression, and paralysis.

Exotic Newcastle Disease (END), a highly contagious and often fatal viral disease that can affect all bird species, not just chickens. END is caused by a very virulent strain of the Newcastle disease virus, which affects the respiratory, nervous, and digestive systems, causing signs like head tremors, paralysis, gasping, diarrhea, and sudden death, potentially leading to near 100% mortality in unvaccinated birds and is a serious threat to the poultry industry.

Why is It Difficult to Control ND?

Rapid mutation and evolving genotypes: As an RNA virus, the Newcastle disease virus (NDV) is constantly evolving, leading to genetic and antigenic variations that affect the efficacy of vaccines. Many widely used vaccines are based on older strains (genotypes I and II), which are genetically and antigenically distant from the new strains (e.g., genotypes V, VI, and VII) now dominant in different parts of the world.

The Geographical Distribution of Newcastle Disease

Virus: Newcastle disease (ND) is a worldwide problem with severe economic implications, affecting chickens, turkeys. .and other birds.

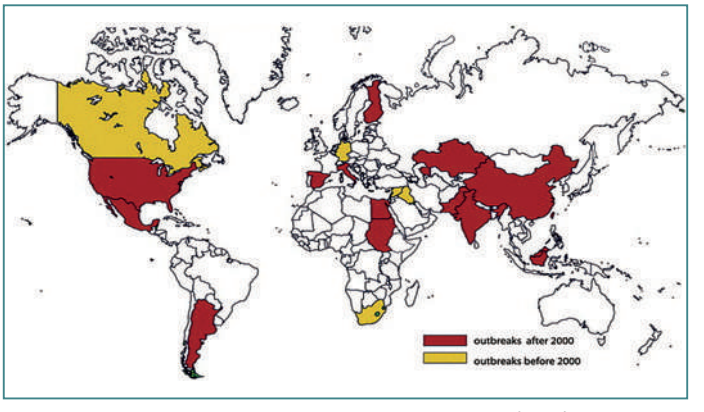

Fig. 3: The global scenario of Newcastle disease virus (NDV) outbreaks in different parts of the world. (Source: google images)

The spread of the disease varies depending on the strains. Velogenic strains are endemic in Africa, Asia, the Middle East and Latin America where they cause severe economic losses.

In Europe, Newcastle disease is a notifiable disease. Large-scale vaccination is used as a prevention measure in most European countries except Sweden, Finland and Estonia, countries considered disease-free. The most common strains of the Newcastle virus in Europe are La -Sota and B1 strains.

Although a large number of preventive measures are carried out, wild birds are a reservoir of the disease that allows the emergence of new outbreaks. In the last year, cases of Newcastle disease have been identified in Russia, Belgium, Romania and Turkey.

The most common genotypes in the Middle East of the Newcastle disease virus are VI and VII and have been described in various countries including, Israel, United Arab Emirates, Iraq, Jordan, Egypt, Lebanon and Saudi Arabia. In these countries there is a great tradition of breeding birds of prey, such as falcons, where the presence of the disease has also been

described. These birds are a reservoir of the disease.
Specs affected: APMV-1 affects all types of birds, with poultry being the most susceptible to this disease. NDV isolates from pigeons are more virulent in pigeons than chickens

Transmission and spread: The virus is present in high concentrations in the bodily discharges of infected birds, such as faeces, and secretions from the nose, mouth, and eyes. The virus is transmitted directly by inhalation or ingestion, from the respiratory secretions and faeces of infected animals. Fomites are also a source of infection, although the persistence of the virus depends on environmental conditions. The APMV-1 persists for long periods of time in the faeces, as well as in the eggshell.

Transmission Occurs Primarily Through

1. Direct contact with infected birds
2. Contaminated materials and equipment, including feed, water, clothing, and vehicles
3. Mechanical vectors, such as flies, rodents, or people carrying the virus on their shoes and clothes

The virus can survive for weeks in a warm, humid environment, and indefinitely in frozen material, but it is destroyed by dehydration and sunlight.

Clinical Manifestations

The clinical presentation of NDV infection can range from acute to subacute or chronic, with later onset symptoms affecting the respiratory, digestive, and nervous systems. Morbidity and mortality depend on virulence of the virus strain, degree of vaccinal immunity, environmental conditions, and condition of the flock. However, the most clinical signs are: respiratory, digestive, and nervous systems in birds.

1. Respiratory Symptoms

- Coughing, sneezing, nasal discharge
- Labored breathing and wheezing

2. Digestive Symptoms

- Greenish diarrhoea
- Loss of appetite and weight loss

Fig. 4: Lethargy and greenish white diarrhoea

3. Nervous Symptoms

- Twisting of the neck (torticollis)
- Paralysis of wings and legs

Fig. 5: Twisting of neck and paralysis of wings

- Tremors and incoordination

4. Other Symptoms

- Drop in egg production in laying hens
- Soft-shelled or misshapen eggs
- Sudden high mortality rate (up to 100% in severe cases)

Fig. 6: Thin shelled and broken eggs

Gross Lesions

APMV-1 affects various lymphoid tissues, especially Peyer´s patches and caecal tonsils, and immune organs such as thymus or spleen, decreasing the immune response of chicken.
Lesions that may be found in postmortem are:

- Oedema of the interstitial or peritracheal tissue of the neck, especially near the thoracic inlet
- Congestion and sometimes haemorrhage on tracheal mucosa
- Petechiae and small ecchymoses on the mucosa of the proventriculus, concentrated around the orifices of the mucous glands
- Oedema, haemorrhages, necrosis or ulcerations of lymphoid tissue in the intestinal wall mucosa
- Streaks of haemorrhages in cloaca
- Oedema, haemorrhages or degeneration of ovaries

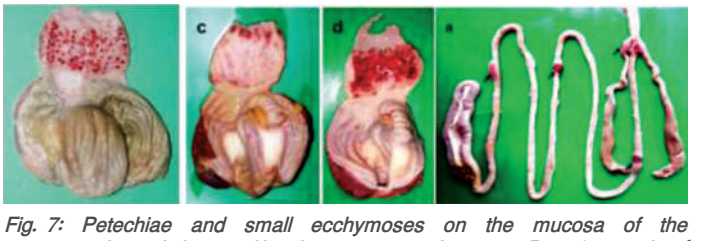

Fig. 7: Petechiae and small ecchymoses on the mucosa of the proventriculusand button like haemorragic ulcers in Payer's patches(Source: Google image)

Diagnosis of ND

- ND is diagnosed in chickens by a combination of clinical signs, lesions, and laboratory confirmation. Key signs include respiratory issues like gasping, neurological symptoms such as head twisting (torticollis) or paralysis, greenish-white, diarrhea and reduced or misshapen egg production
- Definitive diagnosis requires laboratory confirmation, typically through virus isolation and identification via RT-PCR or virus neutralisation tests, to distinguish it from other poultry diseases

Laboratory Diagnostics

A definitive diagnosis requires laboratory testing to identify the Newcastle Disease Virus (NDV)

- **Virus Isolation:** Inoculating swabs or tissue samples into the allantoic cavity of embryonated chicken eggs
- **Molecular Techniques:** Detecting viral RNA using RT-PCR to

confirm the presence of NDV and determine its virulence and genotype

- **Serological Tests:** Hemagglutination inhibition (HI) tests can detect NDV-specific antibodies
- **Intracerebral Pathogenicity Index (ICPI):** A test performed in day-old chicks to assess the virulence of NDV strains

Differential Diagnosis

Because its signs mimic other diseases, Newcastle disease must be differentiated from other poultry illnesses, including:

- Highly pathogenic avian influenza
- Infectious bronchitis
- Infectious laryngotracheitis
- Avian metapneumovirus
- Infectious coryza
- Fowl cholera
- Mycoplasmos

Prevention and Control

It is difficult to control Newcastle disease (ND) in poultry due to the virus's high contagiousness, its ability to constantly mutate, the limited efficacy of conventional vaccines against modern strains, the existence of subclinically infected carrier birds, and challenges in implementing consistent biosecurity measures.

Due to the high risk and economic consequences, countries free of exotic ND have strict regulations to prevent its introduction.

Eradication Efforts Typically Involve

- **Culling:** Rapid destruction of all infected and exposed birds
- **Quarantine:** Imposing strict isolation measures on infected flocks and premises
- **Biosecurity:** Enforcing stringent biosecurity practices, such as restricting vehicle and personnel traffic and disinfecting all equipment especially egg trays from market
- **Surveillance:** Conducting active monitoring to detect any new cases

Prophylactic Vaccinations

- Vaccines for Newcastle disease in poultry include live virus vaccines (like B1 and La Sota strains) administered through drinking water or spray, inactivated virus vaccines for breeders and layers, and vectored recombinant vaccines delivered in ovo
- The choice of vaccine depends on the age and type of poultry Live B1 and La Sota strains are administrated in drinking water or as a coarse spray. Sometimes administered intranasal or intraocular. Healthy chickens may be vaccinated as early as day 1-4 of life, but delaying vaccination until the second or third week increases its efficiency
- Some other infections (e.g. Mycoplasma) may aggravate the vaccine reaction. Killed virus vaccine should then be used

Common Vaccination Practices

- **Drinking water:** Birds are often made thirsty beforehand, and the vaccine is dissolved in water and offered for a short period (around 30 minutes) to ensure all birds drink it
- **Spraying:** Mass application through coarse aerosol spray is another common method for live vaccines
- **Eyedrop:** Used for individual vaccination, particularly for young chicks, using a live virus vaccine
- **Post-vaccination care:** After administration, it's often recommended to provide vitamins in the water to help reduce stress on the birds

Concluding Remarks

Even though a century old disease, Ranikhet / Newcastle disease virus is an economically important pathogen that can affect commercial poultry producers in India and worldwide with outbreaks resulting in trade barriers. Although vaccination programs exist that control disease among poultry, the virus continues to evolve in chickens and other species causing problems in poultry growing areas. To prevent Newcastle disease, implement a strategy of vaccination, strict biosecurity, and good farm management. This includes vaccinating chicks, separating new birds, controlling access to the farm, practicing daily cleaning and disinfection of poultry houses, and maintaining general good care for the flock to minimize stress and boost immunity.

References and Resources

1. ***World Organisation for Animal Health (WOAH):*** *Provides technical disease cards, definition of strains (lentogenic, mesogenic, velogenic), and reporting standards.*
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Article

Biosecurity Measures– Standard Operating Procedure (SOP)

Prabakar Ramamoorthy
R. Chanthirasekaran
Kemin Industries South Asia Pvt. Ltd.

Introduction

In today's poultry industry, biosecurity is no longer an option—it is a necessity. With increasing disease pressure, intensive production systems, and frequent human and material movement across farms, even a minor lapse in biosecurity can lead to significant health and economic losses. A well structured biosecurity program acts as the first line of defence, protecting flocks from infectious agents while ensuring sustainable productivity and animal welfare.

This Standard Operating Procedure (SOP) outlines comprehensive on farm biosecurity measures designed to minimise disease risks at every critical control point—from farm entry and visitor management to shed hygiene, waste disposal, and flock health monitoring. By consistently implementing these SOPs, poultry producers can strengthen disease prevention, enhance flock performance, and maintain long term operational reliability. The key biosecurity measures to be followed at the farm are outlined below.

- A biosecurity signboard stating "Unauthorised Access Restricted" shall be prominently displayed at the main farm entrance
- Lime powder shall be applied at the farm gate/entry point to ensure that the footwear of all employees and visitors comes into direct contact with the disinfectant barrier upon entry
- A visitor register/logbook shall be maintained to record the name, purpose, and duration of each visit
- The farm-visit history of all visitors shall be collected and verified to ensure they have not visited any suspected or confirmed disease-affected farms within the last three days
- Detailed farm-visit history shall be mandatorily recorded for high-risk personnel such as vaccinators, debeaking teams, grading crews, and service technicians
- An In-Pass/Out-Pass system shall be maintained to document the movement of all materials, equipment, and supplies entering or leaving the farm
- Entry of outside vehicles, including visitor vehicles, into the farm premises shall be strictly prohibited
- All vehicles and equipment permitted to enter the farm shall be thoroughly cleaned and disinfected using spray foggers, vehicle dips, and foot dips
- Disinfectant footbaths shall be provided at the farm gate and at the entrance of each shed, with regular replacement of disinfectant solutions to maintain effectiveness
- Unnecessary visitor entry shall be avoided. In unavoidable circumstances, visitors shall be provided with separate footwear or disposable slippers before entering the premises
- Handwashing facilities shall be installed and maintained at the entrance of each poultry shed
- During disease outbreaks, manure removal vehicles and cull bird transport vehicles shall not be allowed to enter the farm premises
- Litter removal shall be avoided during periods of high mortality or active disease to prevent cross-contamination
- All-weather road connectivity up to the farm premises shall be ensured to facilitate controlled movement without compromising biosecurity
- A minimum distance of 50–60 feet shall be maintained between two sheds to reduce the risk of cross-contamination
- Waterlogging within the farm premises shall be prevented and shed floors shall be maintained at an adequate height above ground level
- All water storage tanks, including drinking water tanks, fogger tanks, spray tanks, and sprinkler tanks, shall be kept closed at all times
- Entry of stray animals and wild birds shall be strictly restricted. Birds subjected to post-mortem examination shall be disposed of hygienically in designated disposal pits
- Eggs shall be stored in a separate godown located outside the farm premises to avoid entry of external vehicles into the biosecure zone
- Paper egg trays shall be preferred during disease outbreaks to minimise contamination and avoid reuse
- Summer management practices shall be implemented rigorously without compromise to reduce heat stress and immune suppression
- Feed and medicines shall be stored under appropriate conditions to prevent moisture damage, contamination, spillage, and deterioration of quality
- Following flock culling, thorough cleaning, decontamination, and disinfection of sheds and equipment shall be carried out as per protocol
- An adequate "shed rest" period shall be observed before placement of a new flock
- Vaccination programs shall be implemented strictly in accordance with the recommendations of breeders and poultry consultants

- Feed silos, conveyor feeding systems, and feeders shall be cleaned and sanitised at regular intervals as per standard protocols
- Aerial disinfection inside sheds shall be carried out 2–3 times per week, depending on the disease risk in and around the farm
- Disinfectant spraying (e.g., phenols, bleaching compounds) shall be performed regularly around each shed up to a distance of 6–8 feet from the shed walls
- Farm personnel shall visit young and healthy flocks first, followed by older flocks, and diseased flocks last
- Infected birds and contaminated materials shall be kept strictly separate from healthy birds, and proper hand and foot sanitation shall be followed before entering healthy sheds
- Medicines and vaccines shall be routinely checked for expiry or near-expiry and managed accordingly
- Sudden changes in feed or environmental conditions shall be avoided to minimise stress
- Farm personnel shall avoid direct contact with secretions and excretions of affected flocks
- Entry of wild birds, domestic animals, pets, and local birds into the farm premises shall be completely prevented
- Biofilm formation in nipple drinker lines shall be routinely checked and removed using appropriate water sanitisers
- Drinking water quality shall be periodically tested for pH, E. coli contamination, hardness, and ORP, and suitable water acidifiers and sanitisers shall be used as required
- Mycotoxin risks shall be managed through the use of high-quality toxin binders to prevent immunosuppression
- Used vaccine vials and biomedical waste shall not be discarded within or around the farm and shall be disposed of safely away from the premises
- Stress reduction strategies, including supplementation with Organic Chromium, Vitamin C, and 1,3 β glucans, may be used to enhance immune resilience
- Birds shall be monitored daily for abnormal signs and symptoms to minimise mortality and production losses
- Routine disease monitoring, including post-mortem examinations and periodic serological antibody assays, shall be conducted to assess flock health and immune status
- Farm veterinarians or farm managers shall be immediately informed in case of abnormal mortality or disease suspicion
- Flies, insects (including beetles), rats, and mice shall be controlled effectively through an integrated pest management program
- Dead birds shall never be kept inside sheds and shall be removed immediately
- Carcasses shall be disposed of by incineration or burial in designated disposal pits located at least 200 yards away from the farm premises
- Post-mortem rooms and examination areas shall be disinfected thoroughly after use, and lime powder shall be applied as appropriate
- Feed bags shall be stored in crates with adequate spacing and ventilation
- FIFO (First In, First Out) principles shall be strictly followed for all materials, including feed, medicines, and vaccines
- Hand sanitisers shall be available inside sheds for immediate use after bird handling
- After handling birds or coming into contact with secretions or excretions, handlers shall wash hands with soap and apply hand sanitiser
- Rearing of country birds or free-range birds, especially ducks, shall be strictly prohibited in and around the farm premises.

Conclusion

A well-planned farm and management system requires strict adherence to Standard Operating Procedures covering shed design, biosecurity, rearing practices, and record-keeping. Consistent implementation of these biosecurity measures ensures optimal bird health, uniform productivity, reduced mortality, and reliable operational and research outcomes.

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Article

Organic Agriculture: Debunk the Myth and Appreciate Reality

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

Organic is the current flavour as the clamour for food and allied commodities labelled organic is getting louder; marketeers are reaping a fortune though one cannot be too sure of the product quality consumers are getting under the garb of the label "organic", a food often perceived as significantly more nutritious and environmentally superior, even though the science shows a more nuanced reality.

There are as many terminologies as there are explanations and definitions: organic agriculture, eco-agriculture, bio-agriculture, natural farming, zero budget farming etc.; and there is quite some quibbling too on the meaning and interpretation of these terms. It appears that the whole realm of agriculture has been taken over by ideologues pushing the scientists, and more worryingly the farmer, to the backdrop. The controversy emanating from the terminologies and their explanations are as irrational as our entire understanding of what constitutes organic farming. Decidedly all these explanations converge to define a system that relies on ecosystem management rather than external agricultural inputs. It is a system that accords primacy to a consideration for potential environmental and social impacts of agriculture and thus seeks elimination of the use of synthetic inputs, such as synthetic fertilizers and pesticides, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation. Management practices, generally indigenous, that maintain and increase long-term soil fertility and prevent pest infestation and other diseases replace these synthetic inputs. Let us agree to call it Eco-Agriculture, an overarching title which embraces all other terms even though we may continue to use others too intermittently.

According to FAO/WHO Codex Alimentarius Commission "Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system."

Since the proponents and the opponents of eco-agriculture, driven by passion and emotion, tend to take extreme positions, it would be worthwhile to do a short surgical analysis of this definition. An organic agriculture production system would be robust and rewarding only if it is "holistic." The objective is preservation of the health of the agro-ecosystem, including soil, through biological/natural methods as against synthetic materials "where possible" and after "taking into account that regional conditions require locally adapted systems." Therefore, a blanket exclusion of all other systems and practices, as also imposition of a one size fits all approach, would go against the principle of a flexible "holistic" management which accords due consideration to the local environment. Most importantly, the policy, management and practice of organic agriculture should centre around the interests of the farmer and the consumer, the primary stakeholders, who alas have been rendered voiceless and pushed to the margins in this debate, which is often governed by strong beliefs fuelled by misinformation, if not ignorance.

The story of human civilization and progress is in essence the story of manipulating and dominating nature. Farming in itself is unnatural, no animal other than the human does it. After all, today's farmer was yesteryear's hunter. An assured and stable food supply to mankind has been possible only after the advent of farming, and later on as civilization evolved, it became a major source of livelihood. Increasing world population has resulted in an ever decreasing agricultural land, resultantly the farmers have few options other than the use of high yielding varieties of crops, pesticides and fertilizers. If the world were to transform to completely organic then will not the prices of food skyrocket? Would it not severely compromise the stability of food supply and availability? The questions deserve a decisive answer.

Why are we stigmatising our agriculture? Globally, only 1.2% agricultural land is said to be organic. So is it anyone's case that the entire global population is consuming harmful food? How does one then account for increasing life spans and ever improving health indicators? No doubt humans are prone to harmful diseases due to the presence of hazardous and toxic compounds in certain food items, so the regulatory regime to ensure food standards and safety must be strong and effective; equally worrying is the frequent incidence of worm infestation, especially amongst infants and children in the developing countries. Why does this widely prevalent ailment not find voice? How do we address the tragic consequences of farmers' suicides due to crop failure? Is

organic agriculture a solution or would a sudden shift compound the misery? Production, sale and use of fertilizers is regulated by the governments, so should the strategy not lie in better governance and enforcement rather than portraying the entire agriculture and its produce as toxic: eliminate the toxic compounds and keep a vigilant check on environmental contamination.

Organic food is great and healthy but correspondingly it is wrong to infer that food not grown the organic way is bad and unhealthy. Scientifically enriched varieties of crops help the vast majority to get better nutrition at affordable prices. An enlightened farmer and a vigilant consumer, along with support from government institutions, can surely ensure that food safety and quality standards are not compromised with. Activism seeking a complete transformation to ecological or biological farming would be akin to throwing the baby out with the bath water.

Chronic and acute hunger are on the rise, admit both the Food and Agriculture Organisation (FAO) and the World Bank. While there is no silver bullet to fix this problem, there is little doubt that we will need to use innovative solutions to produce more food, ensure access to it, and improve nutrition. Feeding ten billion people by the year 2050 will be quite a challenge if agriculture driven growth is put to risk by abandoning the very same agriculture models that have revolutionised productivity. Do we wish to head from today's surplus situation to an outcome of food insecurity, particularly so in developing economies such as ours? Against this background, should we not be discussing sustainable agriculture leading to sustainable growth to sustainable food supply, and how could organic/bio/eco-agriculture contribute? Why should the debate be relegated to the narrow confines of either or? Why not both?

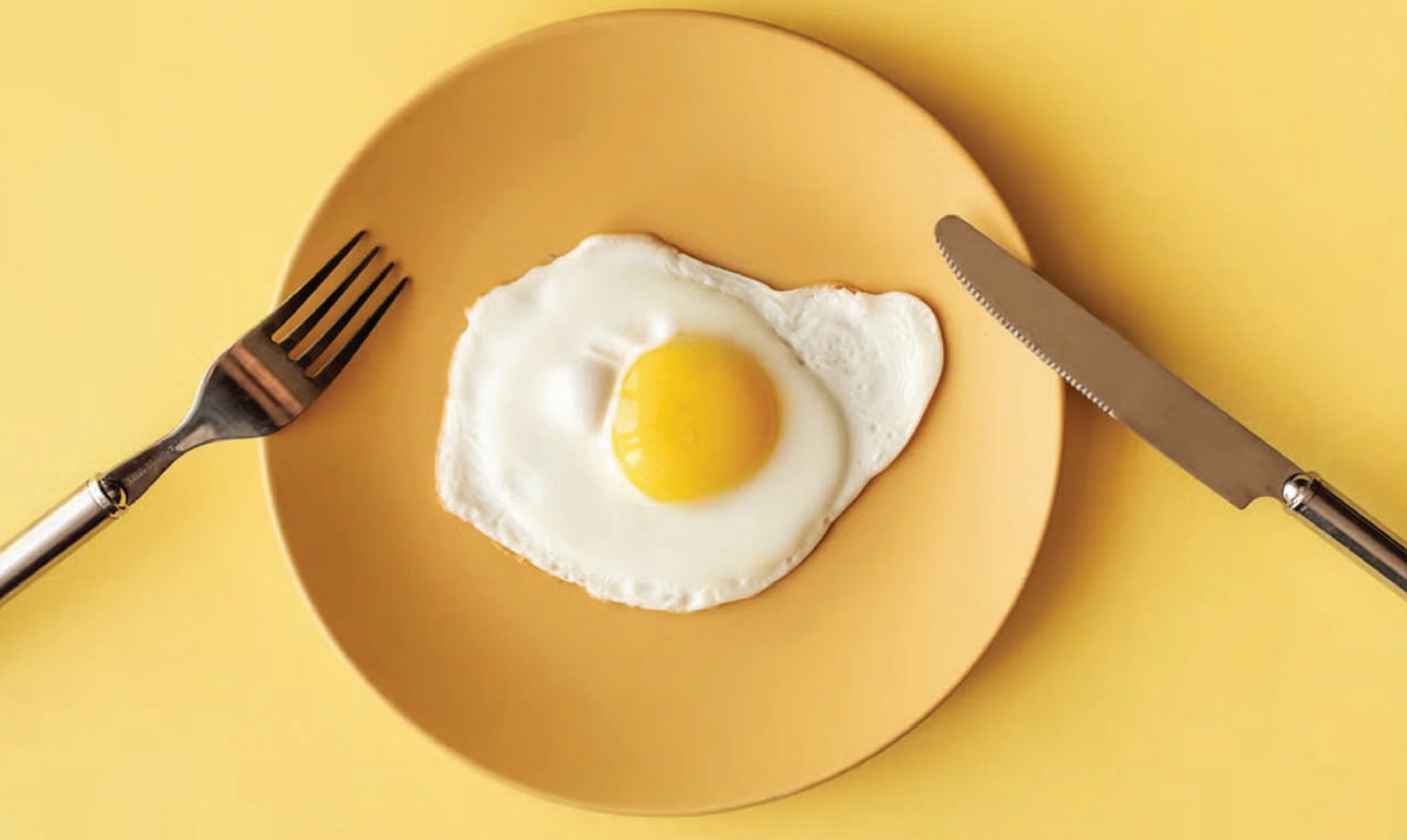
Undoubtedly, organic is good, nay great and makes good business sense. It adds value across the chain and is a fast growing market. Continuing urbanisation shall ensure a continuous increasing demand for organic food products. Let us capitalise on this situation to create investment opportunities. But let it not be just an ideology and belief to be imposed, unless we have some strange wish to go back to the days when we faced severe food shortages threatening starvation of a large population in the immediate post independence period, and we had to import huge quantities of wheat under humiliating conditions. It is a matter of pride that we now boast of surpluses. So why not organic contribute and supplement our production, rather than substitute it? After all, we too are now amongst the top in the world in production of almost all agriculture products, a huge feat of our farmers and scientists. While the imports in the 1950s/60s warded off hunger and starvation, they dented our self-respect.

In any case, we are largely "organic". More than 80% of our farmers are small and marginal who can ill afford expensive large quantities of fertilisers and pesticides. So before we doubt the integrity of our agricultural produce, we would be well advised to base our conclusion on facts and reliable data; when it comes to organic or natural farming, we are in an extremely data poor situation. Opinion, belief and ideology based narratives in public space are dictating our response to our agriculture and its produce rather than science, empirical evidence and common sense. An undisputed global fact is that India, by the number of producers, is the biggest producer of organic agriculture products. As many as 30% of global organic producers are from India. Our traditional knowledge and practices are sound; they enjoy the support of agriculture science. Why not make it an unbeatable partnership instead of following the path of mutual exclusion.

Did not the great scientist Albert Einstein advise, "Science without religion is lame, religion without science is blind."

Organic food is great and healthy but correspondingly it is wrong to infer that food not grown the organic way is bad and unhealthy. Scientifically enriched varieties of crops help the vast majority to get better nutrition at affordable prices. An enlightened farmer and a vigilant consumer, along with support from government institutions, can surely ensure that food safety and quality standards are not compromised with

CRACKING INDIA'S PROTEIN CHALLENGE



This is the story of how India, and particularly southern India, has worked to put more protein on the plate, reduce malnutrition and get more children into school. And how the humble **Egg** has played a starring role in the whole scheme of things. **Chethan Lokesh**, PhD scholar, Ben Gurion University of Negev, Israel, jointly with **Geetha Madhuri. K**, Independent Freelancer and **Dr. K Ravi Kumar**, Protein Activist, both from India has laboriously put together a research article on Protein Scaling in India since 1989

A child who wakes up every morning, walks to school with an empty stomach, and sits in a classroom trying to concentrate but cannot, because her body and brain do not have enough food. This is not a story from the distant past. For millions of children across India, this was and for some, still is an everyday reality.

Protein is not just a word on a nutrition label. It is the building block of muscles, the fuel for the brain, the engine behind a growing child's body. Without enough protein in the diet, children grow slowly, fall sick often, and struggle to learn. Adults too become less productive. Entire communities can be held back by something as preventable as protein deficiency.

India has been fighting this battle for decades. Since the late 1980s, there has been a gradual but significant scaling up of protein availability across the country. The southern states of Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Telangana, and the Union Territory of Puducherry have been at the forefront of many of these efforts. And at the very centre of this nutrition revolution stands one of the most remarkable, affordable, and scientifically validated foods on earth: the egg.

"The egg is not just breakfast. In the fight against child malnutrition, it is one of the most powerful tools we have"

The Egg: Complete Protein Package

Before we trace the history of nutrition policy in southern India, it is worth pausing to understand why the egg deserves special attention particularly for readers who are nutrition focused.

The egg is one of the very few foods that nutritionists call a 'complete protein.' This means it contains all nine essential amino acids, the building blocks of protein, that the human body cannot make on its own and must get from food. On a scale called the Protein Digestibility Corrected Amino Acid Score (PDCAAS), the egg scores a perfect 1.0 the highest possible rating, meaning its protein is fully usable by the human body (*Longvah et. al., 2017*). But protein is only the beginning of what an egg offers. A single medium-sized egg packs an extraordinary range of nutrients into roughly 70 calories and costs, at the time of writing, between Rs. 6 and Rs. 8 at Indian retail prices making it one of the cheapest high-quality nutrition sources available to any Indian family.

Nutrient	Per Whole Egg (approx. 50g)	Why It Matters for Children
Protein	~6.3 g (complete protein)	Builds muscles, supports brain growth
Vitamin A	~75 mcg	Eye health, immune defence
Vitamin D	~1.1 mcg	Bone development, calcium absorption
Vitamin B12	~0.6 mcg	Brain and nerve function
Choline	~147 mg	Memory, cognitive development
Iron	~0.9 mg (heme-iron form)	Prevents anaemia, improves attention
Omega-3 fats	~37 mg (DHA)	Brain and retinal development
Selenium	~15 mcg	Antioxidant, thyroid health
Calories	~70 kcal	Affordable, energy-dense food

Did You Know? The Egg and Brain Development

Choline found in egg yolk is essential for the formation of the brain's memory centres. Studies have shown that children who receive adequate choline during the first 2 years after birth show better cognitive performance, stronger memory, and reduced risk of neural tube defects. One egg provides approximately 147 mg of choline, nearly 27% of the daily requirement for a child aged 1-3 years. No plant food comes close to this level of bioavailable choline. For a country like India, the egg is not just food it is brain fuel.

Where India Stood in 1989 - A Protein-Deficient Nation

In the late 1980s, India was undergoing rapid change. Economic reforms were on the horizon. Population was growing. And millions of families, especially in rural areas, were surviving on diets that were heavy in carbohydrates but dangerously low in protein.

The National Sample Survey (NSS) data of that era showed significant portion of India's rural population consumed less than the recommended dietary allowance (RDA) of protein, then approximately 60 grams per day for an adult. The problem was not the quantity of food, it was the quality. People were eating enough calories to feel full, but their diets lacked pulses, eggs, milk, and other protein-rich foods (*Sen, A., 2001*).

Eggs were among the most conspicuous absentees from poor households' diets. In some communities, cultural or religious beliefs discouraged egg consumption, especially for children and women, ironically the two groups who need protein the most. This resulted in widespread protein-energy malnutrition (PEM) among children under five, stunted growth, poor immunity, and reduced school performance.

The Egg Gap in 1989

India's per capita egg consumption in the late 1980s was estimated at around 20-25 eggs per person per year far below the recommended 180 eggs per year suggested by the World Health Organisation (WHO) and the Food and Agriculture Organisation (FAO) as part of a balanced diet. In contrast, countries like Japan and the United States were consuming over 300 eggs per person per year. The southern states, particularly Andhra Pradesh, were already among India's highest egg-consuming regions a pattern that would become nutritionally significant in the decades ahead.

Government Programmes that Put Eggs on the Plate

One of the most important things to understand about the fight against malnutrition in India is that it did not happen on its own. It took sustained government action through schemes that directly delivered food, healthcare, and nutrition.

The Integrated Child Development Services (ICDS) and the Egg

Launched in 1975 and expanded significantly through the 1990s and 2000s, the ICDS programme operates through Anganwadi centres, locally-run child care and nutrition hubs. Children under six and pregnant or nursing mothers receive supplementary nutrition, health check-ups, and pre-school education.

As ICDS improved, several southern states began incorporating eggs into the supplementary nutrition provided at Anganwadi centres. Tamil Nadu and Andhra Pradesh were among the first to do this systematically. Nutritionists within the system recognised what poultry scientists had long known, no other food of comparable cost delivers as broad a nutritional profile as the egg (*Vir, S. C. 2023*).

The Mid-Day Meal Scheme: Tamil Nadu's Egg Revolution

The state had long topped in school feeding. The modern, state-wide programme was launched by Chief Minister K. Kamaraj in 1956. But it was Chief Minister M.G. Ramachandran (MGR) in 1982 who took the historic step of including eggs in the mid-day meal for all government school students.

This was a bold decision. MGR understood that rice and sambar alone cannot provide the protein, vitamin A, vitamin B12, iron, and choline that growing children needed. The egg, served twice or thrice a week, transformed the nutritional profile of the school meal overnight. Teachers reported more alert, attentive students in the afternoons. Nutritional surveys showed measurable improvements in the weight-for-age and height-for-age scores of children in government schools.

"When MGR put an egg on every child's plate in Tamil Nadu, he was doing what decades of policy documents had only discussed. He was acting on the science"

Tamil Nadu's egg-inclusive mid-day meal became a model that other states and the national programme would later reference. When the Government of India launched the National Mid-Day Meal Scheme in 1995, which grew into the world's largest school feeding programme, the scientific case for including eggs was already well-established, in large part thanks to Tamil Nadu's real-world demonstration (*Kanishka, M. 2025*).

Eggs in Mid-Day Meals: The Evidence

A study published in the journal, Maternal and Child Nutrition, found that children who received eggs as part of school meals showed significantly better growth outcomes specifically in height-for-age compared to children who did not receive eggs. Egg unique combination of high-quality protein, Vitamin A (critical for immunity and eye health), Vitamin B12 (essential for brain function), and iron (which prevents anaemia and improves concentration) makes them uniquely suited for school feeding programmes. In Tamil Nadu, where eggs are served 3-5 times a week in government school mid-day meals, nutritional surveys have consistently shown better outcomes compared to states where eggs are absent from school meals.

Andhra Pradesh and Telangana

Andhra Pradesh has long held a unique position in India's poultry sector. The state and after bifurcation in 2014, Telangana, together constitute one of the largest egg-producing regions in the country. States like Andhra Pradesh and Telangana produce a significant share of India's total egg output, with major poultry clusters around

Namakkal (Tamil Nadu) and the regions around Hyderabad also playing a key role (*Prasad, S., & Kumar, S. 2022*).

This production advantage has had a direct nutritional benefit. Eggs in Andhra Pradesh and Telangana are cheaper and more widely available than in many other parts of India, making them accessible to a broader section of the population. Both state governments have capitalised on this by including eggs in welfare food schemes from Anganwadi supplementary nutrition to school mid-day meals and even subsidised canteen programmes. The result is that per capita egg consumption in these states is among the highest in India, and their nutrition indicators, while still showing challenges, have improved more rapidly than states with lower egg consumption.

Tamil Nadu

Tamil Nadu stands out as a model for nutritional intervention in India. Its early adoption of school feeding with eggs, a robust Anganwadi network, and a universal Public Distribution System (PDS) have contributed to substantial improvements in child nutrition. According to the National Family Health Survey (NFHS-5, 2019–21), the proportion of children under five who are stunted in Tamil Nadu was around 25%, a notable decline from earlier surveys.

The state's Chief Minister's Breakfast Scheme (launched 2022) provides primary school children with a morning meal that includes eggs, further extending the window of egg-based nutrition in a child's day. Tamil Nadu also runs the Namakkal poultry belt, one of Asia's largest egg production clusters which ensures a steady, affordable supply of eggs for both welfare schemes and the open market. The alignment between strong local production and strong state-level nutrition policy is one of Tamil Nadu's greatest public health assets. *Radharkrishna, R., & Subbarao, K. (Eds.) (1997).*

Kerala

Kerala's celebrated 'Kerala Model' of development– high literacy, low birth rates, good health outcomes is well known. The state has one of the lowest rates of child malnutrition in India, with an NFHS-5 stunting rate of about 23.4%. Egg consumption in Kerala is relatively high, consistent with the state's diverse, fish and protein- rich dietary culture (*Iips, I. C. F. 2021*).

The Kudumbashree programme, a women-led self-help and livelihood initiative, has supported poultry-keeping by women's groups in rural Kerala, simultaneously improving livelihoods and increasing local egg availability. This bottom-up approach empowering women to produce eggs and keep them within the household food supply is an underappreciated model with lessons for other states (*Menon, P., Varghese, S. P., & Minimol, K. 2023*).

Karnataka

Karnataka presents a more mixed picture. The state's Ksheera Bhagya scheme provides free milk to school and Anganwadi children, addressing protein and calcium needs. However, Karnataka's mid-day meal programme has faced debates about the inclusion of eggs with some districts including them and others, due to local political and cultural considerations, opting out. NFHS-5 data showed Karnataka's stunting rate at about 35.4%, higher than Tamil Nadu and Kerala, which nutritionists have linked in part to inconsistent egg provision in school meals (*Iips, I. C. F. 2021*).

Advocacy from nutrition scientists, public health experts, and increasingly from the poultry industry itself has pushed for universal egg inclusion in Karnataka's school meals. The scientific evidence is clear: districts that consistently serve eggs show better child growth outcomes. The policy gap is not one of knowledge, it is one of political will.

Andhra Pradesh and Telangana

Both states have been aggressive in using eggs as a nutrition intervention tool. Andhra Pradesh serves eggs in mid-day meals five days a week in government schools, one of the most generous egg provisions of any state in India. Telangana similarly provides eggs multiple times a week and has incorporated eggs into its ICDS supplementary nutrition. NFHS-5 showed Telangana's stunting rate at about 33.1% and Andhra Pradesh's at approximately 31.2% both showing improvement from the 2015-16 survey round.

The poultry industry in these states benefits from this policy alignment: government procurement for school and welfare meals provides a stable, large-scale demand that supports the livelihoods of thousands of poultry farmers, from small backyard operations to large commercial producers.

Puducherry

As a Union Territory, Puducherry has generally recorded strong nutrition outcomes. NFHS-5 placed its under-five stunting rate at around 20.5%, one of the lowest in the country. Its school feeding programme is well-implemented, and eggs feature regularly in both mid-day meals and Anganwadi supplementation. The territory's small size allows for tighter monitoring and implementation quality than is possible in larger states.

The Egg and School Enrollment

One of the most powerful findings in public health and education research is simple-hungry children do not learn well, and fed children stay in school. When eggs are part of the meal, the effect is amplified because eggs do not just fill a stomach, they nourish a brain.

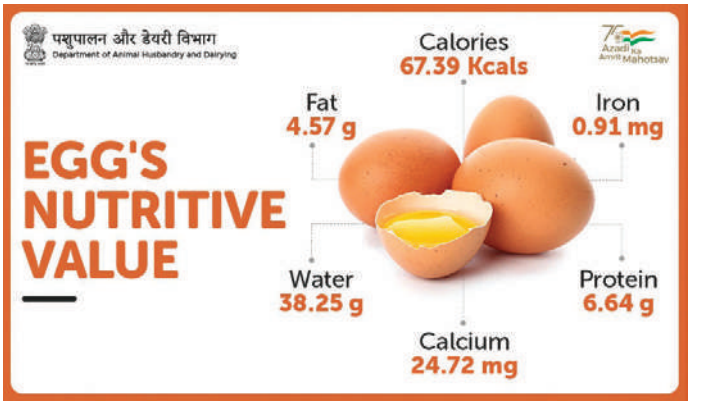
Research consistently shows that iron-deficiency anaemia, which the egg helps prevent through its bioavailable iron content, is strongly associated with poor school performance, reduced attention span, and higher dropout rates. Vitamin B12 deficiency, similarly addressed by regular egg consumption, is linked to neurological impairment that can permanently limit a child's cognitive development if not corrected early (*Iannotti et al., 2017*).

When Tamil Nadu expanded its mid-day meal to include eggs, school enrollment particularly for girls increased measurably. Parents who might otherwise keep their daughter home to help with household chores were more willing to send them to school when it meant a protein-rich, egg-inclusive meal every day. The egg was not just nutrition. It was an incentive that brought children through the school gate (*Jayaraman & Simroth, 2015*).

The Egg as a School Enrolment Tool: Real Evidence from Tamil Nadu

A study by researchers analysing Tamil Nadu's mid-day meal expansion found that the introduction of eggs into school meals was associated with a statistically significant increase in school attendance rates, particularly among girls from lower-income families. The researchers concluded that the meal's nutritional quality of which the egg was the key differentiating factor was at least as important as the meal's mere existence in driving enrolment. This is a finding with enormous implications for education policy across India: it is not enough to provide a meal. The meal must be nutritious. And for nutritional quality at low cost, nothing beats the egg.

This connection between egg provision and school enrolment has begun to be recognised beyond Tamil Nadu. Advocacy groups, nutritionists, and poultry industry bodies have jointly lobbied state governments to include eggs in all school meals



across India. The National Egg Coordination Committee (NECC), which represents India' s poultry sector, has been particularly active in this space, providing data, advocacy, and in some cases subsidised eggs to support state-level programmes.

India's Egg Production Growing to Meet the Need

The story of egg consumption and nutrition cannot be told without the story of egg production. India's poultry sector has grown dramatically since the 1980s, transforming from a largely backyard enterprise to one of the world's largest organised poultry industries.

In 1989, India produced approximately 15-17 billion eggs per year. By 2022-23, this figure had grown to over 138 billion eggs annually, making India the third-largest egg producer in the world, after China and the United States. This growth has been driven by improved poultry breeds, better feed conversion ratios, advances in veterinary science, and the growth of commercial layer farming particularly in the southern states.

Tamil Nadu's Namakkal district and Andhra Pradesh's Chittoor and Krishna districts account for a significant share of India's egg production. The poultry clusters in these regions have created large-scale employment for rural communities while simultaneously ensuring that eggs are affordable and available across southern India. The per-egg production cost in these clusters is among the lowest in the world a result of scale, efficient feed supply chains, and decades of accumulated farmer expertise.

Key Facts (2023)

Total annual egg production: ~138 billion eggs | India's rank globally: 3rd largest producer | Per capita consumption (2023): approximately 95 eggs/year, up from ~25 in 1989 | States contributing most: Andhra Pradesh, Telangana, Tamil Nadu, Karnataka. Employment: The poultry sector employs over 3 million people directly and many more indirectly. NECC (National Egg Coordination Committee): Established 1982, coordinates pricing, quality, and market development for the Indian egg industry. Source: Department of Animal Husbandry & Dairying, GoI, Annual Report 2022-23 (*Statistics, B. A. H. 2019*).

Despite this impressive growth, India's per capita egg consumption of approximately 95 eggs per year in 2023 still falls short of the FAO/WHO recommended 180 eggs per year. The gap between what India produces and what Indians, particularly children, need to eat for optimal health remains the central challenge for both nutrition policymakers and the poultry industry. Bridging this gap is not just a commercial opportunity; it is a public health imperative (UNICEF 2021).

Per Capita Egg Consumption: India vs World (1989-2024)		
Year	India (eggs/person/year)	Starter (eggs/person/year)
1989	20	120
1990	22	122
1991	24	125
1992	26	128
1993	28	130
1994	30	132
1995	32	135
1996	34	138
1997	36	140
1998	38	142
1999	40	145
2000	42	148
2001	44	150
2002	46	152
2003	48	155
2004	50	158
2005	52	160
2006	54	162
2007	56	165
2008	58	168
2009	60	170
2010	62	172
2011	64	175
2012	66	178
2013	68	180
2014	70	182
2015	72	185
2016	74	188
2017	76	190
2018	78	193
2019	80	195
2020	82	198
2021	84	200
2022	86	203
2023	88	205
2024	90	208

Progress Measured- What the Numbers Show

How much has India actually improved since 1989? The data tells an encouraging, if incomplete, story.

Comparing data from NFHS-1 (1992-93) to NFHS-5 (2019-21), stunting among children under five, the best single indicator of chronic malnutrition, declined across all five southern regions. Kerala's stunting fell from over 26% to around 23%. Tamil Nadu declined from roughly 30% to about 25%. Karnataka, Andhra Pradesh, and Telangana all showed declines, though from higher starting points.

Crucially, states with stronger egg provision in welfare schemes Tamil Nadu, Andhra Pradesh, Telangana have consistently shown better improvement trajectories in child nutrition indicators than states with weaker or inconsistent egg inclusion. While causation is difficult to establish definitively from survey data alone, the correlation is strong and is supported by a growing body of intervention research.

Egg consumption data from the National Nutrition Monitoring Bureau (NNMB) shows that per capita egg intake among rural households in southern India more than doubled between 1990 and 2012, with the most significant increases in Andhra Pradesh and Tamil Nadu, the two states with the most consistent egg-inclusive welfare programmes (*Swaminathan, S., Vaz, M., & Kurpad, A. V. 2012*).

School enrollment figures are similarly positive. According to UDISE+ data, primary school Gross Enrollment Ratios in Tamil Nadu, Kerala, Karnataka, and the Telugu states have been close to or at 100% for several years. The mid-day meal programme with eggs as a central feature in the south is widely credited as one of the key drivers of this achievement (*Mukhopadhyay, M., & Parhar, M 2013*).

What Still Needs to be Done

Progress is real, but the work is far from finished. Several challenges demand attention.

First, egg provision in school meals and Anganwadi centres remains uneven. While Tamil Nadu and Andhra Pradesh serve eggs five days a week, some states and districts still serve eggs only once or twice a week, or not at all, citing cultural concerns or budget constraints. The nutrition evidence overwhelmingly supports daily or near-daily egg provision, and policymakers must find ways to address legitimate cultural sensitivities without compromising the nutritional needs of children.

Second, while primary school enrollment is near-universal, the nutritional quality of mid-day meals needs continuous monitoring. Budget pressures can lead to cost-cutting that disproportionately affects protein-rich items like eggs. Vigilance from nutritionists, parents, civil society, and the poultry industry is necessary to ensure that eggs remain a non-negotiable part of the school meal.

Third, tribal, coastal, and remote rural communities in all five states face disproportionately high malnutrition. These communities need targeted outreach including community-level poultry programmes that put egg production and consumption directly into the hands of the most vulnerable families.

Fourth, there is an exciting opportunity for the poultry industry to move beyond being a mere supplier to welfare schemes, and to become an active partner in nutrition education. Industry bodies like NECC can play a powerful role in communicating the science of egg nutrition to parents, teachers, and community health workers building the cultural acceptance and demand that sustains long-term consumption growth.

Conclusion: The Egg at the Heart of India's Nutrition Story

The story of protein scaling and nutrition in southern India since 1989 is, at its heart, a story of what is possible when science, policy, and production align around a single, powerful food source.

Tamil Nadu showed the world that a mid-day meal with an egg can fill a stomach, nourish a brain, and open a school gate. Andhra Pradesh and Telangana demonstrated that a thriving poultry sector and ambitious nutrition policy are natural partners. Kerala and Puducherry proved that empowered communities and good governance multiply the impact of every egg that reaches a child's plate.

The egg is affordable. It is scientifically validated. It is culturally familiar across all five southern states. It is produced at scale, domestically, by millions of Indian farmers. There is, simply put,

no better tool for fighting child malnutrition in India and no better investment for the poultry industry than ensuring that every child in India's schools has an egg on their plate.

The next chapter of this story will depend on how well the lessons are remembered, the gaps acknowledged, and the partnerships between government, the nutrition community, and the poultry sector sustained and deepened. India has the production. India has the policy frameworks. What remains is the collective will to see it through one egg at a time.

"India produces over 138 billion eggs a year. Every child in this country could and should have one every single day. The science is settled. The supply is there. The question is only of will"

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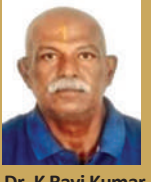

Chethan Lokesh **Geetha Madhuri. K** **Dr. K Ravi Kumar**

E-mail: drkrk1955@gmail.com

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Unit no. L4 04, SLN Terminus, Beside Botanical Garden,
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Article

Mitigating Heat Stress: Comprehensive Nutritional and Management Approaches for Poultry

Dr. Vaani Shreeya
(Nutritionist)
Dr. Himasree Kancharapu
(Formulator)
Trouw Nutrition India

Introduction

Poultry farming is one of the most rapidly growing industries of livestock sector, significantly contributing to food security and offering accessible, high-quality protein, especially in developing nations. The global population is projected to reach 10 billion by 2050, resulting in a substantial increase in the demand for animal-based products. However, maintaining productivity under these circumstances is progressively challenged by environmental stressors, with heat stress being one of the most significant.

Poultry are particularly susceptible to heat stress because of their higher metabolic rate, dense feather coat, and lack of sweat glands, which restrict their capacity to release excess heat. In high temperature and humid conditions, birds experience difficulty in maintaining thermal equilibrium, resulting in physiological stress. The issue is further exacerbated in modern commercial strains, where selection for higher productivity has reduced inherent thermotolerance.

Heat stress is no longer a seasonal concern but a recurring challenge in many production systems. Even short-term exposure to elevated temperatures can lead to noticeable declines in feed intake, growth rate, egg production, and overall flock performance. Addressing this requires a well-integrated approach combining nutrition, environmental management, and long-term adaptive strategies.

Effects of Heat Stress on Performance and Physiology

Physiological and Metabolic Changes

Heat stress induces a sequence of physiological modifications that disturb standard metabolic functions. Birds accelerate their respiratory rate (panting) to improve heat dissipation, which causes an excessive loss of carbon dioxide, leading to respiratory alkalosis. This imbalance affects bicarbonate availability, which is crucial for adequate eggshell development.

Electrolyte imbalances concerning sodium, potassium, and chloride additionally influence hydration, cellular functionality, and metabolic equilibrium. Heat stress impairs thyroid hormone activity at the hormonal level, resulting in a decreased metabolic rate, while simultaneously elevating corticosterone levels associated with the stress response.

These alterations redirect the avian metabolism from growth and reproduction to survival. Protein synthesis decreases, fat accumulation increases, and overall nutrient utilisation become less efficient, leading to reduced performance.

Impact on Productive Performance

One of the earliest and most consistent responses to heat stress is a reduction in feed intake, as birds attempt to minimise metabolic heat production. At elevated environmental temperatures, feed consumption may significantly decrease, typically by 15-30% under extreme conditions resulting in reduced nutrient availability for growth and production.

In broilers, this results in reduced body weight gain, lower feed conversion, and alterations in carcass composition, including increased fat deposition and reduced muscle yield. Heat stress in laying hens adversely impacts egg quantity and quality, resulting in decreased egg output, reduced egg weight, and poor shell strength. With rising temperatures, feed consumption diminishes progressively, thereby restricting nutrient availability for egg production.

Gut Health, Immunity and Welfare

The gastrointestinal system is particularly susceptible to thermal stress. Disruption to the intestinal lining impairs nutrient absorption and increases permeability, allowing the entry of pathogenic organisms

into the circulation. This increases vulnerability to diseases and adds to food safety concerns.

Concurrently, immunological function is impaired, characterised by inadequate antibody synthesis and increased oxidative stress. Birds display behavioural reactions include panting, wing spreading, decreased activity, and higher water consumption, all indicating thermal discomfort. Overall, heat stress adversely affects productivity, health, and welfare.

Mitigation Strategies

Feeding and Nutritional Management

Nutritional strategies remain one of the most effective tools for managing heat stress. Feeding during cooler parts of the day, such as early morning and late evening, helps improve feed intake, while avoiding feeding during peak heat reduces metabolic load. The use of highly digestible ingredients further minimises heat production during digestion.

Feed form also plays an important role under heat stress conditions. Pelleted feed is generally preferred, as it improves feed intake, nutrient digestibility, and energy utilisation while reducing physical activity and heat production during feeding. However, particle size must be optimised while coarse particles may support gut development, excessively coarse feed can increase heat load due to greater digestive effort.

Increasing dietary energy density is a widely adopted approach to compensate for reduced feed intake. In practice, fat inclusion is typically maintained in the range of 2-5%, as fats generate less metabolic heat and improve feed efficiency.

In practice, focusing only on crude protein is not sufficient under heat stress conditions as excess protein contributes to heat production. Instead, diets should be more effectively formulated using a well-balanced amino acid profile, increasing essential amino acids density by around 5-10%, adjusted for reduced intake and higher maintenance demand to sustain productivity in heat-stressed flocks.

Methionine (Met), being the first limiting amino acid in most practical diets, needs close attention during such periods. In field conditions, adequate Met levels help sustain protein deposition and reduce tissue breakdown. This is supported by its influence on pathways related to protein synthesis (IGF1, GHR, PI3KR1) and reduced expression of proteolytic markers such as atrogin1 and CTSL2. In addition, its role in antioxidant systems becomes more relevant as oxidative stress increases with high environmental temperatures.

Arginine (Arg) also plays a functional role under heat stress. Besides supporting protein accretion through polyamine synthesis, it contributes to creatine formation, which is important for energy buffering in muscle. More importantly, Arg is the only nitrogen donor for nitric oxide synthesis, and this can support vasodilation, helping birds dissipate heat more effectively under field conditions.

Threonine is another amino acid that should not be overlooked, particularly due to its role in maintaining gut integrity and immune competence both of which are often compromised during heat stress. Similarly, tryptophan and branched-chain amino acids can help stabilise the stress response and support overall physiological balance.

From a formulation standpoint, reduced feed intake also means that even non-essential amino acids can become limiting. Glycine is a common example in practical diets, and its inclusion (or glycine equivalents) may be necessary to maintain performance and metabolic efficiency during prolonged heat stress.

Electrolytes, Vitamins and Minerals

Maintaining electrolyte balance is a primary nutritional intervention during heat stress, as increased panting leads to loss of carbon dioxide and disruption of acid base equilibrium. Under practical feeding conditions, diets are typically adjusted to a dietary electrolyte balance (DEB) of 220-250 mEq/kg, commonly using sodium bicarbonate (1.5-2.5 kg/ton). This helps restore blood pH, improves water intake, and supports overall physiological stability in birds exposed to high environmental temperatures.

Heat stress also elevates oxidative stress, making antioxidant supplementation essential. Although poultry can synthesise vitamin C, endogenous production is insufficient under heat stress; supplementation helps modulate corticosteroid levels and improves stress tolerance. Vitamin C is widely used at 200-500 mg/kg in feed or 0.5-1 g/L in drinking water to alleviate stress and improve feed intake. Vitamin E (100-200 mg/kg) protects cell membranes from oxidative damage and enhances immune function, while also supporting lipid transport in laying birds. Since it cannot be synthesised, it must be supplied through feed. Vitamin A (10,000-15,000 IU/kg) supports epithelial integrity and overall health.

Mineral nutrition becomes increasingly important during heat stress due to reduced intake and increased excretion. Calcium and phosphorus are critical for maintaining eggshell quality and bone metabolism, both of which decline at elevated temperatures. Heat stress reduces calcium intake and impairs vitamin D_3 activation, along with lowering calbindin levels, thereby limiting calcium absorption. Under these conditions, simply increasing dietary calcium is not effective and may reduce feed intake. Instead, it is more practical to provide coarse calcium sources such as limestone or oyster shell grit (around 1 g/bird) during the afternoon to support eggshell formation during peak demand.

Electrolytes such as sodium, potassium, and chloride continue to support osmotic balance and cellular function. Trace minerals are equally importantin stress adaptation. Zinc supports antioxidant defence and immune function through enzyme systems such as superoxide dismutase and metallothionein. Copper (5-8 ppm) contributes to antioxidant activity and is essential for eggshell membrane formation, with deficiencies often reflected in poor shell quality. Iron supports oxygen transport and immune competence, which are particularly important under stress conditions.

Chromium improves glucose utilisation through insulin action, enhancing energy efficiency when metabolic demand is high. Manganese supports enzyme systems, lipid metabolism, and eggshell formation, while iodine is essential for thyroid hormone synthesis, regulating metabolism and thermoregulation both of which are affected under heat stress.

Selenium (0.2-0.3 mg/kg) plays a central role in antioxidant defence and works synergistically with vitamin E to protect cell membranes from oxidative damage. It also supports immune response, improves nutrient utilisation, and helps maintain intestinal and pancreatic integrity under stress conditions.

Overall, under field conditions, a coordinated approach addressing electrolyte balance, antioxidant support, and mineral nutrition is essential to sustain performance and resilience in heat-stressed poultry.

Feed Additives and Gut Health

Functional feed additives provide additional support to birds experiencing heat stress. Betaine is typically incorporated at approximately 0.5-1 kg/ton, functioning as an osmolyte to preserve cellular hydration and minimise energy expenditure related to ion homeostasis. It additionally promotes intestinal integrity and nutrient absorption.

Managing gut health is particularly important during periods of heat stress. Prebiotics are generally utilised at 0.5-1 kg/ton, whereas probiotics are incorporated at concentrations of 10^6-10^8 CFU/g feed to stabilise gut flora and enhance nutritional absorption. Synbiotics,

typically incorporated at 0.25-1 kg/ton, have synergistic advantages, improving gut morphology and immunological function. Postbiotics, often utilised at 0.25-0.5 kg/ton, offer consistent antioxidant and anti-inflammatory benefits.

Furthermore, phytogenic compounds and bioactive molecules enhance oxidative balance, digestive efficiency, and overall performance in stressful conditions. Lycopene (from tomato and watermelon), resveratrol (present in foods such as grapes and peanuts), epigallocatechin gallate (EGCG) from green tea and curcumin from turmeric are natural bioactive compounds that help poultry cope with heat stress by improving antioxidant defence, immune function, and overall performance.

Water, Environment and Long-Term Approaches

Water management is the most immediate intervention during heat stress, since avian species may augment their water consumption two to threefold relative to typical conditions. Uninterrupted access to clean, cool water, preferably maintained at 20-25°C, is crucial, accompanied by sufficient drinking space and appropriate flow rate.

Environmental regulation is necessary for mitigating heat load in poultry housing. Increasing air velocity in ventilation systems, especially tunnel ventilation, improves heat dissipation, with air speeds generally maintained at 2-3 m/s. Cooling systems, including evaporative pads, foggers, and sprinklers, effectively lower ambient temperature, although their efficiency may fluctuate in conditions of elevated humidity. Decreasing stocking density by around 10–20% during elevated temperatures enhances airflow and birds' comfort, while appropriate housing design, insulation, and shading additionally facilitate thermal regulation.

Long-term strategies emphasise enhancing thermotolerance. Early thermal conditioning of chicks can improve their capacity to manage heat in later stages of life. Genetic strategies, like selection of heat-tolerant breeds like naked neck and frizzle birds, offer persistent benefits by minimizing metabolic heat generation.

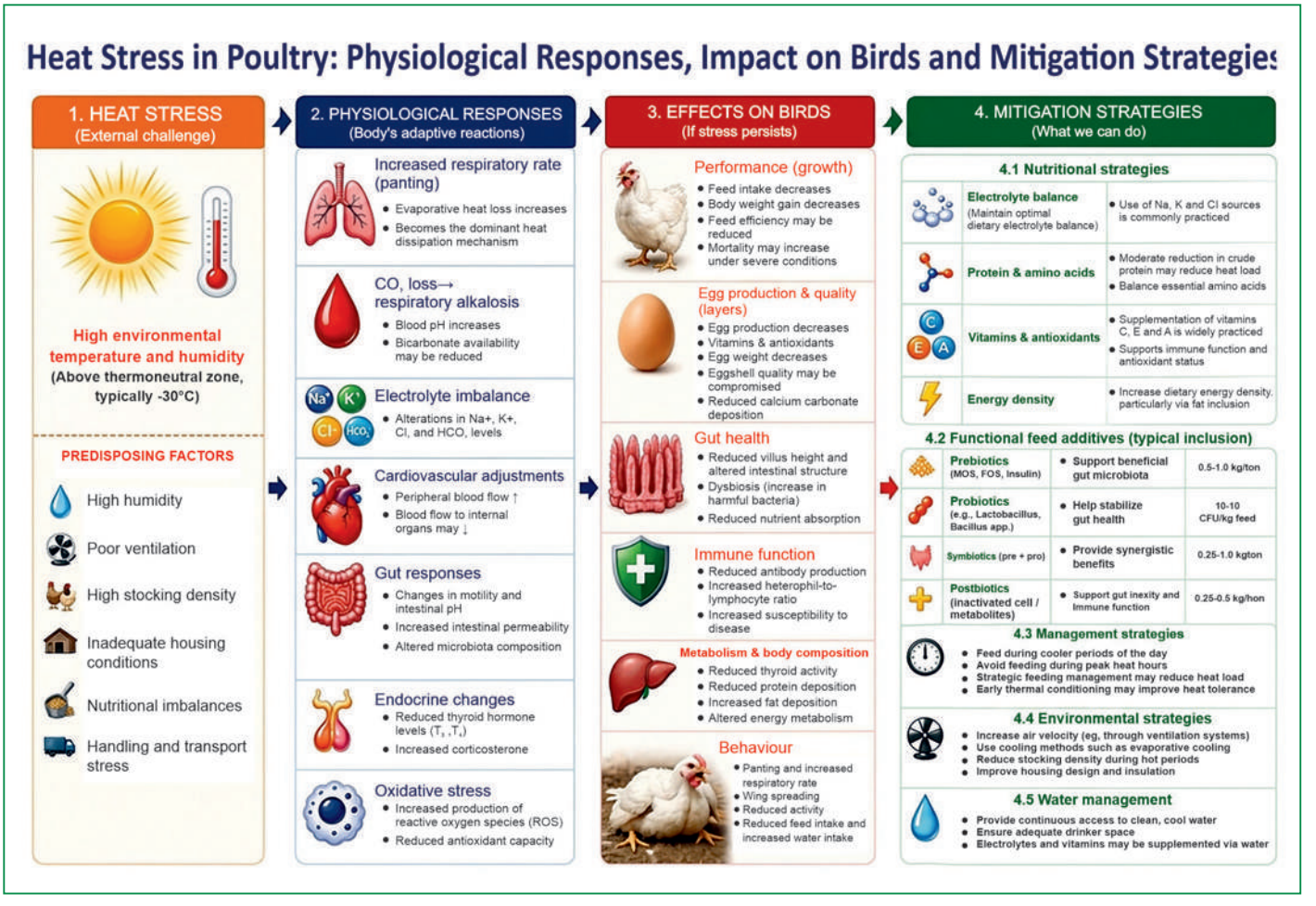
Emerging techniques such as in Ovo feeding of bioactive compounds are also being explored to improve resilience from initial stages of development.

Conclusion

Heat stress continues to pose a significant concern in poultry production, impacting avian health, welfare, and productivity, and is anticipated to worsen due to evolving climatic circumstances. Although it cannot be entirely eliminated, its effects can be significantly mitigated with a comprehensive strategy that incorporates enhanced nutrition, deliberate feeding techniques, appropriate water and environmental management, and sustained genetic advancements.

Among all approaches, nutrition and feeding management are the most immediate and effective measures, directly affecting the bird's capacity to withstand thermal stress. When supported by efficient housing and management methods, these strategies sustain performance even inadverseconditions.

As global temperatures continue to rise, the emphasis needs to shift from only addressing heat stress to developing resilient poultry production methods. Producers employing proactive and scientifically informed strategies will be better positioned to sustain productivity, safeguard bird welfare, and attain long-term profitability.



Article

Azolla: A Carbon Sink and a Nutritious Feed Source for Poultry

Dr. Partha Pratim Biswas
F.Z.S., F.Z.S.I.
Former Professor & HOD
Dept. of Zoology
R.K.Mission V.C. College
Kolkata

A key challenge is the rising demand for high-quality animal feed, particularly protein sources. Soybeans, which serve as the primary protein source in livestock farming, are becoming increasingly unsustainable due to escalating costs and limited global supply. Additionally, soy cultivation contributes to climate change by emitting greenhouse gases. The cultivation of soy is highly resource-intensive, requiring substantial amounts of soil, water, energy, and agricultural chemicals. Transforming grazing lands or natural vegetation into agricultural fields is expected to change the hydrological cycle and encourage soil erosion. As a result, the quest for alternative protein sources has increased, especially for feed for poultry and livestock. Among the viable options, aquatic plants like Azolla have attracted significant interest because of their rich nutritional content, simple cultivation process, and potential for eco-friendliness. Azolla's capability to thrive at extremely fast rates provides the potential to use it as a means to capture a substantial quantity of atmospheric CO_2 as biomass. A. pinnata has a protein content of 25–30% and an excellent amino acid profile, which can boost animal growth and productivity while decreasing dependence on traditional protein sources. They provide advantages comparable to microalgae, but are simpler and more affordable to gather. Due to its symbiotic relationship with the nitrogen-fixing cyanobacterium Anabaena azollae, Azolla rapidly accumulates biomass without needing external nitrogen, providing a distinctly low-carbon, low-cost cultivation method. In true sense, Azolla is a functional and climate-smart feed ingredient for livestock and poultry. Evidence from feeding trials in poultry and other livestock species consistently demonstrate that Azolla supplementation significantly enhance growth performance, feed efficiency, egg and milk production, immune functions, and overall product attributes, while simultaneously lowering feed cost.

Exploring Alternate Protein Sources for Poultry Feed

Due to the reliance on traditional raw materials for poultry feed, primarily corn and soybean meal, sustainability issues arise, including deforestation, loss of biodiversity, and increased greenhouse gas emissions linked to their production and transport. In this context, there is a need for new approaches to create and execute alternative feeding methods for poultry. It is crucial to take into account non-traditional protein sources. Although conventional protein sources like soybean meal and fishmeal are commonly utilised, alternative sources including insects, algae and Azolla spp offer comparable nutritional advantages, while also being more sustainable and eco-friendly.

Key Characteristics, Biology & Distribution of Azolla

In the world, at least eight species of Azolla are known, namely Azolla pinnata, Azolla nilotica, Azolla caroliniana, Azolla japonica, Azolla circinata, Azolla microphylla, Azolla rubra, and Azolla Mexicana, of which most common is Azolla pinnata, an abundantly available aquatic fern. Azolla pinnata (Family: Salviniaceae) is a species of free-floating fern known by several common names, including mosquito fern, feathered mosquito fern and water velvet. It ia small fern (1–3 cm) with deeply pinnate branches, featuring tiny leaves (<1 mm) that often turn reddish in sunlight. Roots are simple, unbranched roots hang down from the rhizome. The fern heterosporous, producing distinct microsporocarps and megasporocarps (spores rather than seeds). It is considered one of the fastest-growing plants, doubling biomass in 1.9 days under optimal conditions. Azolla contains the nitrogen-fixing cyanobacterium Anabaena azollae in leaf cavities, allowing it to thrive in nitrogen-deficient waters. Azolla is unique because it passes on a nitrogen-fixing microorganism (diazotroph) to its offspring through its spores. This fern is found floating on still or slow-moving freshwater. It's great for fertilising and can make soil better, but its thick coverage can use up oxygen in the water, which is why some people consider it a nuisance plant. This aquatic fern, Azolla, floats freely all over the world in calm freshwater areas from the tropics to temperate zones, like marshes, ponds, and rice paddies. It is most common in Asia, Africa, and the Americas, and it often shows up in new places as an introduced species. For instance, A. pinnata is a dominate in Asia, while A. nilotica is originally from Africa. Azolla can soak up a good amount of carbon dioxide from the air, and this is partly thanks to the symbiotic relationship it has with its microorganism partners. The plants are then compacted and stored long-term as a way to combat human-caused climate change through Carbon Capture and Storage (CCS). Fig.1 & Fig. 2

Fig.1: Azolla on finger tip

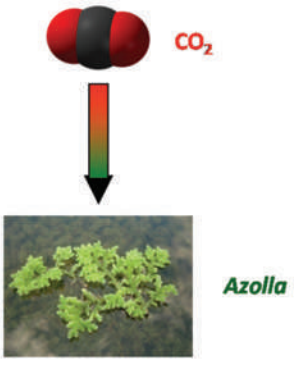


Fig. 2: Azolla has enormous potential to sequester atmospheric CO_2 due to its rapid growth in freshwater without the need for a soil-based nitrogen source

Nutritional Benefits and Application of Azolla in Poultry Feed

Azolla has approximately 15–35% crude protein based on dry matter and offers vital amino acids, vitamins, minerals, and numerous bioactive substances that may enhance animal health and elevate product quality. Its worth as a feed component is primarily influenced by its amino acid composition, and then by the amounts of crude protein, fiber, and digestible carbohydrates. Azolla provides a total of 18 amino acids, such as glutamic acid (12.6% of protein), aspartic acid (9.3%), leucine (8.4%), alanine (6.4%), arginine (5.9%), glycine (5.6%), and valine (5.5%). It is a plant that is naturally rich in protein. It additionally offers crucial minerals—like iron, calcium, phosphorus, magnesium, manganese, potassium, and copper (10–15%)—alongside vitamins (like vitamins A and B12), carotenoids, chlorophyll a and b, biopolymers, probiotics, and substances that promote growth.

Azolla is regarded as a significant source of nutrients. Its cyanobiont, Anabaena azollae, contains chlorophyll a, phycobiliproteins, and carotenoids, although it has low levels of carbohydrates and oils. Azolla is very digestible because of its minimal lignin and elevated protein levels. Fig.3

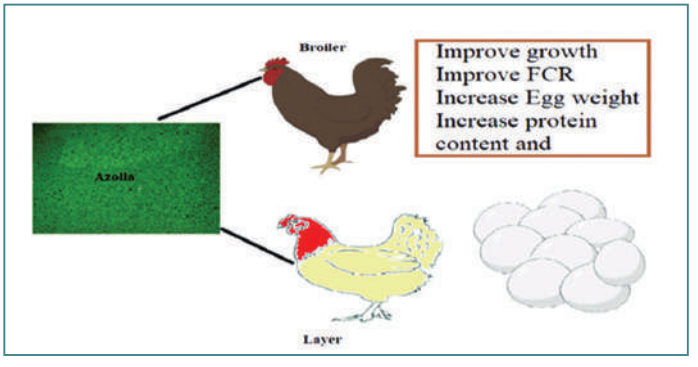


Fig. 3: Impact of Azolla on broiler and layer poultry

Effects of Azolla Supplementation on Production Performance of Chickens

Broiler Chickens

The addition of Azolla to the poultry diet economises production. It is a cheap and plentiful alternative plant protein source that improves FCR, energy efficiency, and performance with no adverse effects on poultry birds. Majority of the data show enhancement of production in poultry fed with diet containing Azolla. Sarria and Preston (1995) found an increase in the growth of broilers when soybean protein was replaced by Azolla up to 15% level. Improvement in the FCR as a result of Azolla feeding was also reported. Incorporation of Azolla up to 5% as a feed ingredient to replace sesame meal in the ration of 2 to 6-week-old broilers improved growth rate, FCR, and energy efficiency without deleterious effect on palatability and mortalities (Basak et al., 2002), along with promising economic returns. The use of 20% fresh Azolla was suggested as a substitute for commercial feed in chicken diets as it could increase the body weight. The study by Dhumal et al. (2009) demonstrated a significant increase in feed intake with an increase in Azolla levels up to 30%. It was found that Azolla pinnata meal can be safely included up to 15% in growing pullet ration with no health issues. But 10% inclusion level in pullet chick diet has given the best performance. This has been suggested that Azolla can be added to the broiler diet by 10% level without adverse effect in the performance.The inclusion of Azolla at 10% level showed the maximum economic benefit. The addition of Azolla to the basal ration could improve FCR with no adverse effects on blood biochemistry and immune parameters. Recently, Samad et al. (2020) suggested that the addition of Azolla up to 15% level enhances the growth performance traits without negative effects on the nutrient digestibility of broiler chickens. A. pinnata supplementation enhances liver health, immune function, and growth performance in broilers through bioactive compounds. Its phenolic compounds (e.g., 5-Hydroxy-7-methoxyflavone) and flavonoids reduce oxidative stress by upregulating antioxidant genes like SOD1 and CAT, which protect liver tissue from damage (Hamouda et al. 2024). Feeding Azolla to broilers increased carcass parameters, including gizzard weight, breast muscle yield, and lower meat pH (Shambhvi et al. 2021).

Layer Chickens

The inclusion of Azolla in poultry diets significantly improves the pigmentation of egg yolks, often quantified by a higher Roche fan (now DSM Yolk Fan) colour score. A higher score indicates a more pigmented, carotenoid-rich yolk, often preferred by consumers and indicating better hen health. This effect is driven by the high concentration of β-carotene, xanthophylls, and other carotenoid pigments found in the Azolla plant. Khatun & Islam (2021) found that the addition of Azolla powder to chicken feed significantly improved the carotene status of the chicken and increased egg production. A similar better egg production performance was detected by Kannaiyan and Kumar (2005) in terms of higher egg yield after Azolla inclusion at the level of 100 g/bird/day. Lakshmanan et al. (2017) stated supplementation of Azolla in layers diets resulted in increasing egg production, improving the nutrient value as well as saving the concentrated feed. Fig. 4 & Fig. 5

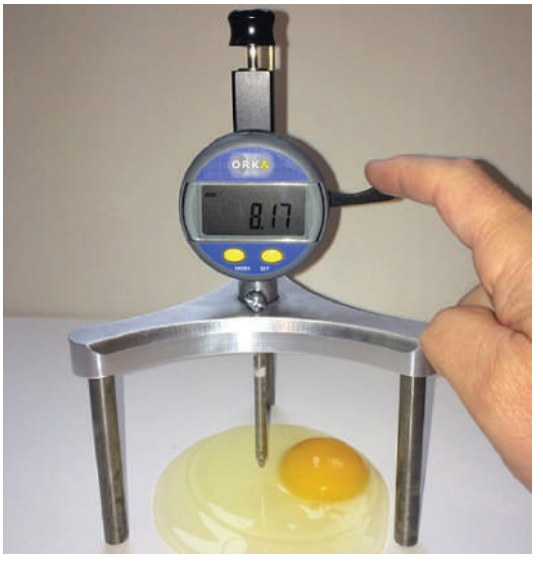


Fig. 4: The Haugh unit (pronounced: "how") is a widely recognised measure of an egg's internal quality and freshness

Fig. 5: The Yolk Fan, made for assessing egg yolk colour to monitor chicken nutrition

Some Challenges in Cultivating Azolla and Using it as Feed

Azolla cultivation requires a steady water supply because it lives in aquatic environments, making it impractical in dry regions. If not managed well, Azolla can spread aggressively and become invasive, so careful control is needed. It forms thick mats on the water surface, which can lower pH and oxygen levels, change nutrient cycles, and decrease the abundance and variety of other aquatic plants. Although Azolla is high in protein, it may be missing some essential nutrients for a complete diet and should be combined with other protein sources. It is relatively rich in lysine but low in tryptophan and sulphur-containing amino acids (like methionine and cystine). While it contains several minerals, their bioavailability is limited—for example, much of its iron is present as less-absorbable ferric forms. Azolla species can produce increased amounts of phenolic compounds when stressed. Under such stressful conditions, they tend to have lower levels of lipids and total proteins but higher amounts of phenolics and carbohydrates. Freshly harvested Azolla also contains a lot of moisture that is very low dry matter (DM) content (7.05%) and requires preservation methods like drying, which can raise labor and storage needs. Sun-dried A. pinnata has been reported to have 93% dry matter. Limitations in management may make cultivating Azolla and using it as a global protein source challenging. Optimal growth occurs at 20–30°C with relative humidity around 85–90%, and it prefers a pH of about 5.5–7.

Conclusion

With the introduction of lab-grown and microbial-based proteins into the mainstream, the demand for alternative proteins has increased. While lowering dependency on conventional livestock-based nutrients, these innovative sources guarantee stable nutritional characteristics. Although Azolla has a lower Metabolisable Energy (ME) value, it is rich in protein, micronutrients, and pigments that are beneficial for feeding laying hens. Azolla meal clearly contributes significantly to enhancing laying performance and feed efficiency while not negatively impacting feed intake and weight variations. The valuable egg quality characteristics such as Haugh unit, shell thickness, and yolk colour score are distinctly enhanced when hens are fed diets with varying amounts of Azolla meal. Egg quality, emphasising freshness and structural integrity, is primarily evaluated using the Haugh unit (HU), linking thick albumen height to egg weight; elevated scores (e.g., >72 for AA grade) indicate superior freshness. Moreover, economic analysis indicates a significant decrease in feed costs with the incorporation of Azolla meal in diets up to 7.5%. The observed combined effects in the experiment suggest that Azolla can enhance the profitability and sustainability of small-scale poultry production.

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Northern Region

COMPANY: IB Group
FARMER NAME: Mr. Rajesh Yadav

MARCH-2026	Top #1
Farm Type	Open House
State	UTTAR PRADESH
Chicks Placed	6624
Mean Age	42.0
Avg Body Wt	3308
FCR	1.481
cFCR	1.190
Livability%	96.5
Daily Gain	78.8
EPEF	513.0

Eastern Region

COMPANY: IB Group
FARMER NAME: Mr. Sontosh Basumatary

MARCH-2026	Top #1
Farm Type	Open House
State	ASSAM
Chicks Placed	1593
Mean Age	39.0
Avg Body Wt	2816
FCR	1.364
cFCR	1.183
Livability%	93.7
Daily Gain	72.2
EPEF	496.1

Central Region

COMPANY: IB Group
FARMER NAME: Mr. Pranit Moreshwar Gohane

MARCH-2026	Top #1
Farm Type	Open House
State	MAHARASHTRA
Chicks Placed	7909
Mean Age	43.0
Avg Body Wt	3557
FCR	1.579
cFCR	1.233
Livability%	91.3
Daily Gain	82.7
EPEF	478.5

South Region

COMPANY: IB Group
FARMER NAME: Mr. Shidray Kalelli

MARCH-2026	Top #1
Farm Type	Open House
State	KARANATAKA
Chicks Placed	3247
Mean Age	39.0
Avg Body Wt	2765.0
FCR	1.479
cFCR	1.309
Livability%	93.6
Daily Gain	70.9
EPEF	448.5

MARCH-Top PERFORMANCE BY AREA

Area	Chicks Placed	Mean Age	BW	FCR	cFCR(2Kg)	Livability%	Daygain	EPEF
North EC House	10381	44.0	3666	1.581	1.211	95.5	83.3	503.1
North Open House	6624	42.0	3308	1.481	1.190	96.5	78.8	513.0
East EC House	17953	42.0	3091	1.437	1.195	95.1	73.6	487.1
East Open House	1593	39.0	2816	1.364	1.183	93.7	72.2	496.1
Central EC House	7909	43.0	3557	1.579	1.233	91.3	82.7	478.5
Central Open House	3994	36.0	2652	1.426	1.281	93.8	73.7	484.4
South EC House	19148	35.0	2410	1.409	1.318	93.1	68.9	455.0
South Open House	3247	39.0	2765	1.479	1.309	93.6	70.9	448.5

MARCH-Top 10 FIELD PERFORMANCE

Flock	Farm Type	State	Chicks Placed	Mean Age	BW	FCR	cFCR	Livability%	Day Gain	EPEF
Flock 1	OPEN SHED	ASSAM	1593	39.0	2816	1.364	1.183	93.7	72.2	496.1
Flock 2	OPEN SHED	ASSAM	1895	37.0	2765	1.357	1.187	92.6	74.7	510.0
Flock 3	OPEN SHED	UTTAR PRADESH	6624	42.0	3308	1.481	1.190	96.5	78.8	513.0
Flock 4	OPEN SHED	UTTAR PRADESH	3000	35.0	1609	1.104	1.191	87.8	46.0	365.7
Flock 5	CLOSED SHED	BIHAR	17953	42.0	3091	1.437	1.195	95.1	73.6	487.1
Flock 6	OPEN SHED	ASSAM	1872	36.0	2618	1.332	1.195	92.4	72.7	504.3
Flock 7	OPEN SHED	UTTAR PRADESH	1579	38.0	2864	1.387	1.195	96.6	75.4	525.1
Flock 8	OPEN SHED	ASSAM	1357	38.0	2728	1.357	1.195	96.2	71.8	508.8
Flock 9	OPEN SHED	ASSAM	1800	37.0	2666	1.345	1.197	96.9	72.1	519.1
Flock 10	OPEN SHED	PUNJAB	2509	35.0	2462	1.300	1.197	93.7	70.3	507.2

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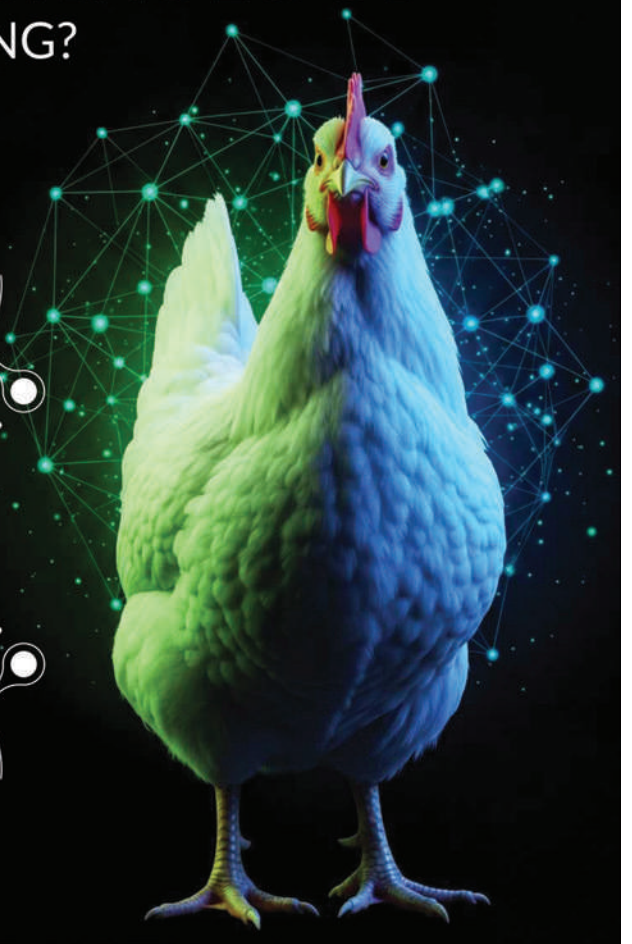

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Article

The Hidden Battlefield Inside Every Bird

Dr. Karthiga K
Product Manager
Nanovet Nutrition Pvt. Ltd.

Every day, a bird faces thousands of invisible challenges. Feed, water, litter, heat stress, vaccination, toxins, bacteria, and environmental pressures continuously interact with the bird's digestive system. Yet despite this constant exposure, healthy birds continue to grow, produce, and perform. The reason is not luck, it is immunity.

For years, immunity was viewed simply as the body's defence system against disease. But modern poultry science now reveals something far more significant: immunity is deeply connected to gut health, nutrient absorption, energy utilisation, stress response, and ultimately, farm profitability.

Interestingly, the battle for immunity does not begin in the blood. It begins in the gut.

The intestinal tract is not merely a digestive organ, it is the largest immune organ in the bird's body. Nearly 70% of immune activity is associated directly or indirectly with the gut environment. Every time feed enters the intestine, the bird must make rapid biological decisions– absorb nutrients, tolerate beneficial microbes, and defend against harmful pathogens simultaneously.

This creates a delicate balancing act.

If immunity becomes too weak, pathogens gain control, damaging the intestinal lining and reducing performance. But if immunity becomes overactive, the bird wastes valuable energy on chronic inflammation rather than growth and production. In both situations, feed efficiency suffers.

That is why modern poultry production is no longer focused solely on killing pathogens, the real challenge is maintaining balance within the gut ecosystem.

Today, producers face increasing pathogen pressure, changing feed ingredients, heat stress, mycotoxins, vaccination stress, and growing restrictions on antibiotic usage. Under these conditions, maintaining gut integrity and controlled immune function has become one of the most critical factors determining performance consistency.

This is also why attention has shifted toward functional nutrition ingredients capable of supporting multiple biological systems simultaneously rather than acting through a single mechanism alone. Researchers are increasingly exploring how specific nutritional components influence microbial balance, intestinal integrity, immune signalling, oxidative stress, and pathogen interaction within the gut.

One particularly interesting area of research involves yeast cell wall components and their interaction with pathogenic bacteria and immune receptors. Scientists now understand that structure and functionality matter greatly. Not all compounds behave biologically in the same way, even when they belong to the same category. The source, processing method, molecular

exposure, and structural configuration can significantly influence how effectively these components interact within the intestinal environment.

Similarly, trace minerals and antioxidant systems are gaining renewed attention for their role in maintaining epithelial integrity, enzyme activation, oxidative stability, and immune resilience during periods of stress. More recently, advances in nano-technology-based mineral delivery systems have further expanded the scope of functional nutrition. Nano-sized trace minerals are being increasingly explored for their improved bioavailability, enhanced cellular interaction, efficient absorption, and ability to support gut integrity, antioxidant defence, and immune performance at lower inclusion levels compared to conventional mineral sources.

The future of poultry nutrition is, therefore, moving towards an integrated approach, one that views the gut, microbiota, immunity, and performance as a single interconnected system rather than separate challenges.

Because in modern poultry production, the question is no longer simply:

"How do we fight disease?"

The real question has become:

"How do we maintain a stable, efficient, and biologically balanced system capable of performing under continuous pressure?"

The answer lies in moving beyond conventional disease management toward a more integrated understanding of gut health, immunity, and nutritional functionality. In modern poultry production, long-term performance will increasingly depend on maintaining biological balance rather than simply reacting to disease challenges.

Ultimately, the future of poultry nutrition will belong to functional nutritional strategies capable of supporting this complex biological network, not by overstimulating immunity, but by helping the bird maintain the right balance at the right time under continuous production stress.

Article

Advanced Summer Stress Management in Broilers



Dr. Sunil Nadgauda
DGM – Technical

Dr. Sanjay Deshpandey
AGM

Dr. Siddhi Velhal
Product Executive

Venkateshwara B. V. Biocorp Pvt. Ltd.

Summer poses a major challenge to broiler production due to elevated environmental temperatures. Heat stress during this period can reduce feed intake, slow growth, suppress immune function, and compromise overall flock health. If not managed effectively, it may lead to poor flock uniformity, increased mortality, reduced productivity, and substantial economic losses. A comprehensive, stage-wise management program is, therefore, essential to sustain performance during hot weather.

1) Brooding Management (0–14 Days)

The brooding phase is the foundation of broiler performance. Strong brooding management supports early chick vitality, better body weight gain, and improved feed efficiency. In summer, chicks are highly sensitive to temperature fluctuations. Excess heat during the first week can quickly cause dehydration, leading to weak chicks, uneven growth, and long-term uniformity issues. Maintaining optimal brooding temperature and comfort is critical.

Key Practices

- **Temperature control:** Maintain target brooding temperatures and monitor chick behaviour for comfort cues (even distribution, active movement, steady feeding and drinking)
- **Ventilation from day one:** Ensure adequate air exchange to remove heat, moisture, and ammonia—without creating direct drafts on chicks
- **Extra floor space:** Compared to cooler seasons, providing slightly more space helps reduce heat build-up and improves chick comfort
- **Chick equipment only:** Use chick feeders and drinkers to ensure easy, continuous access to feed and water
- **Controlled brooding systems:** Electric or gas brooders provide more consistent heat distribution and better regulation than uncontrolled heating methods
- **Avoid overcrowding:** High stocking density intensifies heat stress and reduces access to feed and water.

Early Heat-Stress Signs in Chicks

Watch closely for:

- Panting
- Dullness or lethargy
- Wings spread away from the body
- Reduced feed intake
- Chicks moving away from heat sources and clustering near cooler areas

Immediate Corrective Actions

If stress signs appear:

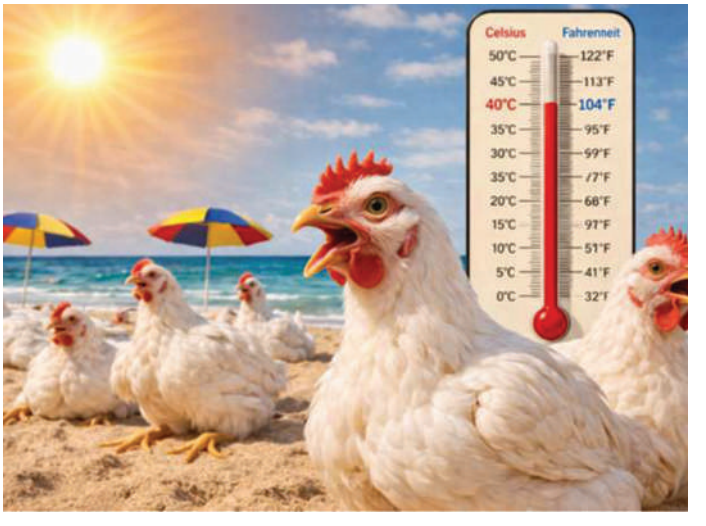
- Increase ventilation and airflow without chilling chicks
- Keep side curtains appropriately open to release trapped heat and ammonia
- Ensure unrestricted access to cool, clean water to prevent dehydration

2) Growing Management (15 Days to Market)

As broilers grow, their ability to tolerate heat declines. Larger birds produce more metabolic heat and are more susceptible to heat stress, making space, resource access, and handling practices especially important.

Key Practices

- **Provide adequate floor space early:** Expand space at the earliest to prevent overcrowding later
- **Resource availability:** Maintain enough feeders and drinkers to reduce competition and ensure uniform intake
- **Improve uniformity:** Separate weak or smaller birds to support growth and reduce stress from competition
- **Schedule stressful activities wisely:** Vaccination and routine procedures should be done during cooler hours (early morning or late evening)
- **Minimise handling of heavy birds:** Higher body weight birds are more vulnerable—avoid weighing, moving, or catching during peak daytime heat to prevent heat exhaustion and mortality



3) Feeding Management

High temperatures reduce feed intake, directly affecting growth rate and feed conversion.

Feeding programs must aim to maximise intake during cooler periods and reduce metabolic heat production during peak heat.

Practical Feeding Strategy

- **Feed during cooler hours:** Offer most of the feed early morning and late evening, when birds are more active
- **Midday feeder management:** During peak heat, feeders may be temporarily lifted or feeding controlled to reduce metabolic heat production and provide birds more resting space
- **Adequate feeder space:** Ensure sufficient feeder access to support uniform consumption across the flock
- **Use structured feeding approaches when needed:** Controlled or phase feeding can help optimise nutrient utilisation and reduce heat load, particularly in high-risk flocks

4) Water Management

Water is essential for thermoregulation and maintaining electrolyte balance during summer.

In heat stress conditions, water intake rises sharply—so quantity, quality, and temperature become critical.

Key Practices

- **Continuous supply:** Ensure 24/7 access to clean, cool water
- **Manual systems:** Replace water multiple times daily to keep it fresh and cooler
- **Nipple systems:** Flush lines regularly to prevent water warming in pipelines
- **Water quality focus:** Low groundwater levels can increase contamination risk. Routine water sanitation and monitoring are essential
- **Acidification:** Water acidifiers can help maintain hygiene by lowering pH and supporting gut health
- **Supportive supplementation:** Electrolytes, probiotics, and Vitamin C through drinking water can improve hydration, reduce oxidative stress, and enhance resilience under heat stress

5) Shed Management

Housing and environmental control can significantly reduce heat load on birds. The goal is to limit radiant heat, improve air exchange, and enhance evaporative cooling where appropriate.

Cooling and Housing Practices

- **Roof insulation:** Use locally available materials (paddy straw, coconut leaves, etc.) to reduce internal temperature
- **Protect water tanks:** Shade external tanks and cover them with wet gunny cloths to prevent water heating
- **Cooling interventions:** Use roof sprinklers, foggers, or misting systems to help regulate shed temperature
- **Wet curtains:** Hang wet gunny curtains along sidewalls to enhance evaporative cooling
- **Reduce direct sunlight:** Ensure proper shed orientation and shading to minimize radiant heat entering during peak hours

Litter and Biosecurity

- Maintain **good litter quality:** Keep litter as dry as possible. Excess moisture increases humidity and ammonia, worsening heat stress and respiratory load
- **Strict biosecurity:** Follow strong biosecurity measures consistently to prevent disease outbreaks, which become more damaging during heat stress periods

Conclusion

Effective summer management in broilers requires an integrated approach across brooding, growing, feeding, water, and shed management. By applying these practical, science-based strategies, producers can minimise heat stress, protect flock health, maintain uniformity, reduce mortality, and sustain consistent performance—even under extreme summer conditions.

Efficacy of PEPIGRO on the Performance of Commercial Broilers Under Field Conditions


Dr. Amit V. Janbandhu
Product Manager-Nutrition
Dr. Sanjay Singhal
Chief Operating Officer
Stallen South Asia Pvt. Ltd

Abstract

This study evaluates the efficacy of PEPIGRO, a Bacillus licheniformis-based probiotic and postbiotics as antimicrobial peptide (AMPs), on the growth and health performance of commercial broilers under field conditions. A total of 36,000 straight-run broiler chicks were assigned to control and treatment groups, with the latter receiving PEPIGRO supplementation at 300 g/ton of feed. The trial was conducted over 42 days during extreme heat (42–45°C), and assessed body weight, feed intake, feed conversion ratio (FCR), weekly gain, and mortality. PEPIGRO supplementation resulted in an 8.18% increase in body weight, a 6.59% rise in feed intake, and a 6.22% improvement in weekly gain compared to the control, alongside a 1.68% enhancement in FCR. Mortality was notably reduced by 28.08%, indicating improved survivability. These findings demonstrate that dietary inclusion of PEPIGRO effectively enhances broiler growth performance, feed efficiency, and health, supporting the role of Bacillus licheniformis as a promising antibiotic alternative under commercial field stressors.

1. Introduction

The widespread use of antibiotics in animal husbandry for growth promotion and disease control has led to serious concerns, including antibiotic resistance and environmental contamination (*Tang et al., 2017*). Consequently, restrictions on antibiotic growth promoters (Organization, 1999) have accelerated the search for safer alternatives. Among these, bioactive feed additives, such as probiotics, antimicrobial peptides, plant extracts, acidifiers, and essential oils—have shown potential in improving growth, immunity, oxidative balance, and gut health (*Xu et al., 2021; Yi et al., 2017; Pearlin et al., 2020; Montassier et al., 2021*).

Probiotics, particularly Bacillus licheniformis, have gained attention due to their safety and multifunctional benefits (*Ningsih et al., 2023*). This spore-forming bacterium enhances nutrient digestion through enzyme production, modulates gut microbiota, suppresses pathogens, and improves immune responses (*Giri et al., 2019*). It also produces antimicrobial compounds and enhances antioxidant activity, contributing to better intestinal integrity and performance (*Jia et al., 2018; Chen and Yu, 2020*).

Necrotic enteritis (NE), caused by Clostridium perfringens, is a major poultry disease causing significant economic losses (*Wade and Keyburn, 2015*). Probiotics like B. licheniformis have demonstrated potential in mitigating NE by improving gut barrier function, modulating immunity, and stabilising microbiota (*Wang et al., 2017; Lin et al., 2017*).

2. Antimicrobial Peptides (AMPs)

Antimicrobial peptides (AMPs) are small, naturally occurring bioactive molecules found in diverse organisms and play a key role in innate immunity as a first line of defence. They exhibit broad-spectrum activity against bacteria, fungi, parasites, and viruses, contributing significantly to host protection (*Huan et al., 2020*).

Antibacterial Substances Produced by Bacillus licheniformis

The endospore-forming bacterium Bacillus licheniformis produces a wide range of antimicrobial compounds with diverse structural and functional properties, typically ranging from 1.4 to 20 kDa. These include bacteriocins, licheniformins, bacitracin, and surfactin (*Shleeva et al., 2023*).

2.1. Bacteriocins

Bacteriocins are ribosomally synthesised antimicrobial peptides or proteins that exhibit bactericidal or bacteriostatic activity against closely related bacteria. Bacillus licheniformis produces various bacteriocins (1.4–55 kDa), influenced by environmental conditions, growth phase, and strain genotype. For example, strain B116 secretes a ~4 kDa bacteriocin active against both Gram-positive and Gram-negative bacteria, including Staphylococcus aureus, Escherichia coli, and Salmonella spp. This compound is heat- and pH-resistant but is inactivated by pronase and partially affected by papain and lipase, suggesting a lipid component (*Shleeva et al., 2023*).

2.2. Licheniformins

Licheniformins are lipopeptide antibiotics produced by Bacillus licheniformis, often occurring as closely related variants. The licheniformin from strain MS3 has a molecular mass of ~1.438 kDa, while the main forms—licheniformins A, B, and C—range from 3.8 to 4.8 kDa with similar amino acid compositions. Despite structural similarity, they differ in antibacterial potency and toxicity due to variations in side chains and lipid modifications (*Shleeva et al., 2023*).

2.3. Bacitracin

Bacitracin is a well-known polypeptide antibiotic non-ribosomally synthesised by certain strains of B. subtilis and B. licheniformis. It is composed of 12 amino acids, with four of them—glutamic acid, aspartic acid, phenylalanine, and ornithine—present in their D-isomer forms. The molecular mass of bacitracin is approximately 1.42 kDa. Bacitracin functions by interfering with bacterial cell wall synthesis, making it a clinically important peptide used to inhibit Gram-positive pathogens (*Shleeva et.al. 2023*).

2.4. Surfactin

Bacillus licheniformis produces cyclic lipopeptides such as surfactin and its analog lichenysin, known for strong surface-active and antimicrobial properties. Strain HSN221 secretes nine variants of these compounds under optimal culture conditions (glucose, ammonium chloride, and yeast extract). The surfactin monomethyl ester homologues have molecular masses of ~1.048–1.063 kDa (ESI-MS) and exhibit potent antimicrobial and emulsifying activities with applications in pharmaceutical, agricultural, and environmental biotechnology (*Shleeva et al., 2023*).

3. Mechanism of Action

Bacillus linchiniformis promote gut health through complementary competitive and immunological mechanisms. First, they competitively exclude pathogens by adhering to intestinal mucosa, thereby occupying ecological niches and preventing pathogen attachment and invasion. They also compete for nutrients by secreting extracellular enzymes that efficiently utilise available macro- and micronutrients, limiting resources required for pathogenic growth. In addition, Bacillus produces antimicrobial metabolites, including lipopeptides, bacteriocins, polyketides, and short-chain fatty acids (SCFAs), which directly inhibit pathogenic microorganisms. Furthermore, oxygen consumption by Bacillus reduces intestinal oxygen levels, creating a favourable hypoxic environment for beneficial anaerobic and fermentative bacteria such as lactic acid bacteria.

Simultaneously, antimicrobial peptides (AMPs) contribute to host defence through direct antimicrobial and immunomodulatory activities. AMPs regulate cytokine and chemokine production and modulate immune cells, including macrophages, dendritic cells, and lymphocytes, maintaining immune homeostasis. Mechanistically, AMPs disrupt microbial membranes via barrel-stave, carpet, or toroidal pore-forming models, leading to membrane destabilisation and lysis. Additionally, they can penetrate cells and inhibit intracellular processes such as nucleic acid and protein synthesis, enzyme activity, and cell wall formation, thereby ensuring effective pathogen clearance and enhanced innate and adaptive immune responses.

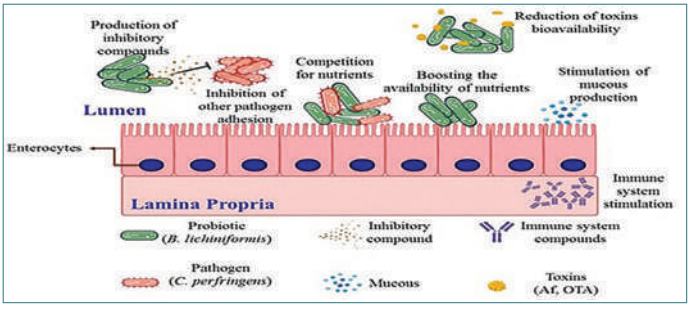


Fig.1: Probiotic Bacillus employs multifactorial competition mechanism to restrict the expansion of pathogens through four pathways

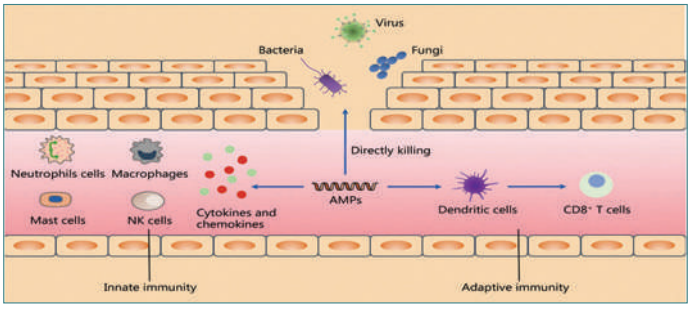


Fig. 2: Models of antibacterial mechanisms of AMPs

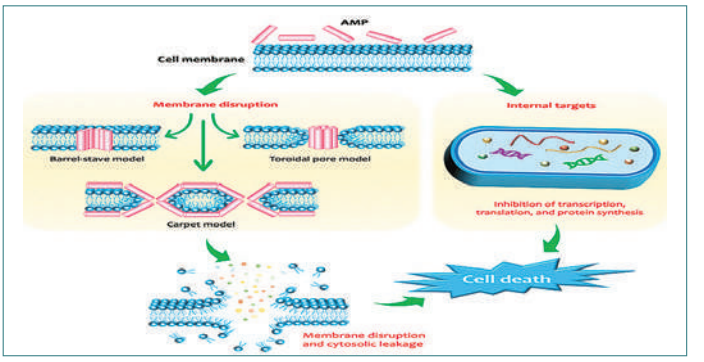


Fig. 3: The membrane-disruptive and non-membrane-disruptive antibacterial mechanisms of antimicrobial peptides (AMPs)

4. Materials and Methods

4.1. Experimental Design and Management

The trial was conducted at Harsh Broiler House -Bilaspur using Vencobb 430 straight run chicks (not sexed at hatchery) in three treatments of around 12000 birds in each treatment. A total of 36000 birds were considered for trial purpose. Feed Formulation used was same for all treatment groups except in T3 where PEPIGRO (Bacillus lincheniformis $3*10^9$) was added at 300 gm per ton feed respectively in all stages. (Table.1). In the study, the energy level was equivalent to the standard requirements of broilers recommended in the Vencobb 430. The trial was carried out over a period of 42 days. The birds were fed ad lib feed and water was available all the time. Care was taken to provide good conditions by adopting strict biosecurity measures. The housing and vaccination procedures were same in both groups.

Broiler Feed Formulation (Control)			
Raw Materials	Pre-starter	Starter	Finisher
Maize	625.15	652.75	686.65
HiPro Soya	335	300	260
Soya Crude Oil	6	14	23
Limestone Powder	8.5	8.5	8
Dicalcium Phosphate	10	10	8
L Lysine HCl	2.7	2.4	2.3
DL Methionine	3.3	3	2.7
L Threonine	1	1	1
Salt	2.5	2.5	2.5
Soda Bi Carb	1.5	1.5	1.5
Choline Chloride 60%	1	1	1
Organic TM	0.5	0.5	0.5
Broiler Vitamin Premix	0.5	0.5	0.5
Coccidiostat	0.5	0.5	0.5
AGP	0.05	0.05	0.05
NSP Enzyme	0.1	0.1	0.1
Phytase 5000	0.1	0.1	0.1
Feed Acidifier	1	1	1
Toxin Binder	0.6	0.6	0.6

Table 1. Composition of basal diet for broiler chicks in control group for 3 phases

The premix provided the following per kilogram of the diet: vitamin A, 6000 IU; vitamin D3, 2500 IU; vitamin B1, 1.75 mg; vitamin B2, 5.5 mg; vitamin B6, 4 mg; vitamin B12, 0.18 mg; vitamin E, 25 mg; vitamin K3, 2.25 mg; Cu, 7.5 mg; Mn, 60 mg; Fe, 75 mg; Zn, 60 mg; Se, 0.15 mg; biotin, 0.14 mg; NaCl, 3.7 g; folic acid, 0.8 mg; pantothenic acid, 12 mg; phytase, 400 U; nicotinic acid, 34 mg; chloride, 350 mg. *Nutrient levels were all calculated values.

4.2. Treatment Details

T1: Control group fed basal diet
T3: Control group fed basal diet + PEPIGRO @300 g PMT

4.3. Parameters Studied

1. Body Weight gain was recorded weekly
2. Feed Consumption recorded daily and leftover feed was adjusted in the other day quota to know actual intake.

3. Mortality was recorded daily
4. EEF calculated post harvesting of the flock
5. FCR was calculated every week and post harvesting of the flock.

5. Result

Effect of Pepigro on growth performance parameter in broiler.

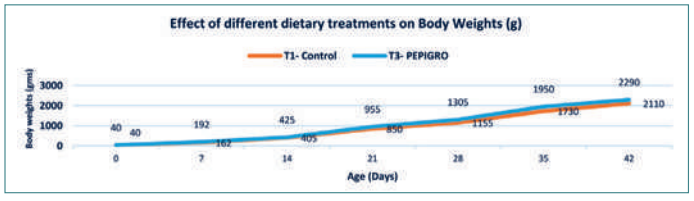


Fig. 4: Effect of different dietary treatments on Body Weights (g)

Conclusion: *PEPIGRO supplementation at 300g/ton of feed (T3) resulted in a statistically significant 8.18% increase in broiler body weight compared to the control (T1), indicating improved growth performance.*

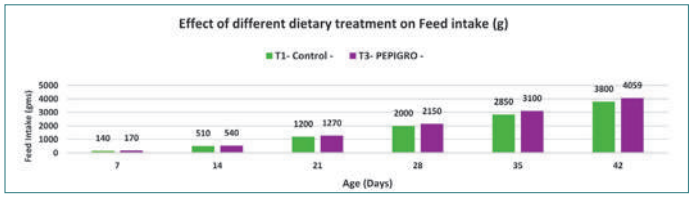


Fig. 5: Effect of different dietary treatment on Feed intake (g)

Conclusion: *The broiler supplemented with PEPIGRO (T3) at 300g/ ton of feed had a feed intake of 4059 g, which is 6.59% higher than the control group (T1) with 3800 g feed intake. This increase in feed intake indicates that PEPIGRO supplementation positively influenced the birds' feeding behaviour, likely by enhancing the palatability or nutrient availability of the diet.*

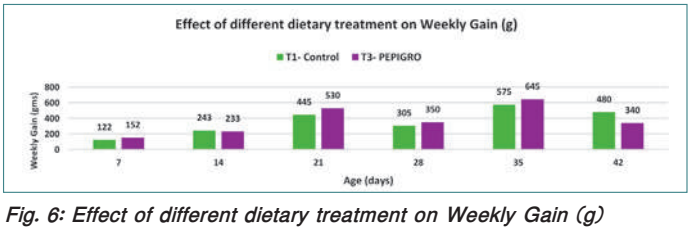


Fig. 6: Effect of different dietary treatment on Weekly Gain (g)

Conclusion: *PEPIGRO (T3) supplementation in broiler diet at 300g/ton of feed resulted in the average percentage difference in weekly gain between T1 (Control) is approximately 6.22%. This indicates that PEPIGRO supplementation had a positive overall effect on growth performance, enhancing weight gain efficiency in broiler chickens.*

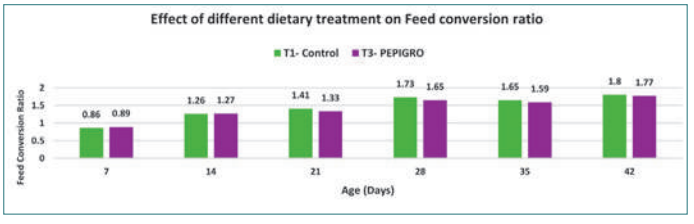


Fig. 7: Effect of different dietary treatment on Feed conversion ratio

Conclusion: *PEPIGRO (T3) supplementation in broiler diet at 300g/ton of feed resulted in a 1.68% improvement in feed conversion ratio (FCR) compared to the control group (T1), indicating enhanced feed efficiency and better growth performance.*

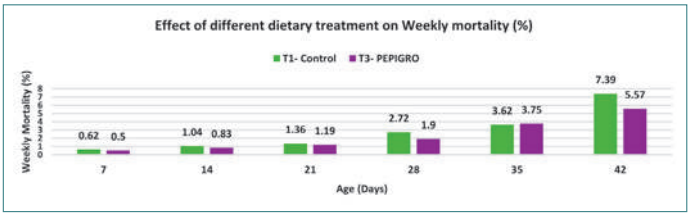


Fig. 8: Effect of different dietary treatment on Weekly mortality (%)

Conclusion: *PEPIGRO supplementation at 300g/ton of feed reduced mortality in broiler poultry from 7.39% in the control group to 5.57%, reflecting a 28.08% decrease. This suggests that PEPIGRO may contribute to improved bird health and survivability during the rearing period.*

Parameters	T1- Control	T3- PEPIGRO	% Difference
Body Weight (g)	2110	2290	8.18
Feed Intake (g)	3800	4059	6.59
FCR	1.8	1.77	1.68
CFCR	1.77	1.69	4.62
Mortality (%)	7.39	5.57	28.08

Table 2. Summary of the Report

6. Discussion

The discussion for this article highlights the significant positive effects of PEPIGRO, a Bacillus licheniformis-based probiotic, on the growth performance, feed efficiency, and health status of commercial broilers under field conditions. The 8.18% increase in body weight and 6.59% increase in feed intake, along with improvements in feed conversion ratio (FCR), align well with previous studies showing Bacillus probiotics enhance nutrient digestibility, modulate gut microbial populations, and improve intestinal morphology (*Pan et al., 2022; Hung et al., 2019*). These effects are especially valuable in the context of rising restrictions on antibiotic growth promoters (*Tang et al., 2017*), pushing for safer and sustainable alternatives.

The notable 28.08% reduction in mortality observed in this study suggests enhanced resilience of broilers to environmental stressors, likely owing to improved gut barrier integrity and immune modulation. Bacillus licheniformis produces antimicrobial peptides, enzymes, and metabolites such as bacteriocins and surfactins that inhibit pathogens like Clostridium perfringens, a major agent of necrotic enteritis (NE) in poultry (*Shleeva et al., 2023; Wade and Keyburn, 2015*). PEPIGRO's capacity to maintain intestinal health and microbial balance may underlie the reduced pathogenic infections and inflammation, consistent with findings that show Bacillus supplementation upregulates tight junction proteins and mucins while enhancing beneficial microbes like Lactobacillus (*Chen and Yu, 2020; Wang et al., 2017*).

Moreover, the probiotic's ability to stimulate the host immune system by inducing cytokine production and activating phagocytic cells further supports its protective role in the gut environment (*Babakuliyev et al., 2022*). This immunomodulatory effect is critical for mitigating subclinical infections and improving overall flock welfare, which translates into better productivity under commercial rearing conditions.

Additionally, PEPIGRO contributes to antioxidant status improvement by elevating enzyme activities such as superoxide dismutase and glutathione peroxidase, reducing oxidative stress that commonly compromises poultry health under heat stress conditions (*Jia et al., 2018*). This antioxidant benefit complements its antimicrobial and immunomodulatory functions.

In conclusion, this study reinforces the role of Bacillus licheniformis as a multifunctional probiotic that enhances growth

performance, feed efficiency, and health in broilers. It offers a sustainable alternative to antibiotics, aligning with global efforts to reduce antibiotic use in animal production. Future studies should explore optimal dosing strategies, combinations with other feed additives, and long-term effects on microbiota composition and immune function to fully harness the benefits of PEPIGRO in commercial poultry systems.

7. Conclusion

The trial was conducted in the extreme heat season where average temperature in the surrounding was around 42-45 degree Celsius. The T3 (PEPIGRO) group showed notable improvements compared to the T1 (Control) group. Body weight in T3 (PEPIGRO) increased by 8.18% compared to T1 (Control), indicating better growth performance. Both Feed Conversion Ratio (FCR) and Corrected Feed Conversion Ratio (CFCR) in T3 (PEPIGRO) improved, showing reductions of 1.68% and 4.62%, respectively, compared to T1 (Control), indicating more efficient feed utilisation. Additionally, mortality rate in T3 (PEPIGRO) decreased significantly by 28.08% compared to T1 (Control), reflecting better overall health and survival.These results suggest that PEPIGRO supplementation positively impacts growth, feed efficiency, and mortality compared to Control.

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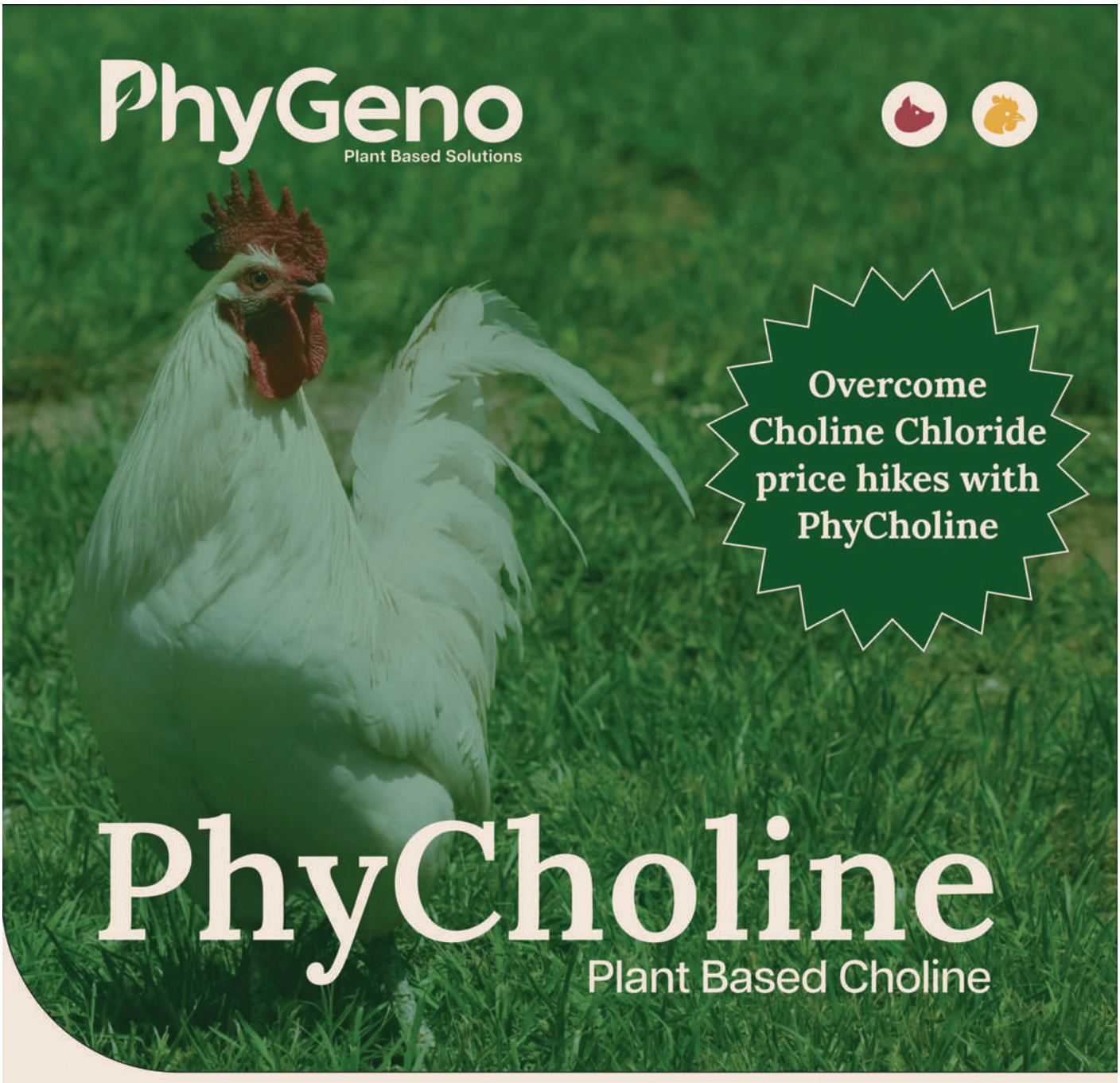

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IPEMA-Poultry India Celebrates World Veterinary Day 2026

On 24th April IPEMA-Poultry India participated in and supported the World Veterinary Day 2026 celebrations organised in collaboration with the Department of Poultry Science, College of Veterinary Science (CVSc), Rajendranagar, Hyderabad.

The event revolved around the global theme, "Veterinarians: Guardians of Food and Health" and was graced by Chief Guest, Dr. M. Gnana Prakash, Honourable Vice Chancellor, and Guest of Honour Dr. M. Udaya Kumar. Uday Singh Bayas, President, IPEMA-Poultry India, attended the event as Special Guest, reaffirming the industry's commitment to fostering stronger academia-industry partnerships and advancing veterinary education and research.

Held under the chairmanship of Dr. R.M.V. Prasad, the event brought together eminent academicians, industry experts, faculty members, students, and poultry professionals for an insightful and engaging technical session.

In his address, Uday Singh Bayas underlined the critical role played by veterinarians in ensuring food safety, public health, and consumer awareness. He stressed the importance of closer collaboration between academia and industry, appreciated the enthusiastic participation of students, and highlighted the need to address misconceptions surrounding poultry consumption and nutrition through scientific communication.

IPEMA-Poultry India felicitated the top five winners of the elocution competition organised ahead of the event. The competition, themed "Poultry Products and Lifestyle Diseases: Myths, Facts, and Veterinary Insights," encouraged students to develop scientific perspectives and effective communication skills on issues relevant to the poultry and veterinary sectors.

The technical session featured prominent experts from the poultry industry who shared valuable insights into career opportunities and emerging trends in the sector.

Dr. Mujeeb Ather, Senior Poultry Consultant, delivered an informative presentation on the growth and future potential of the Indian poultry industry, offering practical guidance and motivation to aspiring veterinarians and poultry professionals.

Dr. Srinivas Rama Raju spoke on entrepreneurial opportunities and consultancy prospects within the poultry sector, encouraging students to explore innovative and diverse career pathways.

The celebration served as a meaningful platform to recognise the indispensable contribution of veterinarians to food safety, animal health, and sustainable poultry production, while inspiring the next generation of veterinary and poultry professionals.

NATIONAL

Vantara University to "Create Legends" in Wildlife Science, says Anant Ambani

In a significant announcement blending philanthropy, science, and ambition, Anant Ambani laid out an expansive global vision for wildlife conservation and veterinary sciences at the foundation stone ceremony of Vantara University in Jamnagar.

Speaking at the event, the Reliance Industries Executive Director emphasised that the institution aims to become a transformative force in the global wildlife ecosystem. "Team Vantara is trying to create a legacy that will not only serve the current purpose of wildlife but will be a legacy that will serve the world for the next thousands years," Ambani said.

"This University will, every year, give out top-class veterinarians not only to India but to the entire world. We will give out scientists not only to India but to the entire world," he added.

Positioned as the world's first integrated global institution dedicated to wildlife conservation and veterinary sciences, Vantara University expands Anant Ambani's existing Vantara initiative, which operates a large-scale animal rescue and rehabilitation centre in Jamnagar.

Ambani underscored the university's long-term aspirations, saying, "This University is going to create legends for the wildlife field in the up-coming years. We will be the best University, the most dynamic, the most advanced in the world."

With its ambitious blueprint, Vantara University aims to position India as a global hub for wildlife research, conservation, and veterinary excellence.

IPR Knowledge Review at Lucknow Drives Discussion on Modern Layer Farming

On 9th May Lucknow witnessed an engaging gathering of poultry industry stakeholders, veterinarians, nutritionists, policymakers, and progressive layer farmers during the latest edition of the IPR Knowledge Review seminar, organised on the theme "Modern Layer Management Strategies for Improved Productivity." The seminar was conducted in collaboration with Kukkut Vikas Samity.

Guest of Honour Mukesh Kumar Meshram IAS, Additional Chief Secretary, Government of Uttar Pradesh, spoke extensively about the various initiatives and policy interventions introduced by the Government of Uttar Pradesh for the welfare and growth of poultry farmers, particularly layer farmers. He highlighted several government schemes aimed at strengthening poultry infrastructure, improving access to finance, encouraging entrepreneurship, promoting food processing, and supporting value-added poultry businesses across the state. Stressing the immense growth potential of the sector in Uttar Pradesh, he urged progressive poultry farmers and industry stakeholders to actively utilise these schemes and incentives to modernise their operations, improve productivity, and build sustainable and profitable enterprises. He further emphasised that stronger participation from farmers would play a crucial role in transforming Uttar Pradesh into a leading poultry-producing state in the country.

IPR Knowledge Review

Guest of Honour, Devendra Pandey IAS, Special Secretary, Governmnet of Uttar Pradesh emphasised that while alternatives and opportunities exist within the poultry sector, long-term success will depend on organised growth, cooperative efforts, and sustainable business practices. He highlighted the importance of leveraging government support schemes, including

capital subsidies and infrastructure incentives, to strengthen the industry and improve profitability. Mr. Pandey stressed on transforming poultry farming from traditional operations into professionally managed, market-oriented enterprises driven by smart management and efficient supply chains. He noted that sustainability should not remain merely a fashionable term, but must become a practical business approach focused on consistent productivity and profitability. Mr. Pandey further underlined the need for stronger producer organisations and cooperative movements within the poultry sector. According to him, individual farmers cannot fully realise market potential alone; collective action is essential to build stronger market linkages, improve bargaining power, stabilise supply chains, and effectively manage demand-supply fluctuations.

In his Keynote Address, Prof. (Dr.) P. K. Shukla, President, Indian Poultry Science Association & Professor and Head, Department of Poultry Science, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura, said that the poultry sector in Uttar Pradesh is emerging as a major growth driver for the state's agricultural economy, supported by rising demand, increasing investment, and proactive government initiatives. He highlighted that the poultry population in the state has increased nearly eleven-fold over the past five years, largely due to the establishment of commercial layer units and expanding consumer demand. Despite being one of India's largest consumption markets, Uttar Pradesh currently produces only 1.5 to 2.2 crore eggs daily against a demand of nearly 4 to 5.5 crore eggs, resulting in heavy dependence on imports from other states. The state contributes only 4–5% of India's egg production, indicating significant scope for expansion. Prof. (Dr.) Shukla identified key



challenges including high feed costs, fluctuating market prices, inadequate infrastructure, disease outbreaks, and weak institutional support. However, rapid urbanisation, rising incomes, nutritional awareness, and growing protein consumption are creating strong opportunities for the poultry industry. He highlighted that government policies offering subsidies, infrastructure support, and incentives for processing and investment were major enablers. He emphasised the need for better biosecurity, vertical integration, feed security, and value-added processing to strengthen the sector. Prof. (Dr.) Shukla concluded by saying that with collaborative efforts and supportive policies, Uttar Pradesh can emerge as one of India's leading poultry-producing states.

Dr. Shirish Nigam, Chairman INFAH, Subcommittee on Public Policy & Advocacy and Member CII – AMR Task Force emphasised the importance of building a "future-ready" poultry sector. Drawing from over three decades of experience in the poultry and animal health industry, he highlighted that sustainable profitability in layer farming depends not only on production, but also on consistency, efficiency, biosecurity, gut health, water quality, and customer-focused practices. He stressed the need for technology adoption, responsible antibiotic use, disease prevention, and data-driven management to meet future market and regulatory demands. Dr. Nigam also underlined the importance of One Health, integrating animal, human, and environmental health, while encouraging farmers to focus on branding, quality assurance, and consumer trust to ensure long-term industry growth and global competitiveness.

The seminar also featured insightful addresses from several distinguished industry experts and technical specialists, including:

Dr. Rakesh Kumar Gupta General Manager (Technical) Venkateshwara Hatcheries Pvt. Ltd.	The Path to 100 Weeks Layers: Some Important Milestones
Mr. Tommy Lim Product Manager, Climate Solutions & Sales Manager, India Big Dutchman	Ventilation Control and Digitalisation in Modern Farming
Dr. Nirmal Basnet Asst. General Manager - Technical Service (Pan India) Japfa Comfeed India	Strong Start, Strong Lay: Role of Robust Pullets in Layer Success
Mr. Makkena Saiteja Senior Sales Manager (South) Big Dutchman	Smart Housing Systems – Sustainable Layer Production with Innovative Manure Handling Solution
Mr. Rulesh S. Kherde Managing Director Yaashvan Veterinary Services	Water Health - A Pillar of Sustainable Poultry Farming

IPR Knowledge Review once again reinforced the importance of continuous learning, innovation, and collaboration in driving the future growth of India's poultry sector. With increasing focus on productivity, sustainability, and technology adoption, the event highlighted how modern layer management strategies can play a crucial role in strengthening profitability and ensuring long-term industry resilience.

EW Nutrition Celebrates Veterinary Fraternity on World Veterinary Day

To celebrate the vital role played by veterinarians in ensuring animal health, food safety and sustainable livestock production, EW Nutrition organised "Samman Sandhya" on 23rd April at New Delhi, coinciding with World Veterinary Day. The gathering witnessed participation from industry leaders, veterinarians, and stakeholders across the poultry and animal nutrition sectors.

The evening was graced by the presence of dignitaries like Dr. Tarun Shridhar, Prof. (Dr.) P. K. Shukla, Dr. Pankaj Kumar Singh, Uday Singh Bayas, Ranpal Dhanda, Sanjeev Gupta, Ranveer Singh Sandhu, Dr. Sharad Kumar Singh and Dr. N. K. Mahajan.

Speaking on the occasion, Dr. Shirish Nigam, Managing Director – South Asia, E W Nutrition emphasised the importance of continued collaboration and innovation within the veterinary ecosystem.

Dr. Tarun Shridhar, Director General, Indian Chamber of Food and Agriculture and former Secretary, Ministry of fisheries, Animal Husbandry and Dairying, Government of India said that the veterinary profession must not remain an exclusive domain limited only to degree holders. Organisations such as the National Academy of Veterinary Sciences and other professional bodies add immense value to the profession by expanding its vision and influence beyond academic qualifications. Veterinarians today must see themselves not merely as holders of veterinary degrees, but as key contributors to a much larger ecosystem that supports public welfare. Referring to the theme highlighted by the World Veterinary Association, Dr. Shridhar emphasised the systemic role of veterinary services in safeguarding food safety, food security, public health, and animal health worldwide. The sequence itself is important: animal health is protected not in isolation, but as part of ensuring safe food, nutritional security, and better public health for humanity. According to him, the World Veterinary Association further underlines that veterinarians stand at the frontline of ensuring that food of animal origin is safe, nutritious, and responsibly produced. Their work protects consumers, strengthens sustainable food systems, prevents zoonotic diseases, and enhances global health security. He added that in essence, veterinarians are not just animal doctors — they are guardians of human food and nutrition security. He urged veterinary professionals to project themselves as protectors of human health and nutrition rather than limiting their identity







to animal treatment alone. He also encouraged the profession to involve more advocates and ambassadors from outside the sector to strengthen awareness and appreciation of livestock, dairy, poultry, and animal agriculture. Such outreach, he noted, would be one of the greatest services to the profession and would reinforce its critical role in society.

Addressing the gathering, Prof. (Dr.) P.K. Shukla, President, Indian Poultry Science Association & Professor and Head, Department of Poultry Science, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura said that looking ahead, veterinarians will play an increasingly critical role, not only in protecting animal health, but also in safeguarding global public health. Diseases of animal origin continue to emerge, and out of nearly a million viruses believed to exist in nature, humanity has identified only around 2,000 so far. This means a vast knowledge gap still remains, and veterinarians will have an even greater responsibility in the years ahead.

At the same time, advances in science and technology have transformed food production systems. What was once produced on a small scale is now produced on a massive scale, and the same is true for livestock and livestock products. Earlier, the focus was primarily on increasing production volume and improving productivity but now the time has come to shift focus toward quality and safety. Prof. Shukla added that in the current scenario food security alone is not enough; food safety has become equally important. In this context, veterinarians are the true custodians of the livestock industry and guardians of public health. Their role is central to ensuring safe, sustainable, and responsible food systems. He went on to say that from a broader scientific perspective, every veterinarian also understands the importance of maintaining genetic diversity within animal populations. Selection and breeding are essential, but without a broad genetic base, populations become vulnerable to random genetic drift and extreme outcomes. Sustainable progress, therefore, depends on balancing selection pressure with genetic diversity.

The evening concluded on a note of gratitude and renewed commitment to the veterinary profession and its expanding role in society. The event served as a powerful reminder that veterinarians today stand at the intersection of animal health, human wellbeing, and sustainable development.

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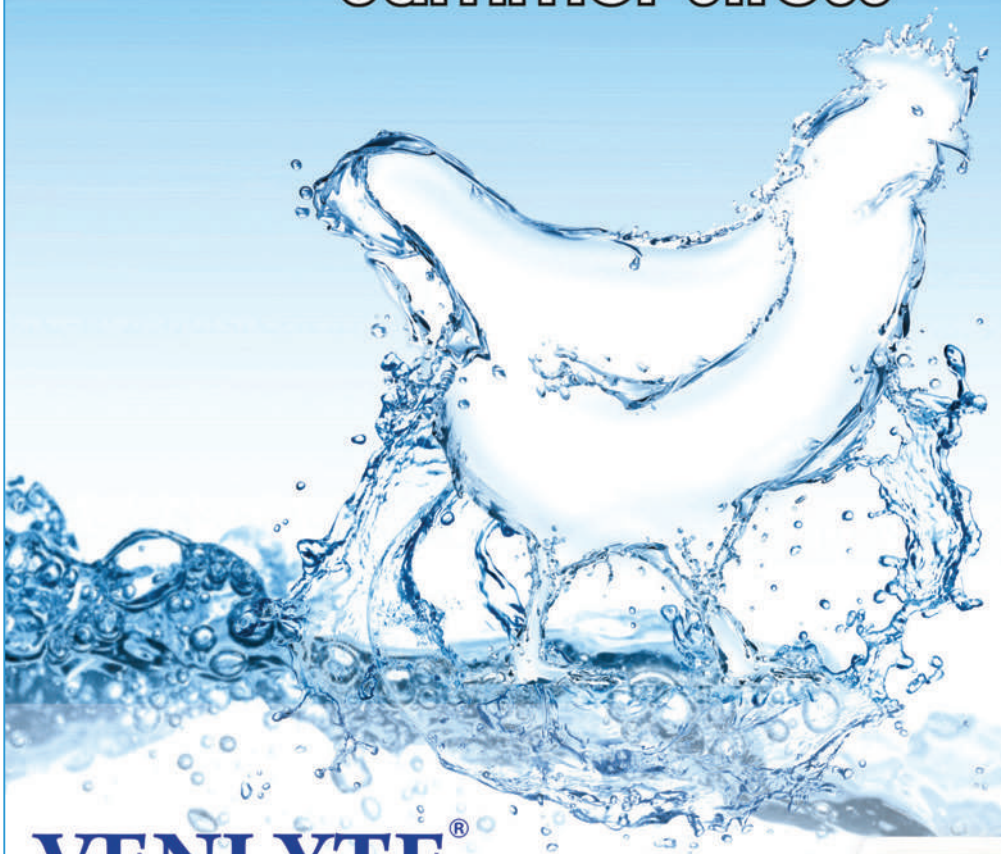

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VENGEM Debuts in Nepal

Low Pathogenic Avian Influenza (LPAI) H9N2 continues to inflict substantial economic losses on the global poultry industry. In Nepal, the G1-W lineage of H9N2 has become increasingly prevalent, posing a serious and sustained threat to poultry health and productivity. While commercial H9N2 vaccines are available internationally, their field performance in Nepal has often been inconsistent. This is largely due to antigenic mismatch between imported vaccine strains and locally circulating viruses, resulting in suboptimal protection and a higher risk of vaccine failure.

Addressing this critical gap, Ventri Biologicals has introduced its indigenously developed H9N2 vaccine in Nepal. The vaccine, successfully deployed in India since December 2024, has already demonstrated strong outcomes in improving respiratory disease control, reducing economic losses, and supporting farmer livelihoods.

The vaccine technology was developed by ICAR-National Institute of High Security Animal Diseases (NIHSAD), Bhopal, specifically to tackle antigenically diverse H9N2 strains prevalent in the region. Through a government-facilitated technology transfer, the "Inactivated Low Pathogenic Avian Influenza (H9N2) Vaccine for Chickens" was licensed to Venkateshwara Hatcheries Pvt. Ltd., with support from Agrinnovate India Ltd. Ventri Biologicals further strengthened this initiative by establishing a state-of-the-art Biosafety Level-3 (BSL-3) manufacturing facility, equipped with advanced automation across production stages—from embryo inoculation to final formulation and packaging. Marketed under the brand name "VENGEM," the vaccine represents a strategic solution to enhance flock immunity against H9N2..

To support adoption, awareness programs were conducted in Kathmandu and Chitwan on 6th and 8th April. The sessions, led by Dr. Prakash Reddy, highlighted effective disease control strategies and the role of VENGEM in mitigating LPAI-related losses. The events also featured contributions from Chita Sahoo, Dr. Sambhaji Nimbalkar, and Jivan Kunwar.

The launch of VENGEM marks a significant step forward in strengthening Nepal's poultry disease management framework, offering a locally relevant and scientifically robust solution to a persistent industry challenge.

Highlights 2025

- 550+ EXHIBITORS
- 35,000 +sqm2 Display Area
- 50+ Global Companies
- 20+ Associations (Indian)
- 51,251 Visitors
- 20+ Associations (Global)

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UP Poultry Conclave 2026 Highlights Innovation, Inclusion, and Rural Empowerment

The Uttar Pradesh Poultry Conclave 2026 was organised on 15th and 16th April at Indira Gandhi Pratishthan, Lucknow, bringing together policy, industry, and grassroots stakeholders under the unifying theme "Poultry to Progress." Hosted by the Department of Animal Husbandry, Government of Uttar Pradesh with support from IPEMA – Poultry India, the two-day event drew over 2,500 participants, reflecting the growing strategic importance of poultry in the state's agri-economy.

The conclave opened with a ceremonial lamp lighting attended by key dignitaries, including Prof. S. P. Singh Baghel, Union Minister of State; Shri Dharampal Singh, Minister for Animal Husbandry & Dairy Development; and Shri Dinesh Pratap Singh, Minister for Horticulture & Food Processing, signalling strong commitment to the sector.

Uday Singh Bayas, President, IPEMA – Poultry India highlighted the immense growth potential of India's poultry sector, emphasising its role in nutrition security, rural employment, and economic development. He acknowledged the Government of Uttar Pradesh and the leadership of Hon'ble Chief Minister Yogi Adityanath for advancing agriculture and allied sectors. Mr. Bayas showcased the global scale of Poultry India Expo, with over 50,000 visitors, participation from 50+ countries, and 500+ exhibitors, reinforcing its position as South Asia's leading poultry platform. He also advocated for wider inclusion of eggs ("Pakshiphal") in welfare programs to address malnutrition and emphasised the sector's strong CAGR growth trajectory.

Deliveriing the Keynote Address, Prof. S. P. Singh Baghel offered a pragmatic roadmap for unlocking Uttar Pradesh's poultry potential. He stressed the importance of backyard poultry in empowering rural households and women, while calling for



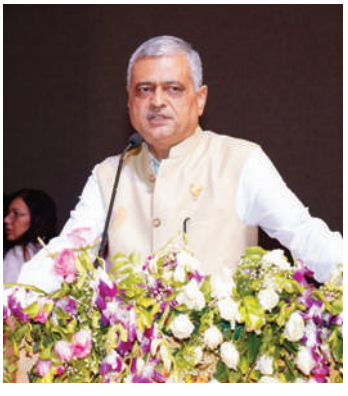
increased scientific awareness, innovation, and solutions to persistent challenges such as feed costs and disease control.

The conclave featured a comprehensive mix of policy dialogue and technical exchange, including:

- Inaugural sessions featuring senior government leadership and industry stakeholders
- Technical sessions on market linkages, financing, policy support, and backyard poultry
- Focus on rural empowerment, skill development, and entrepreneurship
- Investors' Summit highlighting emerging opportunities in the poultry sector
- Sessions on sustainability, poultry waste management, and antibiotic-free production
- Book release showcasing success stories of poultry entrepreneurs
- Recognition of progressive farmers and sector contributors

A notable moment was the curtain raiser for the 18th Poultry India Expo 2026, marking anticipation for one of the region's most significant industry gatherings.

The success of the conclave underscores the value of collaborative platforms in shaping sectoral progress. With continued alignment between government initiatives and industry participation, Uttar Pradesh is poised to play a defining role in India's poultry growth story.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VIP Hosts National Press Conference

On the eve of World Veterinary Day, Vets in Poultry (VIP) organised a press conference in New Delhi, 24th April on the theme, "Chicken & Eggs: Fiction Vs Facts – Setting the Record Straight."

The initiative was designed to counter misinformation, highlight evidence-based insights, and promote informed public discourse on the nutritional and economic significance of poultry. According to VIP, the press conference is part of a broader effort to strengthen awareness about the poultry industry's contributions while ensuring that facts prevail over myths.

In his opening address Dr. Santosh Ire, Secretary, VIP highlighted the immense responsibility of the poultry and nutrition sector in ensuring protein sufficiency for India's 1.4 billion people. He noted that despite the scale of the challenge, the industry continues to provide affordable and accessible nutrition, commending poultry producers for their outstanding contribution to food security and public health.

Dr. Ajay Deshpande, President, VIP, said that the event marked the beginning of a meaningful conversation around facts, science and nutrition. He outlined the three core objectives of VIP – to encourage veterinarians to become entrepreneurs and employers, promote awareness about the nutritional importance of chicken and eggs and to collaborate with industry associations and contribute valuable inputs to government policy-making related to animal health, vaccine imports, disease control and the overall development of the poultry sector. Highlighting the importance of protein in human nutrition, he explained that while the body can store fats and carbohydrates, it cannot store protein, making regular protein intake essential for children, adults, and the elderly alike. Eggs and chicken, therefore, play a critical role in addressing India's nutritional challenges.

Uday Singh Bayas, President, IPEMA-Poultry India congratulated VIP for taking the initiative of organising the press conference to highlight the importance of eggs and chicken in addressing the protein deficiency issue of the country. He

also said that through various activities Poultry India is also trying to promote chicken and egg consumption across the country.

Dr. Jeevan Sonwane, Dr. Anurag Jena, Dr. Surinder Jangir and Nawab Akbar Ali also addressed the gathering.

The highlight of the press conference was the presentation by Dr. Anju Deshpande titled, "Chicken & Eggs – Fiction Vs Facts : Setting the Record Straight.

The final talk of the day was by Dr. Pinky Dalal of AIIMS wherein she spoke about the nutritional value of eggs and debunked health myths surrounding the consumption of eggs.

VIV Select India 2026 Marks Powerful Debut

The inaugural edition of VIV Select India 2026 was organised from 22nd to 24th April at Yashobhoomi Convention and Expo Centre, Dwarka, New Delhi positioning itself as a new business and knowledge platform for the country's rapidly expanding animal protein and livestock industry. Organised by VNU Exhibitions Europe in partnership with Poultry Federation of India (PFI), the expo brought together key stakeholders from across the poultry, dairy, animal health, feed, breeding, processing, aquaculture, and agri-tech sectors.

According to the organisers, the show attracted more than 7,100 professional visitors from 37 countries, alongside 130 exhibitors representing companies from India, Europe, Asia, the Middle East, and South America. Spread across a 10,000 sqm exhibition area, the event showcased technologies and solutions spanning precision farming, hatchery automation, feed additives, animal nutrition, biosecurity, processing systems, digital monitoring, and AI-enabled livestock management.

The inauguration ceremony was attended by senior government officials, diplomats, and industry leaders including H.E. Marisa Gerards, Ambassador of the Netherlands Embassy in India, Nepal & Bhutan; Jeroen van Hooff, President and CEO, Royal Jaarbeurs and VNU Group; Mahipal Dhanda, Hon'ble Education Minister, Government of Haryana; Ranpal Dhanda, President, Poultry Federation of India; Dr. S.K. Dutta, Joint Commissioner (NLM), Department of Animal Husbandry and Dairying, Government of India. Dr. Jeetendra Verma moderated the inauguration ceremony.

A major attraction of the event was its comprehensive conference programme, which focused on key developments shaping the future of poultry and livestock production in India. Technical sessions during the first two days covered advances in poultry production, biologicals and vaccines, animal nutrition, dairy technologies, processing efficiency, and the integration of automation and artificial intelligence into livestock management systems.

"The response from the Indian industry to this first edition has been something we are genuinely proud of. Producers, integrators, technology providers and policymakers came together with a


shared intent: to exchange, to learn, and to build. What we saw on this show floor gives us every confidence that this platform will grow into something of lasting value for the sector," said Patrick van Rooij, Project Manager of VIV Select India.

As PFI President Ranpal Dhanda noted ahead of the show, the collaboration is designed to help Indian producers access cutting-edge technologies and international best practices, while showcasing India's productionpotential to the global community — a two-way exchange the inaugural edition actively delivered upon.

The partnership between VIV Worldwide and the Poultry Federation of India played a central role in shaping the event's strategic direction. The collaboration aims to create stronger global connections for Indian producers while also enabling international companies to better understand the scale and potential of the Indian market.

"VIV Select India 2026 has exceeded all expectations and delivered a quality show which the Indian animal protein industry was looking for many years. There were quality visitors, an excellent atmosphere to discuss business opportunities and moreover, attendees from India and abroad, " reflected Rajeevan Vattakat, VIV Worldwide representative in India.

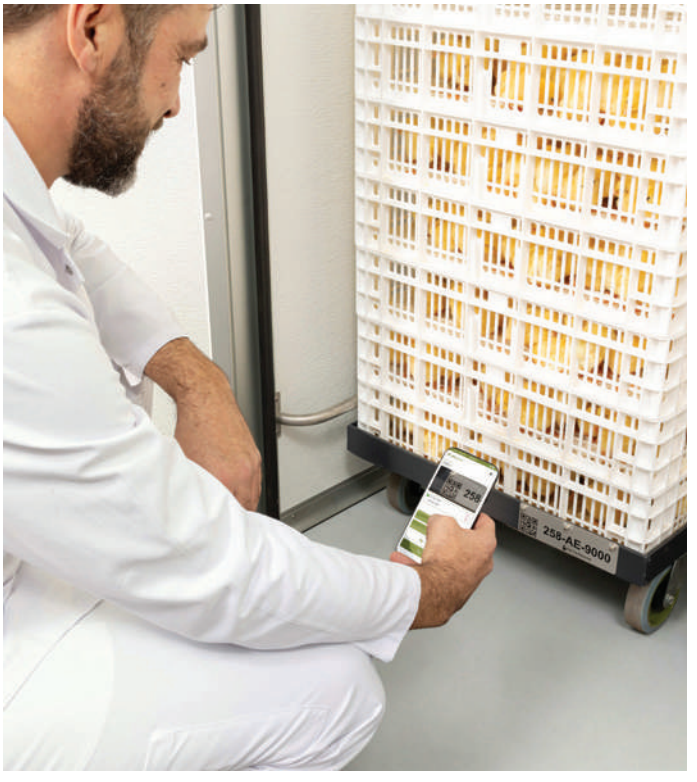
According to Jeroen van Hooff, President and CEO of Royal Dutch Jaarbeurs and VNU Group, "VIV Worldwide has spent over four decades building trust with the industries and markets it serves. We do not enter a market for a single edition – we enter to build something durable. India is one of the most significant animal protein markets in the world, and the response to this inaugural edition reinforces our belief that this is the right platform, in the right place, at the right time. VIV Select India is a long-term investment in the Indian industry, and we are proud to stand alongside the Poultry Federation of India and the broader sector in that commitment."

The 2027 edition of VIV Select India will be organised from 21st to 23rd April in New Delhi.

Petersime Unveils UniStreamer

Petersime recently launched UniStreamer, its next-generation range of single-stage incubators, engineered to deliver superior chick uniformity alongside end-to-end traceability. Designed to address the poultry industry's growing demand for consistency, transparency, and performance, UniStreamer represents a significant leap forward in incubation technology.

As retailers continue to raise demands of consistent supply volumes, uniform product sizing, and stringent quality standards, the need for greater transparency across the value chain has intensified. Petersime's response to this demand is the introduction of UniStreamer as a future-ready solution that aligns hatchery performance with market requirements.



At the heart of UniStreamer is its breakthrough in chick uniformity. By leveraging advanced, nature-inspired technologies such as HatchSound and HatchScan the system ensures tighter hatch windows and enhanced post-hatch performance. These innovations build on Petersime's proven Embryo-Response Incubation approach, which dynamically adapts incubation conditions to the specific needs of each batch - now elevated to a new level of precision and efficiency.

Equally transformative is UniStreamer's approach to traceability. Through unique trolley identification and integration with Eagle Trax cloud software, hatcheries gain full visibility of every stage of the process, from farm storage to chick delivery. This comprehensive digital tracking enhances biosecurity, supports data-driven decision-making, and ensures complete audit readiness.

Available in multiple configurations, including the high-density UniStreamerHD with 12% increased capacity, the system is complemented by integrated solutions such as Re-Store and Chick-Store, ensuring optimal conditions before and after hatching.

"At Petersime, innovation isn't about adding features for the sake of it – it's about delivering measurable results for our customers," says Rudy Verhelst, Business Development Manager at Petersime. "With UniStreamer, hatcheries can count on consistently high chick uniformity and full traceability across their operations. A predictable output of uniform, high-quality chicks is only possible when nothing is left to chance. By monitoring every step – from breeder farm to grow-out farm – hatcheries gain the clarity and control to maximise results. And that pays off across the value chain with more uniform growth on the farm, smoother processing and a more profitable, efficient and transparent production process overall."

Announcement

Shobit Kumar Sahu Joins Glamac

Glamac International Pvt Ltd, recently announced the appointment of Shobit Kumar Sahu as International Business Manager. In this role, he will spearhead the company's international business development initiatives and contribute significantly to Glamac's global growth strategy.

Mr. Sahu holds a postgraduate degree in Marketing from Mumbai University and brings with him a strong blend of practical industry expertise and a results-oriented approach. With a keen focus on global trade and long-term collaborations, Mr. Sahu will work closely with distributors and business partners worldwide to strengthen Glamac's presence by delivering science-backed, value-driven nutritional solutions for the poultry and aquaculture industries. His focused and resilient approach is expected to further reinforce the company's commitment to sustainable animal nutrition solutions.

Over the course of his career, Mr. Sahu has worked with several leading organisations in the feed additives and animal nutrition sector, gaining more than eight years of experience across poultry, swine, ruminant, and aquaculture markets globally.

A significant milestone in his professional journey was his six-year association with Vinayak Ingredients, a well-established name in the animal nutrition industry. During his tenure, he played an active role in developing and managing distributor networks, identifying new business opportunities, and building long-term relationships with key stakeholders across international markets. He also

contributed significantly to strengthening the company's footprint, particularly in the LATAM and Southeast Asian regions.

In Memoriam

Prof. G. Devegowda

(26th March 1945 – 12th May 2026)

We, at Indian Poultry Review, mourn the passing of Prof. G. Devegowda, a distinguished scholar, scientist and global authority in animal nutrition and biotechnology.

A veterinary graduate with a Doctorate in Animal Sciences from the University of Minnesota, USA, Prof. Devegowda made outstanding contributions to poultry science and feed technology. He worked as a Visiting Scientist / Professor at North American Biosciences Center, USA and was an Expert Member of the National Advisory Committee of the Government of India under the Chairmanship of the Union Minister of Animal Husbandry and Dairying.

Prof. Devegowda was the recipient of numerous national and international honours, including the Lifetime Achievement Award from Indian Poultry Science Association, Biotechnology Medal of Excellence for contribution to biotechnology & nutrition and CLFMA Award for his outstanding contribution in the field of animal feed technology. He has mentored generations of scholars and represented India on several prestigious scientific platforms worldwide and was a Fellow of National Academy of Veterinary Sciences. He served as Emeritus Professor and Head, Division of Animal Sciences, UAS, Bangalore; Emeritus President of Institution of Veterinarians of Poultry Industry and Emeritus Vice-President of World's Poultry Science Association.

Prof. Devegowda was a member of the Editorial Board of Indian Poultry Review and we will greatly miss his mentorship and guidance. May his remarkable legacy continue to inspire us and the global livestock industry.

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OFFICIAL ANNOUNCEMENT

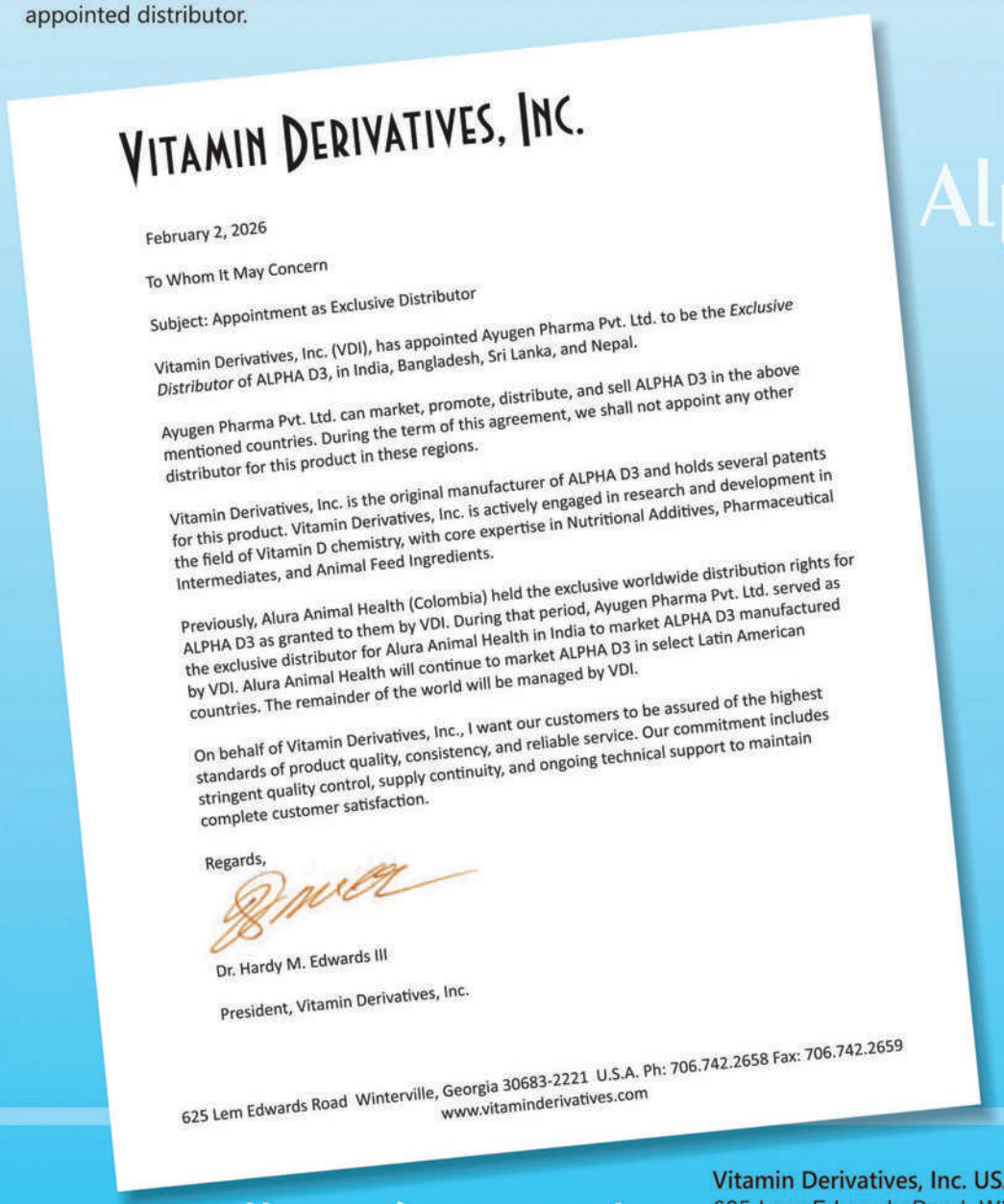
Exclusive Distributor of ALPHA D3

Vitamin Derivatives, Inc. (USA), the original manufacturer of **ALPHA D3** and a global leader in Vitamin D3 research, has appointed: **Ayugen Pharma Pvt. Ltd.** as the **exclusive distributor of ALPHA D3** across **India, Bangladesh, Sri Lanka, and Nepal**.

Under this agreement, no other entity is authorized to distribute or represent **ALPHA D3** within these territories.

Earlier, **Ayugen Pharma Pvt. Ltd.** distributed **ALPHA D3** exclusively in India through **Alura Animal Health**, which held global exclusive distribution rights for **ALPHA D3** produced by **Vitamin Derivatives, Inc. (USA).**

All inquiries, orders, and related business communications for these regions must be directed solely to the appointed distributor.



VITAMIN DERIVATIVES, INC.

February 2, 2026

To Whom It May Concern

Subject: Appointment as Exclusive Distributor

Vitamin Derivatives, Inc. (VDI), has appointed Ayugen Pharma Pvt. Ltd. to be the *Exclusive Distributor* of ALPHA D3, in India, Bangladesh, Sri Lanka, and Nepal.

Ayugen Pharma Pvt. Ltd. can market, promote, distribute, and sell ALPHA D3 in the above mentioned countries. During the term of this agreement, we shall not appoint any other distributor for this product in these regions.

Vitamin Derivatives, Inc. is the original manufacturer of ALPHA D3 and holds several patents for this product. Vitamin Derivatives, Inc. is actively engaged in research and development in the field of Vitamin D chemistry, with core expertise in Nutritional Additives, Pharmaceutical Intermediates, and Animal Feed Ingredients.

Previously, Alura Animal Health (Colombia) held the exclusive worldwide distribution rights for ALPHA D3 as granted to them by VDI. During that period, Ayugen Pharma Pvt. Ltd. served as the exclusive distributor for Alura Animal Health in India to market ALPHA D3 manufactured by VDI. Alura Animal Health will continue to market ALPHA D3 in select Latin American countries. The remainder of the world will be managed by VDI.

On behalf of Vitamin Derivatives, Inc., I want our customers to be assured of the highest standards of product quality, consistency, and reliable service. Our commitment includes stringent quality control, supply continuity, and ongoing technical support to maintain complete customer satisfaction.

Regards,

Dr. Hardy M. Edwards III

President, Vitamin Derivatives, Inc.

625 Lem Edwards Road Winterville, Georgia 30683-2221 U.S.A. Ph: 706.742.2658 Fax: 706.742.2659
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