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Poultry Fortune

Estd. 1991

Health • Nutrition • Technology • Marketing

March 2025

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Inside ...

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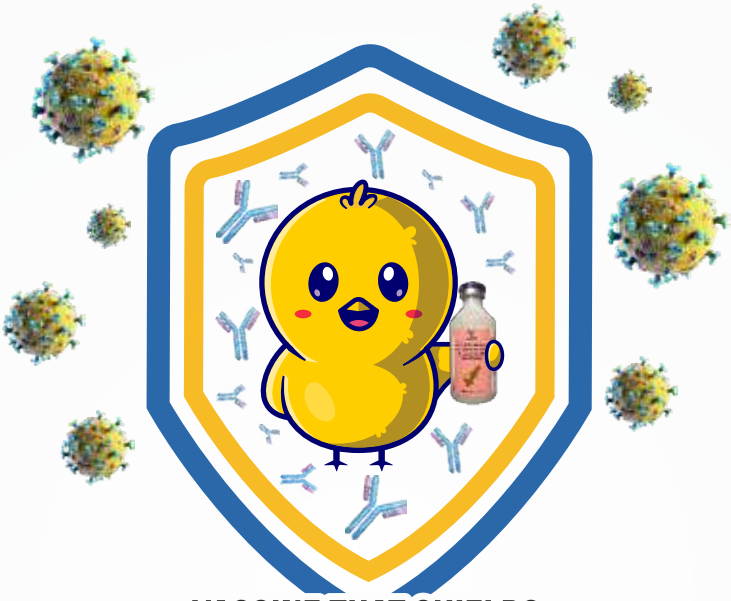
VH NBD GUARD



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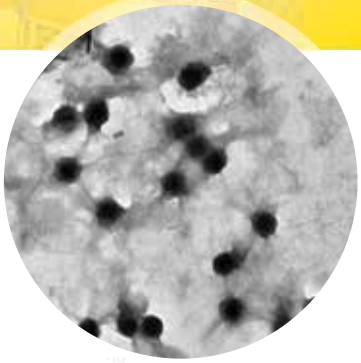
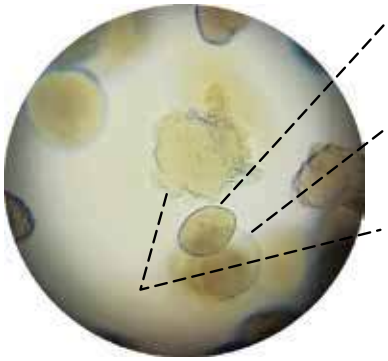


Stages of *Salmonella* colonies infected with Bacteriophages & Progressive Lysis observed on an Agar Plate, under Stereo Microscope



Colony 1 in Stage 1: Intact colony may be infected or yet to get infected

Colony 2 in Stage 2: Phage infected Colony showing Partial Lysis

Colony 3 in Stage 3: Phage infected Colony Completely lysed, cell contents with multiplied phages spreads out in search of their host

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Poultry Fortune

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M. A. Nazeer

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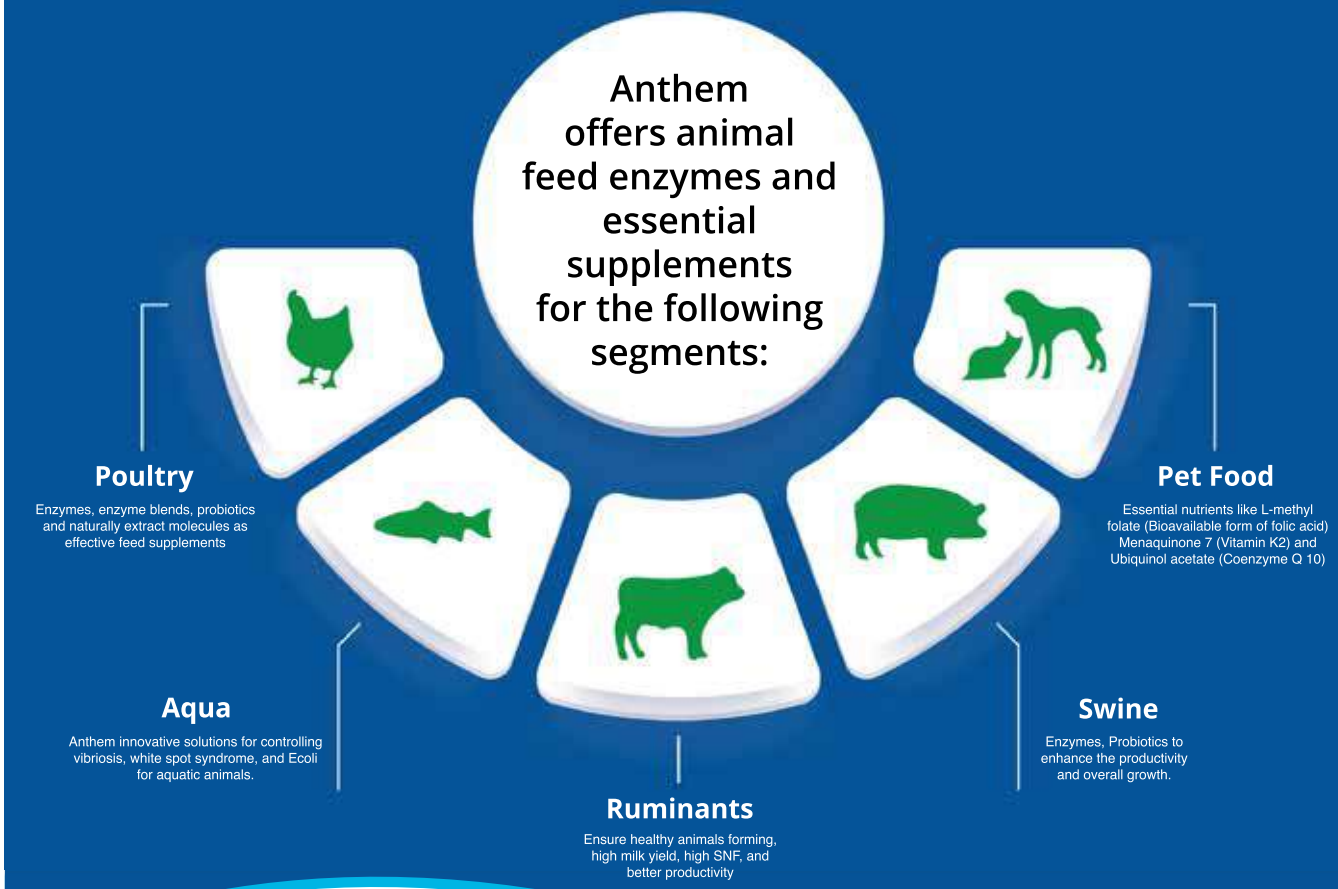

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Bird flu: Properly cooked chicken and eggs safe for consumption

*Why not Poultry Industry plan for **IPL Poultry 20** tournament at National level!*

The most prevalent infectious diseases and metabolic syndromes of poultry, which can negatively impact the welfare of the birds and cause economic losses to producers, are continuing to evolve worldwide. Good feeding and nutrition management, biosecurity and vaccination programs must be in place for prevention and eradication to occur.

Silica is known to be an important essential ultra-trace mineral which does not currently have a recommended level for supplementation in poultry, beyond avoidance of deficiency.

Dear Readers,

The March 2025 issue of Poultry Fortune is in your hands. In the news section you may find news about...

Amid rising concerns over Avian Influenza (Bird Flu) in Andhra Pradesh and Telangana, the Veterinary and Animal Husbandry Department in Telangana urged the public not to panic, assuring that properly-cooked chicken and eggs are safe for consumption. In a bulletin released, the department underscored that poultry meat cooked at temperatures above 70°C for at least 30 minutes is deemed safe, in line with the Government of India's advisory. According to WHO, cooking chicken & eggs above 70°C kills Bird Flu Virus. Indian cooking happens over 100°C.

The department has ramped up surveillance efforts by conducting inspections at poultry farms and educating farmers on preventive and control measures, including biosecurity protocols. Thousands of farmers and countless others reliant on the poultry industry in Telangana are grappling with the fallout of the bird flu outbreak in neighbouring Andhra Pradesh. As fear spreads, the sales of poultry meat and eggs have sharply declined, leaving the sector in turmoil.

Telangana Poultry Federation President K. Mohan Reddy estimates a 50% drop in the industry's average daily income, which typically reaches ₹10 crore in the State.

Demand from other States is also on the wane in recent days, he notes, adding that bird flu is not a new phenomenon, having struck 4-5 times in the past 25 years. The real issue, he asserts, is the fear surrounding the flu rather than its impact on consumers. Farmers have been advised to report any unusual bird mortality to the department for timely intervention.

Cricket has become one of the most popular sport in the World and IPL 20 in India is the most successful game. Now a days, many people in Indian poultry industry are conducting cricket tournaments state wise. More than 20 teams in poultry sector in different states in the country are conducting cricket tournaments where the stakeholders of poultry industry are the cricket players. Why not we promote ***IPL Poultry 20*** cricket tournament at national level in poultry industry. If like minded people in the industry join together it would be possible to have a national tournament on cricket. All of you, give a thought to it !

Veterinary Marketing Personnel Welfare Association (VMPWA), Hyderabad, a body of sales and marketing personnel and distributors serving in poultry industry in Telangana state, organised its 3rd annual cricket tournament in Hyderabad on 14 February 2025. A total of 90 players with six teams, each team consisting

Contd on next page

NRS GROUP

Poultry Fortune

Our Mission

Poultry Fortune will strive to be the reliable source of information to poultry industry in India.

PF will give its opinion and suggest the industry what is needed in the interest of the stakeholders of the industry.

PF will strive to be The Forum to the Stakeholders of the industry for development and self-regulation.

PF will recognize the efforts and contribution of individuals, institutions and organizations for the development of poultry industry in the country through annual Awards presentation.

PF will strive to maintain quality and standards at all times.

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of 15 player-members played the one day tournament. Tradinova team are the winners of the trophy (Champions) and Tara Group team are the runner-up. 10 Poultry Pharma companies supported the tournament with sponsors.

The Maharashtra Government's decision to remove egg from its midday meal scheme a year after it was introduced ostensibly for financial reasons seem to place political imperatives over public-health prudence, especially since it comes on the heels of protests from right-wing groups against its inclusion. The state government had earlier allocated an annual budget of Rs 50 crore to provide eggs or bananas or a local fruit once a week to government school children to combat mal nutrition, It later amended it to state that in schools where 40 percent or more parents protested against the inclusion of eggs, it would not be served in midday meals. The new directive cites a finance issue in its amendment and has asked schools to seek public sponsorship should they wish to include eggs or sweets in the menu. In withdrawing egg pulao and rice-kheer or nachani satva, a sweet dish, for students of Classes 1 to VIll, the Devendra Fadnavis-led government has joined a list of BJP-ruled states that do not provide eggs in mid-day meals. Only three BJP-ruled states Uttarakhand, Odisha and Assam still do. The decision in Maharashtra shows a callous disregard for the already alarming rates of malnutrition among school children from economically disadvantaged back-grounds by a government that has returned to power with an overwhelming mandate.

In the Articles section, **Infectious Diseases and Metabolic**, authored by Aviagen India Poultry Breeding Company stated that the most prevalent infectious diseases and metabolic syndromes of poultry, which can negatively impact the welfare of the birds and cause economic losses to producers, are continuing to evolve worldwide. Having good management of feeding and nutrition, as well as biosecurity and vaccination programs in place can help prevent disorders and eradicate or limit the spread of diseases. It is also important to consider the role that migratory birds, rodents, pests and the global movement of people, among other factors, play in regulating these conditions. Quickly recognizing the signs and symptoms of these disorders is essential for corrective actions and preventions to be achieved. Many infectious diseases can be prevented with good biosecurity practices and, when available, vaccination. Metabolic diseases can be prevented by understanding the factors that predispose flocks to these conditions and how to avoid them. As the most prevalent infectious diseases and metabolic syndromes of poultry continue to evolve, good feeding and nutrition management, biosecurity and vaccination programs must be in place for prevention and eradication to occur.

Mycoplasma synoviae (MS) has persisted despite improved approaches to controlling and monitoring the disease. In addition, MS often presents as a silent infection, where broiler breeder flocks may seroconvert (test positive serologically) with no sign of illness or negative impact on performance, making it difficult to assess. MS has re-emerged due to a decrease in antibiotic (AB) use and the occurrence of more pathogenic strains. These strains can cause the typical synovitis issues (swollen joints and footpads), secondary respiratory issues (especially in broilers) and a fairly new effect on eggs called Eggshell Apex Abnormalities (EAA) or Top Coning EAA more often affects commercial layers but has also been seen in broiler breeders.

A decrease in AB use to control Mycoplasma infections coincides with more companies starting antibiotic-free programs (ABF), minimizing AB use or the ban of AB (all or specific) in some countries. Reduced AB use has led to more flocks showing seroconversion. Initially, a few live Mycoplasma gallisepticum (MG) vaccines were introduced worldwide, which seemed to work well against MG, and were cost-effective. Many producers used these live MG vaccines and subsequently stopped using continuous AB in feed to control MS. As a result, MS seemed to re-emerge and thrive. More recently, live MS vaccines have been introduced, and some broiler companies have started using these in conjunction with MG vaccines in their broiler breeders.

Another Article titled, **The role of bioavailable silica in supporting poultry growth and development**, authored by E. J. Burton, D. V. Scholey, S. Prentice, D. J. Belton, A. Alkhtib & C. C. Perry, discussed that the Silica is known to be an important essential ultra-trace mineral which does not currently have a recommended level for supplementation in poultry, beyond avoidance of deficiency. The chemistry of silicon dictates its bioavailability and depending on source and concentration, solubility varies widely. This review details the chemistry and biology of silica and the potential mode of action for improving bone health while also bringing together research from human and other animal fields. The poultry sector has investigated the effect of supplementation with several silicon containing compounds with inconsistent outcomes. This may be due to the large variability in bioavailability of differing silicon containing compounds, so this is also discussed. Finally, the authors consider whether bioavailable silica should have a recommended supplemented level for poultry to maximise performance and skeletal integrity in the future, and if so, should this be of a known bioavailable form.

Readers are invited to send their views and comments on the news, special feature and articles published in the magazine which would be published under "Readers Column". Time to time, we shall try to update you on various aspects of Poultry sector. Keep reading the magazine Poultry Fortune regularly and update yourself. Wish you all fruitful results in your efforts.

M.A.Nazeer
Editor & Publisher
Poultry Fortune

Could chickens be the answer to future food security?

With over 65 billion birds found globally, the domestic chicken has become one of the most popular livestock species in the world and thanks to its genetic diversity and adaptability, it could be the key to future food security.

The success of the species today is partly due to it being a popular source of protein and its largely successful breeding improvement programmes. The popularity of the domestic chicken can also be attributed to the high level of diversity that enables rapid adaptation to new environments and production systems.

A new study published in *BMC Biology* is now providing a new light on the origin of domestic chicken diversity.

Genetic diversity is the basis through which organisms adapt, survive and are able to reproduce in a challenging environment. For a domesticate species, like the chicken, it is at the root of their improvement for productivity.

Olivier Hanotte, Professor of Population and Conservation Genetics, in the School of Life Sciences at the University of Nottingham, and senior author of the study, said: "Chickens are one of the most popular species in the world because of its huge genetic diversity.

The understanding of the domestication of the species and what makes up its diversity are of key importance. As a result, our research addresses these critical questions, and for the first time, at a genome-wide level."

In the study, experts give an estimation for the domestication of the species to 8,000 years ago in locations around South and Southeast Asia. It also shows that while the main ancestor of the chicken is the Red Junglefowl, other wild species within the genus, including the Grey junglefowl, Ceylon junglefowl and Green junglefowl, have also contributed to the diversity of chicken, depending on which part of the world it is found in.

The geographic locations and the climatic conditions of the chicken's domestication centres varies from where the majority of chickens are found in the world today.

For instance, over time, chickens have evolved and adapted to diverse ecological conditions including the tropics, temperate, arid and rainforests. They are also known to survive some extreme cases like cold, heat, drought and water scarcity, to name a few.

Dr Raman Akinyanju Lawal, the first author who did the investigation during his PhD study at the University of Nottingham and currently a Postdoctoral Associate at the Jackson Laboratory, Maine in the US, said: "There is a strong disparity in the climatic conditions of today compared to 8,000 years ago when the chicken was first domesticated. We believe that gene flow from other species within the genus contributed to their genetic diversity and survivability."

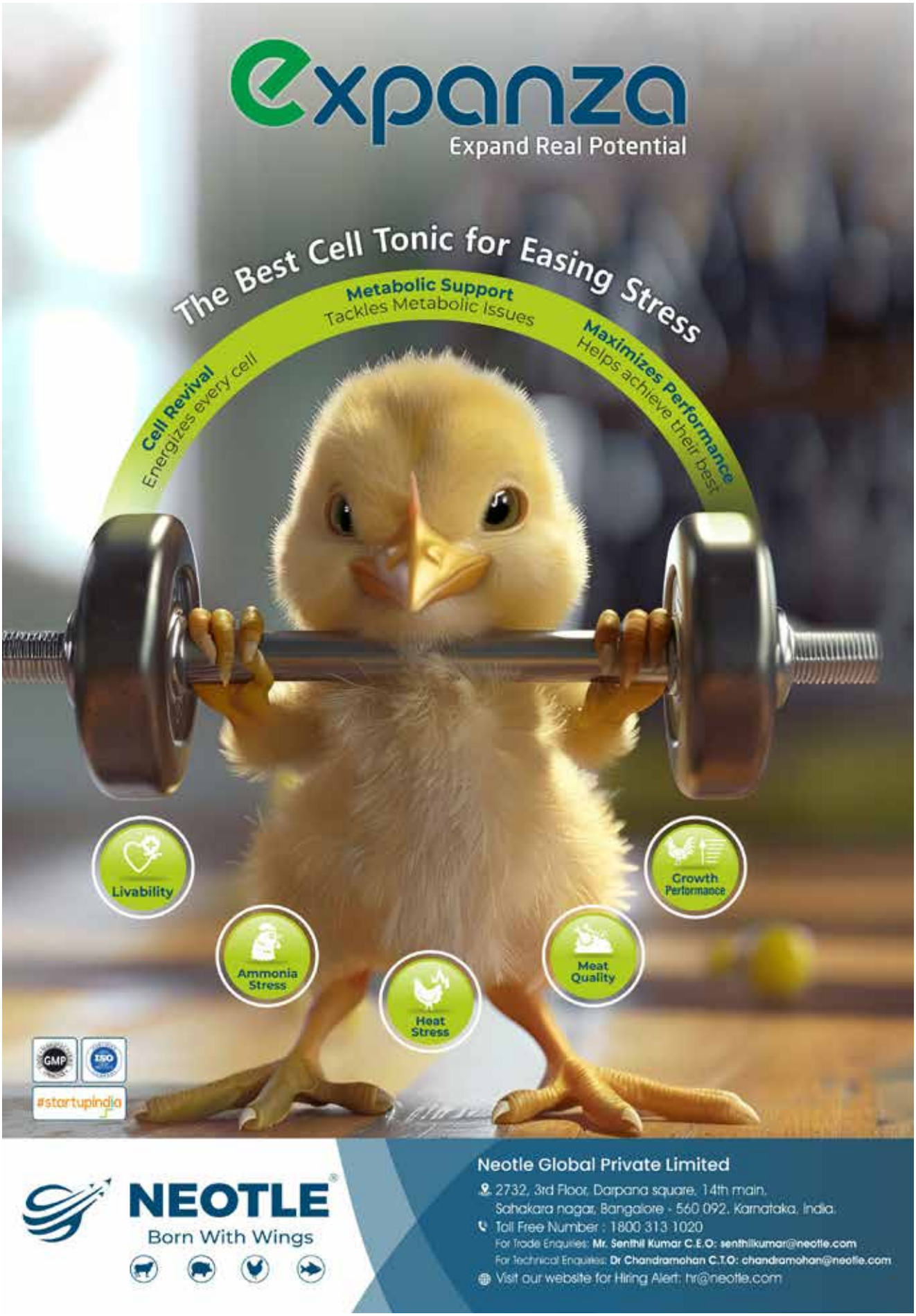
For thousands of years, chickens have become part of households, serving first as religious/traditional figures and latterly as a source of food. Chicken gestation is 21 days with about 200-300 eggs produced per year for commercial lines. Indigenous village chickens, which are less productive, need less or no resources from humans to survive different environmental challenges.

"Basically, chickens are scavengers, being able to feed and survive by themselves, underscoring the significance of genetic diversity," says Dr Lawal.

Professor Hanotte says: "By taking advantage of the domestic chicken genetic diversity, which we now know was enhanced which contribution from several species as identified in our study, we can also improve their productivity."

Dr Lawal explains that as the threat of climate change becomes imminent, the consequences, including famine and increased poverty, will be global. Low income countries will suffer the most. The United Nations has projected that by 2050, the world population will reach 9.7 billion from the current 7.7 billion. The majority of this increase will come from the developing countries.

To deal with the effect of global warming and population expansion, could the answer lie in chickens? For Professor Hanotte and Dr Lawal, the answer is definitively a yes, according to the poultry site.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Bird flu: Properly cooked chicken and eggs safe for consumption, say authorities

Amid rising concerns over Avian Influenza (Bird Flu) in Telangana, the Veterinary and Animal Husbandry Department has urged the public not to panic, assuring that properly-cooked chicken and eggs are safe for consumption

In a bulletin released the department underscored that poultry meat cooked at temperatures above 70°C for at least 30 minutes is deemed safe, in line with the Government of India's advisory.

The department has ramped up surveillance efforts by conducting inspections at poultry farms and educating farmers on preventive and control measures, including biosecurity protocols. Farmers have been advised to report any

unusual bird mortality to the department for timely intervention.

Bird flu, primarily a dis ease affecting birds, is transmitted by wild migratory species. The outbreak has been reported in Maharashtra, Chhattisgarh, Rajasthan, and Andhra Pradesh, prompting the Central government to issue advisories to all states to enhance biosecurity measures in poultry farms

In response, the Telangana government has directed district administrations to increase vigilance and awareness among poultry farmers stakeholders.

"As a precautionary measure, inter-state border check posts have been set up to monitor and regulate the entry of poultry. eggs, feed, and chicks from neighbouring states. Additionally, key departments such as Forest, Health and Police, have been put on high alert to coordinate containment efforts," the bulletin said.

It was further added that recent reports of poultry mortality in specific areas of Telangana have triggered an immediate investigation. Samples have been sent to the National Institute of High Security Animal Diseases in Bhopal for testing, and results are awaited.

Bird flu scare: Poultry market hit ahead of Ramzan, mutton demand surges

Bird flu scare: Poultry market hit ahead of Ramzan, mutton demand surges

The bird flu scare in Hyderabad has led to a sharp decline in chicken prices with demand plummeting, while red meat prices have surged following an increasing consumer shift. Poultry vendors are facing heavy losses, while mutton sellers are struggling to keep up with the soaring demand, especially with Ramzan approaching.

Syed Hashmi, owner pf Taj Chicken Centre in Baba Nagar Colony, Mallapur, highlighted the drastic drop in sales: "Chicken prices have fallen from 210 to 195 per kilogram, but even that isn't helping. I usually sell around 200 chickens a day, but now I am struggling to sell 10. even on a Sunday"

Another vendor from Venkatapuram noted the Poultry vendors in Hyderabad are facing heavy losses due to the bird fiu threat, NAGARA GORAL sharp price fluctuations. "Mutton was earlier being sold at 1700 per kilogram, but now it is 1900-1000.

Chicken, which was (240 per kilogram, has dropped to 190. Even egg prices have fallen-frum 100 per tray C10 eggo about 15 days agn to 1155 now he said

A minton vendor with outlets actos Alwal shared how business hain charged dramanically "Last Sim day, we brought in 20 goats, and they were sold out by noon. Before VID-19, we med to stock 18 20 goats on Sundays, which lasted the entire day. Even after the pandemic Sunday demand was around 15

goats. But now, demand is skyrocketing" With Ramzan approach ing, vendors are bracing for even higher prices, "Rates could touch 1,000 1,500 per kg during the festive season. In KPHB, mutton is already 1,200 per kg. We are cu reuity selling it for 1900 a soul 1,100 A boneless muton. This Sunday alone, we sold 244

Ned Sanday, ww will have to figure out how to meet the soaring demand," wid another vendor

Explaining the supply chain challenges, he added, "We source Mutton from Maharashtra, in it has the best quality after Telangana. This Sunday, we ordered one quntal of chicken be cos't even seil that. Usually, we sell three quintals every Sunday"

RELATED REPORTS

Chicken biryani falls out of favour as bird flu ruffles Hyderabad food scene

Dinners are hesitating to indulge in their once - favourite order even as big and small restaurants grapple with dwindling sales; meanwhile, mutton biryani has stepped in as the hero of the hour, though soaring demand is driving prices through the roof.

The bird flu scare has rattled Hyderabad, striking at the heart of the city's culinary identity — its beloved chicken biryani. A staple at gatherings and a goto comfort food, this iconic dish is now met with caution as whispers of the flu spread. Diners are hesitating, casting wary glances at their oncefavourite order and restaurants are grappling with dwindling sales. Amid this scenario, mutton has stepped in as the hero of the hour, though soaring demand is driving prices

Chicken biryani sales have dwindled amid bird flu scare.

through the roof.

Ashmeet Singh Dua, owner of Papa Ji Ka Dhaba in Abids, observes the changing trends in customer preferences. "People are scared and avoiding chicken," he says. "While news reports suggest caution rather than an outright ban, people are more conscious these days. The sudden spike in mutton demand has led to supply shortages from our usual vendors, and prices are rising as a result."

The shift in demand is equally noticeable at Hotel Paradise, a well-known name in Hyderabad's food scene. A spokesperson reveals that there has been a 10% drop in chicken biryani sales, adding, "We have managed to handle the supply so far and will continue catering to customers based on demand."

Ketan Agarwal, owner of Fat Pigeon and Peanuts Bar, expresses similar concerns: "Obviously, people are scared and no longer prefer chicken. I even noticed a popular fried chicken joint struggling at the airport with empty seats. Mutton supply is being hit, and the surge in demand is massive. We need to figure out how to meet it."

A staff member of a restaurant at Suchitra Circle shares insights into their kitchen's shifting dynamics. "Earlier, we prepared 70-80 handis of biryani daily, with 50 for chicken and only 15 for mutton. Now, the number of mutton handis has tripled, and demand for chicken is plummeting," he says.

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PRESENTATION

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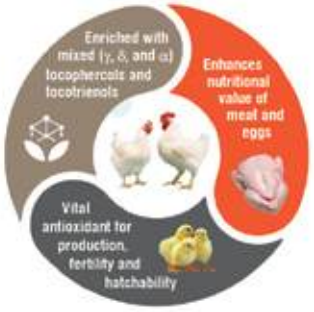

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FEED INCLUSION RATE

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Double quantity is recommended for breeders.

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VMPWA holds Cricket Tournament in Hyderabad

Tradinova team are the winners of the trophy (Champions) and Tara Group team are the runner-up. Some 10 poultry pharma companies supported the tournament with sponsorship.

The six teams of the Cricket Tournament held by VMPWA on 14 February 2025 at Hyderabad.

Hyderabad: Veterinary Marketing Personnel Welfare Association (VMPWA), a body of sales and marketing personnel working in poultry industry in Telangana state, organised its 3rd annual cricket tournament in Hyderabad on 14 February 2025. A total of 90 players with six teams, each team consisting of 15 members played the one day tournament.

Sponsors of the tournament at Hyderabad.

Champions: Tradinova Team, winners of the tournament held on 14 February 2025 at Hyderabad.

Mr V. Rajashekar Reddy, President, VMPWA informed that 10 companies sponsored the tournament like: Provet Pharma, Symbio Nutrients, Tradinova International Pvt Ltd, Tara Group, Vaishno Pharmatek Pvt Ltd, Poulpro Solutions, Quest Agrovet, Teja Group, JV Enterprises and Crescent Marketing. VMPWA has 285 members representing poultry pharma companies.

Teams and their Sponsors: Tradinova, Tara Group, Vaishno Pharmatek, Quest Agrovet, Crescent Marketing and Teja Group. While Provet Pharma hosted food and hospitality, Trophies were sponsored by Symbio Nutrients, Winners reward sponsored by Poulpro Solutions and Runners reward sponsored by JV Enterprises.

Poultry Fortune Editor M.A. Nazeer, who was present during the tournament congratulated the teams and the organisers.

How farmers' kidneys are facing the heat

New Research Shows Dehydration From Spending More Than Five Hours A Day In The Sun Can Increase Chances Of Renal Disease

Too much sun and too little water and that too laced with chemicals may be taking a toll on kidneys of farm work ers. Doctors are finding that chronic kidney disease (CKD) from uni dentified causes is rising in rural areas, and prolonged sun exposure leading to dehydration and heat stress may be the key reasons, especially in those with no prior risk factors such as diabetes, diabe hy pertension and family history

"More than five hours a day in the sun increases the risk of kidney dis enses," says Dr N Gopalakrishnan, sen jor nephrologist and head of the state transplant registry "It accelerates kid-ney damage, especially in those already at risk. Climate change is creating hot-ter days, but many people don't stop working. They must move to a cooler place and drink water every hour. If you are dehydrated toxins build up in the kidneys and cause infections. Over time, it can lead to damage" Dr Go palakrishnan says people in rural areas rely on groundwater, which is hard and contains high magnesium and calcium levels. "Pesticide runoff from fields floods speed up absorption of chemi cals into groundwater. Risk analysis shows minerals and agrochemicals in water harm kidney function."

Data from the health department shows the cause of CKD in a third of patients in urban areas and half of patients in rural areas is unknown a condition called chronic kidney disease of unknown origin (CKDu), Experts recently discussed the social and economic burden of CKD at a World Bank meeting. A 2023 study by the directorate of public health and Madras Medical College found 8.4% of the population have mild to severe CKD requiring medical intervention, including dialysis and transplants.

Diabetes, hypertension, heart disease, family history, inflammation of the kidney cysts, stones, and some medications can increase the risk of CKD. "But in the patients, particularly those who are 40-50 years old, we see none of these conditions. We don't know what triggered the disease," says director of public health Dr TS Sel vavinayagam, co-principal investiga tor of the study. "We just know we are seeing an increase in CKD and CKDu over the past 10 years."

There is a surge in patients at neph rology wards across all hospitals, an increase in people registering for dialy sis, and those on the waitlist for renal transplants too, say doctors. Between Jan and Dec 2034, more than 300 crore was claimed for dialysis from insur ance companies by hospitals under the chief minister's health insurance scheme. The state also funded more than 800 kidney transplants at ₹17 crore under the scheme. In 2024, 3,350 farmers in Tamil Nadu were studied, including 1,749 women, from different climatic zones to understand the ris ing CKD burden, especially in rural arvas. Scientists focused on farmers due to increasing cases and trends seen in countries such as Sri Lanka. Doctors analysed height, weight and samples at the state public health lab. The results yet to be peer-reviewed and published were presented before the World Bank committee. Analysis showed 267 (7.9%) people had moder ate to severe CKD. While doctors were able to ascertain the cause of CKD in 178 (5.3%) farmers, they tagged the re-maining 89 (2.6%) patients as CKDu. While incidence of kidney disease ranged between 2.2 and 7.7, incidence due to unknown origin varied between 1.3 and 3.8.

Last week, Dr Jay Lemery from the University of Colorado, popularly known as the "Climate Doctor, warned that the disease burden in tropical countries such as India is likely to Increase as hotter days are likely to increase. "Extreme beat has proved to be worse than extreme cold. We need stronger health policies and strategies to combat diseases due to heat waves caused by climate change," said Dr Lemery who advocates for changes with international organisations

Tamil Nadu has identified climate change as a problem, says former health secretary Supriya Sahu. "And multiple departments are working on micro and macro mensures to combat issues." Public health experts say that the state will work on reducing risk factors such as diabetes and hyperten sion while increasing awareness, espe cially among rural workers exposed to the sun. "We will ensure employers limit outdoor work to five hours daily, and ensure access to shaded areas for breaks, and access to clean water and toilet facilities," says Sahu. "We understand that rigorous health edu cation campaigns are needed to raise awareness about CKD risk factors." Email your feedback with name and address to southpole.toi timesofindia.com

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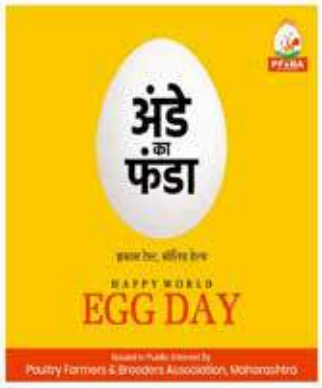
Not Without Egg!

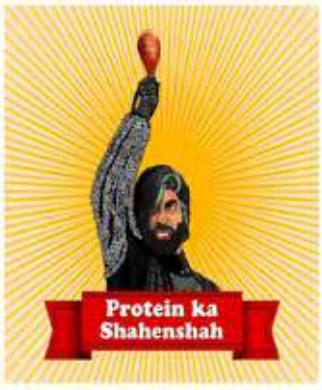
Maharashtra government's decision to withdraw eggs from midday meals will exacerbate under-nutrition in the state

The Maharashtra Government decision to remove egg from its midday meal scheme a year after it was introduced ostensibly for financial reasons seem to place political imperatives over public-health prudence, especially since it comes on the heels of protests from right-wing groups against its inclusion. The state government had earlier allocated an annual budget of Ra 50 crore to provide eggs or bananas or a local fruit once a week to government school children to combat mal nutrition, It later amended it to state that in schools where 40 per cent or more parents protested against the inclusion of eggs, it would not be served in midday meals. The new directive cites a finance issue in its amendment and has asked schools to seek public sponsorship should they wish to include eggs or sweets in the menu. In withdrawing egg pulao and rice-kheer or nachani satva, a sweet dish, for students of Classes 1 to Vill, the Devendra Fadnavis-led government has joined a list of BJP-ruled states that do not provide eggs in mid-day meals. Only three BJP-ruled states- Uttarakhand, Odisha and Assam-still do. The decision in Maharashtra shows a callous disregard for the already alarming rates of malnutrition among schoolchildren from economically disadvantaged back-grounds by a government that has returned to power with an overwhelming mandate.

According to the National Family Health Survey (NFH5) child malnutrition remains a significant challenge in India, with data pointing to alarming levels of under nutrition, stunting, and wasting. NFHS-V(2019-21) reported that 355 per cent of children under the age of five in India were stunted (low height for age, while 19.3 per cent were wasted [low weight for height) In Maharashtra's Dhule and Chandrapur, districts in the bottom 10 across India in wasting, the numbers stood at 3859 and 38.5 respectively. In Nandurbar to the north-west of the state, 572 per cent of children under the age of five were underweight, second only to Pashchimi Singhbhum in Jharkhand. These figures indicate the deep-rooted nutritional deficiencies many children face, particularly in rural areas. The data also highlights the critical role of protein in addressing these deficiencies, Compared to pulses, milk or even fruits such as bananas, eggs remain a more effective, affordable and easily accessible source of nutrition, The Maharashtra government has sought to replace eggs with alternatives like chickpea and soybean but the substitution ignores the logistical challenges of providing these at scale. By removing eggs, it risks exacerbating the nutritional gap.

Food choices are inextricably tied to questions of caste and religious identity and to privilege. Over the last decade, protracted, and often violent, dissensions over non-vegetarian food, be it over eggs or beef, have propelled the myth of India as a vegetarian nation. Before Maharashtra, Madhya Pradesh had dropped eggs from its midday-meal menu In 2022, Goa, too, briefly introduced and dropped eggs from its mid-day meal menu. According to NFHS-V data, however, 45.1 per cent women and 573 per cent men eat non-vegetarian food at least rice a week. In a country struggling to deliver nourishment to its children, to discriminate on the basis of food can have disastrous consequences. The Maharashtra government must reconsider its decision.





Leading to improved productivity and enhanced animal welfare

Tiruchirappalli: Bentoli India Agrinutrition, a leader in innovative animal nutrition solutions, announces the launch of its state-of-the-art cattle trial farm. This cutting-edge facility is dedicated to enhancing livestock health, nutrition, and productivity through rigorous research and testing, reinforcing the company's commitment to the Indian dairy sector. By focusing on research tailored to local conditions, the new facility aims to develop products that meet the unique needs of Indian dairy animals.

The Dairy Trial Unit is designed to address key aspects of animal health, nutrition, and productivity while aligning with Indian farming practices. By simulating local environmental conditions, the research conducted at the unit will help develop solutions optimized for India's dairy farming landscape, where factors such as climate, nutrition, and animal welfare present distinct challenges.

"The opening of this Dairy Trial Unit reflects our commitment to supporting India's dairy industry," said Mr. Edward Robinson (President, Bentoli). "India is a key and rapidly growing market for us, and this facility will enable us to develop more targeted solutions that address local needs and contribute to the industry's growth."

Dr Arul Victor Suresh, Managing Director and Global Technical Director, emphasized the significance of this milestone: "This is an important achievement not only for Bentoli but also for India's dairy sector. Our goal is to conduct meaningful research that directly addresses the specific needs of dairy animals in India, leading to improved productivity and enhanced animal welfare."

Dr Sushanta Saha (Regional Director - Sales and Marketing), highlighted the importance of research-driven, market-focused strategies, stating, "By expanding our global dairy product portfolio and understanding the specific needs of farmers, we can offer customized solutions that enhance productivity, improve customer satisfaction, and ensure optimal animal health and welfare."

The Dairy Trial Unit is at the forefront of research and innovation, serving as a collaborative hub that brings together researchers, veterinarians, and animal nutritionists to address critical challenges in dairy farming.
Dr Jayanta Bhattacharya (Director – Techno marketing), noted that the unit's research will focus on sustainable higher milk production, optimal rumen function, rumen bypass technologies, reproductive nutrition, and immuno modulation. These efforts will yield practical, locally relevant insights that can be implemented on farms across the country.

This initiative marks a significant step forward in advancing sustainable and efficient dairy farming practices in India, benefiting farmers and supporting the continued growth of the industry.

Glamac Strengthens Leadership with the appointment of

Dr Manish Chaurasia as AGM - Sales & Marketing-Key Accounts

Mumbai: Glamac International Pvt Ltd, a leading company in Poultry Nutrition, is pleased to announce the appointment of Dr Manish Chaurasia as AGM-Sales & Marketing, Key Accounts. In this role, he will be instrumental in managing and growing relationships with high-value clients while developing marketing strategies to drive business growth and contributing to the company's success.

Dr Manish Chaurasia, AGM - Sales & Marketing, Key Accounts

Dr Manish Chaurasia is a distinguished professional in the field of Veterinary Science and Animal Husbandry, with over 15 years of extensive experience in various capacities, including marketing, product management, farm management, disease diagnosis, and technical support. Born and raised in Madhya Pradesh, India, Dr Chaurasia has built a remarkable career marked by his expertise and contributions to the animal nutrition and feed industry. Dr Chaurasia completed his graduation in Veterinary Science and Animal Husbandry from the prestigious Nanaji Deshmukh University of Veterinary Science in Jabalpur, Madhya Pradesh. His academic foundation laid the groundwork for his deep understanding of animal health, nutrition, and farm management. To further enhance his managerial and leadership skills, he pursued an Advanced Management Development Program from the UCD Michael Smurfit Graduate Business School in Dublin, Ireland, an opportunity by Alltech to continue his learning and professional growth.

Throughout his career, Dr Chaurasia has worked with some of the leading feed manufacturers and feed additives businesses in India, specializing in monogastric animals. His roles have encompassed a wide range of responsibilities, from managing marketing strategies to providing technical support. One of the notable milestones in Dr Chaurasia's career was his tenure at Alltech, a global leader in animal nutrition and health, where he served as the Marketing Manager for South Asia. In this role, he played a pivotal part in driving marketing initiatives, fostering business growth, through strategic vision and industry knowledge. Dr Manish Chaurasia's career is a reflection of his passion for animal health and nutrition, coupled with his dedication to advancing the industry through innovation and excellence.

With this new addition, Glamac continues its commitment to strengthening its leadership and driving innovation in the industry.

Lumis Enzymes at IPPE 2025

Lumis Enzymes exhibited at the International Production & Processing Expo (IPPE), the world's largest annual event for the poultry, egg, meat, and animal food industries, and one of the top 25 largest trade shows in the United States. This year, attendees came from not only the Americas but also from diverse continents, including Europe, Asia, Africa, and the Middle East.

Our participation provided an excellent opportunity for industry professionals and customers to gain insights into Lumis Enzymes' innovative solutions. Through detailed technical discussions and presentations, we demonstrated how our enzyme technologies address industry-specific challenges. This engagement highlighted our commitment to continuous innovation and allowed professionals to explore how our sustainable, high-quality enzyme solutions can enhance their operations.

Our discussions highlighted the unique features of our enzymes, designed to boost productivity, reduce environmental impact, and offer cost-effective solutions. We emphasized their flexibility and customization, tailored to the specific needs of the poultry, meat, and animal feed sectors. With a focus on performance, sustainability, and innovation, our enzymes help customers improve processes and maintain competitiveness.

IPPE offered a valuable networking platform to strengthen relationships with existing partners and build new connections. Our participation reinforced Lumis Enzymes' leadership position in enzyme manufacturing and processing, while expanding our global presence and market reach.

More Nutrients Don't Have to Cost More – NOVUS at VIV Asia

BANGKOK, THAILAND (February 14, 2025) – As the leader in intelligent nutrition, NOVUS is focused on helping poultry, pork and dairy animals reach their full potential through advanced technologies that deliver more. At VIV Asia, March 12-14 in Thailand, nutrition experts will share how producers can get more from their highest cost – feed.

During his presentation called **More Nutrients Don't Have to Cost More**, NOVUS Senior Technical Services Regional Manager David Torres will share how feed additives can transform broiler nutrition and tackle feed challenges.

David Torres, Senior Technical Services Regional Manager

"We all know that feed is the highest cost for producers. Ensuring the nutrients in feed are accessible to animals is vital for capturing a positive return on investment," Torres says. "During this presentation, we'll talk about recent evidence on enhancing nutrient utilization in feed ingredients to impact the cost of production. I'll also explain how shifts in soybean quality – which can vary widely – affect broiler performance."

Torres will also explain how the age of a bird influences its nutrient digestion, and how producers, nutritionists and feed mills can unlock nutrients from feed through intelligent nutrition.

"Where broiler production is concerned, globally, the industry is facing evolving feed and genetic challenges. Producers need to educate themselves on the available solutions to ensure cost-effective performance improvements and long-term sustainability," Torres says.

More Nutrients Don't Have to Cost More will begin at 10:00 a.m. (GMT+7) on March 13, 2025, in Room Jupiter 5, G Floor of the IMPACT Exhibition Center in Bangkok. The presentation is free to all VIV Asia attendees, but registration is required. Visit novusint.co/vivasia2025 to register.

Conference attendees who can't attend the presentation are welcome to visit the NOVUS booth (2-2980) anytime during VIV Asia to speak with representatives about how to get more from their feed, their animals, and their operations. For more information about NOVUS activities at VIV Asia, visit novusint.com/novus-at-viv-asia-2025.

VIV Asia is the largest feed-to-food event in Asia, dedicated to the world of livestock production, animal husbandry and all related sectors. To learn more, visit vivasia.nl.

Bird Walks in Vikarabad and Gajwel Forests on February 23 and March 2

The Telangana Forest Development Corporation (TGFDC), under the brand name of 'Deccan Woods & Trails', would conduct Bird Walks in Vikarabad and Gajwel Forests on February 23 and March 2 respectively. Those interested in participating can contact 9493549399 or 9346364583 for details on charges, resources provided and others.

The corporation has organized a two-day Bird Walk at the Botanical Garden in Hyderabad on Saturday and Sunday (February 8 and 9, 2025). A total of 55 bird watchers and bird enthusiasts from various parts of Hyderabad participated in the walk.

They were divided into two groups: one group was sent to 'Vriksha Parichaya Kshetram' spread on 94 acres and the other group was sent to 'Virtual Wildlife Safari Park Conservation Zone'. Over the course of the two days, four bird experts, Aparanjani, Manoj, Thomson, and Abdul Raheem led the groups. They guided the participants in identifying the birds, explaining the scientific and common names of the birds, their habits, and behavior.

The participants were also provided with the 'Birds

Pocket Guide' developed by TGFDC. The participants used the pocket guide to identify the birds they spotted. The experts demonstrated how to observe birds, how to identify them, and the sounds different birds make.

Bird watchers, volunteers team up to develop Hyderabad Bird Atlas

The exercise to develop Hyderabad Bird Atlas is underway with birdwatchers along with volunteers scanning different parts of the city to map avian fauna. The Atlas, a first of its kind for the city, is being developed to understand bird distribution in the city, monitor changes in their population, identify important bird areas and inform authorities about land use planning. Pune, Mysore and Coimbatore are some of the cities in India that have developed bird atlases.

The three-year project was rolled out on February 3, which will go on till February 23. It will be conducted in February (Winter) and July (Summer) to know birds which migrate in winters. Summer season helps to know resident birds. Prior to the launch, the volunteers were trained in the basics of bird identification.

Following the training session, volunteers were divided into smaller groups consisting of two to five members and assigned to randomly selected survey regions across Hyderabad," said Sriram Reddy, core member of Hyderabad Birding Pals.

HatchTech launches SetCare, a revolutionary new hatchery solution

Joost ter Heerdt, one of the owners and commercial director of HatchTech, spoke to The Poultry Site's Sarah Mikesell at the International Processing and Production Expo (IPPE) in Atlanta, Georgia, USA.

Joost, tell us about HatchTech.

HatchTech is a Dutch company based in the center of Holland and is approximately 25 years old. We are active in various parts of the poultry industry, but one of our main product lines is incubation equipment - setters, hatchers, ventilation, cooling and heating. Everything that you need to equip an incubation plant - that's our main product.

We are a global company, and our sales team is active in many different regions. We work with distributors in about 30 countries. We also have our own offices in Beijing, Germany, Poland, Ukraine and Latin America.

Tell me a little bit about some of the challenges and issues that you see in the poultry industry.

One thing that I see, at least in our field of expertise, is in the incubation plant. There are products that are relatively old, whereas genetics have been really developing a lot over the last years. We see that the equipment in the hatcheries cannot really cope with the heat that is coming out of embryos. That is one of the challenges, and that results in lower performance incubation.

One way to improve incubation performance is to make sure the incubation equipment that is in the hatchery can at least cool the embryos that are inside there and to give that genetic potential a chance to survive.

This is also one of the products that we launched here at IPPE. It's called SetCare and it's focusing on making sure that we're doing everything possible for the embryos that go into an incubator to survive. I think there's a lot to gain there. There are a lot of breeders who lay eggs. We must make sure as an industry that every egg counts and that we make a chicken from that egg. That's what we try to do with innovative products such as SetCare, which we launched this year.

Every egg counts. In the US, we've seen table egg prices double, so eggs are becoming more valuable.

The egg prices that you are referring to are mainly consumption eggs. Of course, we are more in

the hatching eggs sector; however, with both types, every egg does count.

If you look purely at hatching eggs, a hatching egg is a valuable part of the chain. We as a company have an influence on that so we must make sure that we make incubation equipment that is so good that it's worthwhile incubating it. Making sure that we get the maximum number of high quality chickens hatched and placed into the field so they can perform well.

Any other challenges or issues that you see in the industry that you're helping to solve?

Challenges that we face as an industry not only here in the US, but globally involve AI. I think it's a big topic now. AI will come and evolve over time, but it will never disappear again.

Another thing that we will probably face again soon is the volatility of prices of raw materials such as feed. I think that's a little bit the same as with the egg. We must make sure that once we put these birds in the field that they perform well because the highest percentage of the cost is still the feed. That's what we try to do with our products.

With HatchCare, we try to give the newly born chicks feed and water directly after hatch and that gives them a better start in life. Once they arrive at the farm, they perform better and have better feed conversion. If you have better feed conversion, that's basically helping you indirectly to cope with the volatility of raw material prices.

Better incubation and better birds in the field - that's what we try to contribute to the industry challenges we are facing, according to the poultry site.

US: 1 lakh eggs worth $40,000 stolen in Pennsylvania amid nationwide shortage

Egg prices have broken record after record as bird flu spreads across the US, killing millions of chickens

A sign with information about egg shortages at a grocery store in San Francisco, California, US, on Thursday, Jan. 30, 2025. Bird flu is forcing farmers to slaughter millions of chickens a month, pushing US egg prices to more than double their cost in the summer of 2023.

Thieves stole about one lakh eggs from a distribution trailer in Pennsylvania, authorities told CNBC. According to the report, the theft took place around 8:40 pm at Pete and Gerry's Organics LLC in Greencastle, police said in a report. The eggs are worth about $40,000.

The police officials said they did not have additional details and a probe was underway. In a statement, the egg supplier said it is aware of the incident in Franklin Country and is "actively working" with law enforcement agencies to probe.

"We take this matter seriously and are committed to resolving it as quickly as possible. Due to the ongoing investigation we cannot comment any further on this matter," the supplier added.

Egg shortage across US

The restaurants across United States are bearing the brunt of a national egg shortage, sending the prices to $7 a carton, Bloomberg reported.

Egg prices have broken record after record as bird flu spreads across the country, killing millions of chickens. A dozen large eggs in the Midwest now cost an average of $7.08 wholesale, about seven times the price just two years ago, according to the US Department of Agriculture.

Some 104 million egg-laying hens have been lost since the outbreak started in 2022, with 29 million killed since October, according to farmer group United Egg Producers. That's resulted in shortages at grocery stores at a time when shoppers just keep on buying more, the report added.

Drugs such as Ozempic, designed to treat diabetes but widely used for weight loss, are boosting demand for eggs as a source of protein, said Amanda Oren, vice president of industry strategy for grocery in North America at supply-chain platform RELEX Solutions.

In New York City, prices reached as high as $11.99 for a carton of a dozen cage-free eggs at Whole Foods Inc. The national retailer placed a three-carton purchase limit on customers at some locations in the city.

Bentoli inaugurates New Applicator Innovation center

Hyderabad: November 2024: Bentoli Inc., a globally renowned leader in animal nutrition, is proud to announce the inauguration of its state-of-the-art Applicator Innovation Center in Hyderabad, Telangana, India. The opening ceremony, held on the November 29 2024, was graced by Dr Arul Victor Suresh, Managing Director of Bentoli, marking a significant milestone in the company's growth and its commitment to the animal nutrition market.

The opening was attended by dignitaries, business partners and employees, reflecting Bentoli's unwavering dedication to excellence in animal nutrition. The modern innovation center is strategically located in Hyderabad's Kushaiguda business district, boasts cutting-edge infrastructure that supports key functions such as applicator innovation, R&D, QC, and testing.

This innovation center is pivotal in advancing bentoli's mission to manufacture customized applicators for moisture integration programme, liquid antioxidants application, mold inhibitors, and fish meal hygiene programs. These advancements solidify Bentoli's role as a significant contributor to the animal nutrition industry in the region and reinforce its commitment to enhancing animal health and productivity. The center will be headed by Mr Deepak Ramulla (Lead Engineer) who has hands-on experience in applicator development.

"The opening of the Applicator Innovation Center in Hyderabad highlights Bentoli's dedication to localizing solutions for the Indian animal feed industry," said Dr Sushanta Saha, Regional Director at the ceremony. He reaffirmed "India is a dynamic and growing market for Bentoli, and this expansion will enable us to offer customized applicator systems that meet the unique needs of the region. It is an exciting step forward in our goal to better serve our clients and contribute to the continued growth of the animal nutrition sector."

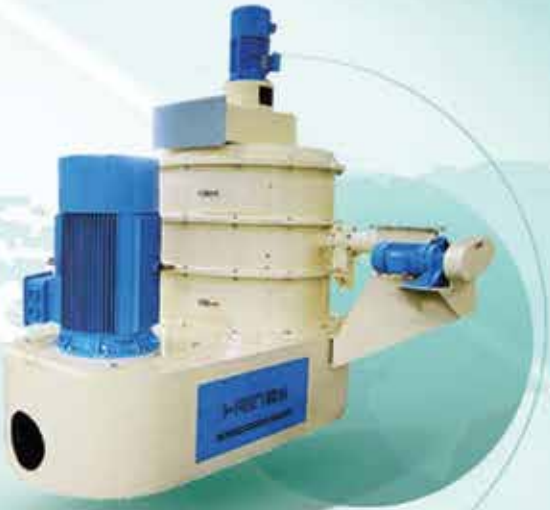
A major highlight of the new facility is the integration of Bentoli's innovative liquid applicator technology with the Internet of Things (IoT). This integration will optimize feed safety, control moisture content, secure nutritional integrity, and improve overall machinery efficiency. Furthermore, the newly developed technology allows engineers to maintain and calibrate applicators off-site with zero downtime, ensuring optimal performance and minimal disruption.

The Applicator Innovation Center will serve as Bentoli Agrinutrition's central hub for applicator manufacturing in India, consolidating R&D, customer support, and QC functions in one location. With this expansion, Bentoli is set to enhance its services and make a lasting impact on the success of farmers and producers across the country, providing them with innovative, high-quality animal nutrition solutions.

Bentoli remains dedicated to delivering cutting-edge nutritional technologies that support animal health, ensuring a prosperous future for India's agricultural and animal husbandry sectors.

About Bentoli: Bentoli® is dedicated to providing our customers with the highest quality products, services, and consultative solutions that will tangibly improve their operational and financial performance. The company manufactures preservatives, processing, and nutritional additives for aqua and animal feeds. It employs a comprehensive and methodical approach to develop optimal solutions for feed manufacturers and farmers. Working closely with feed manufacturers and livestock operators to thoroughly understand

Professional Feed Machinery Manufacturer



Hengrun SWFL Series Vertical Pulverizer

Vertical shaft with no-screen grinding, Bearing no maintenance. The production is uniform and the fineness is adjustable (Range from 40~200 mesh.)

Hengrun HRYTZ Series Vacuum Sprayer

Totally enclosed spraying space, Precision & Efficient spraying proportion widely ranged from 2%~30%.

their specific needs, the company uses a consultative, collaborative approach to identify problems, develop solutions, and continuously monitor performance to achieve desired results for our customers. It has active R&D involving labs and animal rearing facilities.

Bentoli has manufacturing facilities in North America and Asia and serves customers through an extensive network of sales offices and valued distributor partners throughout the globe.

The company's innovative approach and commitment to quality have earned it a reputation as a trusted partner in the animal nutrition industry.

Fear of bird flu

Telangana is on alert as it is confirmed that Andhra Pradesh virus is spreading 24 check posts have been set up across the state where the officials are sending back the chickens coming from AP Chicken sales drop due to bird flu scare

Telangana government has been alerted by the officials there that Burt Puu is spreading in Eluru, West Godavari and NTR districts of Andhra Pradesh. Gayinda Ichindaluni, diseased chickens in the state! The Animal Husbandry Department has advised the District Collectors to take precautions to prevent it from entering. That branch is a special main Secretary Savyasachi Ghosh has issued internal orders to the collectors to this effect. He asked the Collector to hold district level meetings with the officials of the Animal Husbandry Department and to get an action plan from other states to take preventive measures. 24 Chekipons have been set up across the state by the innovative Kale Kartu. ok Authorities have stepped up their efforts in the border districts. On Tuesday, the officials brought the chickens from AP back. Lakhs of chickens die of bird flu virus in AP: At the same time, 10-20 days old chicks died of the deadly virus in many parts of the joint Khammam district. Chicken farms in Khammam mostly get

chicks from West Godavari, Eluru and Krishna districts due to the threat of Tenflu virus entering through them.

A special vigilance was arranged at the interstate co-posts in the state and measures were taken to prevent the arrival of chickens from AP. Chicken breeding in the common area has stopped.

33,030 chickens in Gadwal

Vehicles transporting broiler chickens from AP to the state were sent back at Pulluru Tolteja on the 44th Sambaru National Highway on the borders of Jogulamba Gadwal district. 3.030 broiler chickens being brought in 5 vehicles. 500 ducks and 30,000 broiler chicks, which were being transported from Tamil Nadu to Kama Reddy district in two containers, were returned. In two days, a total of 33,030 broiler chickens and 500 ducks were sent back. Three check posts were set up at Kodada, Vadapalli and Nagarjunasagar on the border of Telangana and AP in the joint Nalgonda district. A few days ago chickens died in Nizamabad, Kamareddy and Khammam districts

The State Department of Animal Husbandry has declared that the reason for their death is not due to their death. On the other hand, Art Fu scares caused anxiety among the owners of the Cvo Kshafaras. The sale of chicken in the market has fallen drastically.

Vikev's 'WhatsApp' shock!

Millions of kgs of chicken are consumed in Hyderabad every day. Chicken sales and prices are good till 3 pm on Tuesday. As soon as Vira Supply campaign started on TV and social media, Anam suddenly got scared. At 5 pm, a kilo of screenplay-less chicken fetched Rs.200-210, but within an hour, it fell to Rs.170, just like the stock market crashed. It means that the people of Hyderabad city can understand how scared they are. Do not eat eggs. Owners are worried that the poultry industry is at risk of complete loss due to the WhatsApp campaign of not eating chicken.

Bird flu shaking Godavari districts

Bird flu is shaking the Godavari districts of AP. Kanur in East Godavari district and Tanuku rural mandal of West Godavari district in Velpur were in chicken farmsv and thousands of chickens died after testing their samples.

Study says it's a matter of US national security that farmers survive, women are key to their survival

Recent research from the University of Georgia suggests the unique stresses from farm life may be taking a toll on one of the pillars of the families that make your dinners possible: the women who keep farming families running.

"If we don't control our food sources, we don't control our health and safety," said Anna Scheyett, lead author of the study and a professor in UGA's School of Social Work. "It's a matter of national security that farmers survive in the United States. And one of the big factors in helping farms survive is women."

Women vital in farming, on and off the agricultural field

The researchers held six focus group sessions with more than two dozen women married to farmers in rural Georgia.

Women are vital in farming, Scheyett said. Many women are farmers themselves while others work the farm alongside their spouse. But much of their work is "invisible," sometimes even to the women themselves. That's a theme that emerged among the women in the groups.

They often take care of everything but the farm, managing housework,

Anna Scheyett

yardwork and child care. One participant even described herself as being, in a sense, a single parent, saying, "If it has to do with our kids or my household … that is 100% on me."

Because farming is uncertain and one bad frost can spell disaster for the season's crops, two-thirds of the women in the study also work full time outside the home. This provides more financial stability and health care coverage for the families, but it also increases the mental load the women carry.

On top of their careers and role handling all the non-farming tasks, over half of the women in the study also managed the books for their families' farms, a unique source of stress for many of them.

"He doesn't look at the bank account … as far as looking at it on paper, what we have coming in and what we have going out, I carry that burden," one woman said.

Many also work on the farm as well. But they often discounted their own contributions to farm work, saying things like they "only" managed hay or that their husband was "the primary farmer."

Managing emotions, coping with stress gets tough for female farm wives

The women described feeling like they had to be the "bright spot in everyone's day," saying it was up to them to manage their husbands' emotions when things got rough and the farmers got grumpy.

"Any time they're under stress, boy, you're going to get the brunt of it," said one participant.

They lead an isolated and often lonely life, the women agreed.

"What a lot of people don't realize is as a farmer's wife … you can't get off at 5 o'clock and go and hang out with your friends like 'normal' … because it's a full-time, seven day a week deal," one participant said.

"It is really easy to get sad," said another.

Minimizing difficulties, finding joy and pride to thrive in farm life

The women often minimized the difficulties they experience, describing their farm work as simple and their husbands' as "the real work." And they also minimized the negative emotions they absorbed from their spouses.

"I don't think that they mean it" and I just "tune it out" were common refrains from the women in the focus groups.

A positive repeatedly stated by women was the pride they felt in farm life and how it gave them real joy to see their children raised on a farm. One wife noted how lucky she felt because "we live right here in the midst of it all, so there's no life like it" while others talked about how "it's a great way to raise kids."

"These are powerful, resilient women," Scheyett said. "The title of the paper — 'A great life if you can stand it' — is a quote from one of the women.

"They are passionate about farming and farm life, proud of what their families are doing, proud of their kids, proud of how hard their husbands are working and how hard they're all working."

And they don't want your pity, the researchers said. The participants universally agreed that raising their families on a farm was a uniquely challenging but rewarding experience, and they wouldn't change that.

Thank farming families

Still, a little recognition of their contribution to securing the U.S. food supply could go a long way,

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the researchers said.

"I'd love to see a campaign thanking farmers and their families for their service to the country," Scheyett said. "They put their bodies on the line every day so we can eat and live. The least we could do is say 'thank you.'"

Using Extension services to connect the women to lessen their feelings of isolation could also improve quality of life among this population.

Another obstacle is child care. Rural child care is hard to find and often extremely expensive when you do find it. Policies increasing access to quality and affordable care "would give the women a little bit of breathing space," Scheyett said.

"I ultimately would hope that people can move beyond whatever stereotypes they have about farming and families who farm," Scheyett said. "If we don't support

Avitech Nutrition showcases innovative animal nutrition solutions at 18th PDFA International Dairy & Agri Expo 2025

Avitech Nutrition participated in the 18th PDFA International Dairy & Agri Expo 2025, held from February 8th to 10th at the Cattle Fair Grounds in Jagraon, Ludhiana, Punjab. Recognized as one of the topmost exhibitions for the Indian dairy industry, the exhibition brought together key stakeholders, including farmers, milk producers, milk processing units, veterinarians, consultants, dairy feed millers, and animal nutrition companies.

Avitech Nutrition highlighted its commitment to advancing animal nutrition through its innovative product offerings. The company showcased a range of cutting-edge solutions from its PhyGeno division, including **Genoliv**, a plant-based liver stimulant designed to enhance liver function by optimizing its detoxification capacity.

Visitors also showed keen interest in Avitech's established product portfolio, including:

Avilact Pro – A potent rumen alkalizer that neutralizes acids in the rumen and supports productivity.

Trisorb Alpha – A complete toxin binder to safeguard livestock from mycotoxin-related risks.

Nutriox – A powerful antioxidant formulation for nutrient protection against oxidation.

Performins – A range of organic mineral monoglycinates that represent the latest technology in organic trace minerals.

The event served as a valuable platform for Avitech Nutrition to engage with industry experts, share knowledge, and explore new opportunities for collaboration. The positive response from attendees showed the increasing demand for innovative and science-based nutrition solutions in the dairy industry.

Avitech Nutrition remains committed to delivering high-quality, research-driven products to support the dairy industry's evolving needs and looks forward to continuing its contributions to livestock nutrition.

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Telangana on high alert in view of bird flu

The Telangana Government has declared a 'high alert' in view of outbreak of Highly Pathogenic Avian Influenza (HPAI) or Bird Flu cases reported in the neighbouring Andhra Pradesh, by setting up over two dozen border check posts to check vehicles transporting poultry birds into the State.

Though, no cases has been reported in Telangana so far, Animal Husbandry Department officials have been on their toes throughout the day and had activated all its district teams to be on round-the-clock vigil at the borders to check vehicles entering the State.

Additional Director of Animal Husbandry Ch. Malleswari said that as many as 24 check posts have been set up on the borders connecting towns with Andhra Pradesh, Maharashtra and Karnataka. "Our team of veterinary doctors and police are jointly mounting a vigil and checking poultry vehicles entering the State," she said adding that a helpline has been set up for the benefit of the poultry breeders and farmers.

Vehicles entering Telangana at the inter-State borders at Kodad, Wadapally, near Nagarjunasagar, Pullur (near Kurnool) are being checked thoroughly and in case of any doubt, they are being turned back. "The vigil and vehicle checks will continue for the next 15 days," said Dr Malliswari and stated the mobile teams on the field have been asked to provide a regular update on the number of vehicles checked and asked to return.

There have been cases of some poultry farmers and others contacting the helpline numbers to complain about suspicious deaths of birds. "But, on testing the samples, we have ruled out any bird flu case from among them," she said. There are 6,064 registered poultry farms in the State with 9.69 crore layer and broiler birds.

The department has already held talks with the poultry farmers, industry associations also also representatives of the National Egg Coordination Committee (NECC). The representatives apparently informed that the sudden rise in temperatures had led to some deaths in the poultries and no bird flu cases has been detected so far.

Veterinary doctors too have been drafted for border checks and a senior Animal official mentioned that the poultry breeders should take adequate bio-security measures to avoid any outbreak of Bird Flu.

Free chicken, eggs distributed in Andhra Pradesh's Guntur

The initiative saw an overwhelming response, with thousands gathering to receive freshly cooked poultry dishes, leading to an unexpected surge

The crowd at the event grew so large that organisers had to lock the gates to maintain order.

Guntur: In an effort to counter bird flu rumours and revive the struggling poultry industry, poultry farmers and industry representatives in Guntur organised a free chicken and egg distribution programme at Swami Theatre premises on Friday.

The initiative saw an overwhelming response, with thousands gathering to receive freshly cooked poultry dishes, leading to an unexpected surge. The crowd grew so large that organisers had to lock the gates to maintain order.

The recent bird flu outbreak severely affected chicken and egg sales. Fear and misinformation led to a significant drop in demand, prompting poultry farmers to take proactive steps to reassure consumers. Industry leaders emphasised that properly cooked poultry poses no health risk.

Prominent leaders, including MLAs Kanna Lakshminarayana and Naseer Ahmad, participated in the event, encouraging the public to continue consuming poultry products. They highlighted the economic hardships faced by farmers and urged people not to fall for baseless fears.

Following the overwhelming public response, industry representatives expressed optimism that such awareness campaigns would help restore consumer trust and stabilise sales. With chicken and egg prices gradually recovering, poultry farmers hope their businesses will soon return to normal levels.

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Infectious Diseases and Metabolic

Syndromes Impacting Broiler Breeders

The most prevalent infectious diseases and metabolic syndromes of poultry, which can negatively impact the welfare of the birds and cause economic losses to producers, are continuing to evolve worldwide. Having good management of feeding and nutrition, as well as biosecurity and vaccination programs in place can help prevent disorders and eradicate or limit the spread of diseases. It is also important to consider the role that migratory birds, rodents, pests and the global movement of people, among other factors, play in regulating these conditions. Quickly recognizing the signs and symptoms of these disorders is essential for corrective actions and preventions to be achieved.

INFECTIOUS DISEASES

Mycoplasma synoviae (MS) has persisted despite improved approaches to controlling and monitoring the disease. In addition, MS often presents as a silent infection, where broiler breeder flocks may seroconvert (test positive serologically) with no sign of illness or negative impact on performance, making it difficult to assess. MS has re-emerged due to a decrease in antibiotic (AB) use and the occurrence of more pathogenic strains. These strains can cause the typical synovitis issues (swollen joints and footpads), secondary respiratory issues (especially in broilers) and a fairly new effect on eggs called Eggshell Apex Abnormalities (EAA) or Top Coning **(Figure 1)**. EAA more often affects commercial layers but has also been seen in broiler breeders.

A decrease in AB use to control Mycoplasma infections coincides with more companiesstarting antibiotic-free programs (ABF), minimizing AB use or the ban of AB (all or specific) in some countries. Reduced AB use has led to more flocks showing seroconversion. Initially, a few live Mycoplasma gallisepticum (MG) vaccines were introduced worldwide, which seemed to work well against MG, and were cost-effective. Many producers used these live MG vaccines and subsequently stopped using continuous AB in feed to control MS. As a result, MS seemed to re-emerge and thrive. More recently, live MS vaccines have been introduced, and some broiler companies have started using these in conjunction with MG vaccines in their broiler breeders.

Fig. 1. Egg shell abnormalities (EAA) or "top coning" caused by MS infection in hens.

As companies become more conscious about biosecurity and more affordable testing becomes available, more MS infections are detected. Good biosecurity practices and management of MS-free breeding stock must be active decisions in the process to eradicate this disease.

Coccidiosis is most commonly seen due to improper management of birds after vaccination with live coccidiosis vaccines. Coccidiosis control starts with vaccination at the hatchery (most common) or on farm. The vaccine must be properly handled, never frozen and applied correctly, ensuring that when applied in the hatchery, that chicks are well covered, and the oocysts do not settle out of solution. Even with the best vaccine application, the farm must have the correct environmental conditions for proper sporulation of oocysts and vaccine cycling within the birds and the house. Adequate cycling of oocysts does not occur if the litter is too dry or too wet, if the bird density is too high or too low or if anticoccidial medications are used. If one or more of these occur, birds can either have too much of a reaction causing coccidiosis issues early (usually 14-30 days of age) or, if not exposed to enough vaccine and recycling in the litter, the result is typically a coccidiosis outbreak later in life (6-20 weeks of age). Coccidiosis outbreaks may also occur due to severe immunosuppression from a simultaneous or recent infection such

as Marek's Disease Virus (MDV) or Chicken Anemia Virus (CAV). Further information regarding coccidiosis prevention can be found in the Aviagen Briefs

- *Coccidiosis Control in Broilers with the use of Vaccines or Coccidiosis Control in Broiler Breeders with the use ofVaccines.*

Viscerotrophic Velogenic Newcastle Disease (VVND) is a form of Exotic Newcastle Disease (END) and is a respiratory virus recognized in many regions. In areas where it is widespread, birds must be vaccinated to protect against morbidity, mortality and egg production drops. If unvaccinated birds are exposed, the result can be similar to highly pathogenic avian influenza (HPAI), resulting in morbidity/mortality of 90-100%.

Vaccination programs for VVND are a combination of live and killed vaccines to induce very high protective titers. Poor quality vaccines, poor vaccination technique or insufficient vaccination can result in antibody titers not being fully protective against morbidity, mortality and egg drops. If birds are not fully protected, it is common to see minor egg production drops (5-15%) and a slight increase in mortality (0.5-1.0%). Symptoms can present as:

- Torticollis (wry neck or twisted neck, especially during rear).
- Petechial hemorrhages in the trachea, proventriculus, intestines, cecal tonsils and sometimes the brain.
- A sudden increase in Newcastle disease virus (NDV) titers.

Egg quality problems such as thin shells and white color (more noticeable in brown eggs) can also be seen with an accompanying drop in egg production. Good biosecurity is key to keeping this disease out of the flock, along with a good vaccination program to give fully protective titers.

Histomoniasis ("Blackhead") is primarily reported in the US but has recently been reported throughout the EU, Asia, and Latin America. In many regions, the removal of all preventative medications and effective treatments has caused an increase in the incidence of Blackhead.

The presence of dirt floors and/or re-used litter makes it more difficult to completely clean and disinfect a house between flocks and control secondary carriers, such as cecal worms **(Figure 2)** and earthworms, known to harbor the histomonas protozoan organism. There is good evidence that darkling beetles can also carry the organism, and it has been theorized that direct transmission between birds is possible. Therefore, the best way to prevent or control Blackhead is by effective cleaning and disinfection. In instances where dirt floors and/or re-used litter are present, floors should, at a minimum, be treated with one of the following on top of the floor before spreading litter material:

- Iodine and acid with salt (such as sodium hypochlorite).
- A combination of salt and lime.
- Organic acid and iodine.

In addition, crates used to transport birds must be cleaned, as birds have been shown to contract histomoniasis from equipment.

Blackhead has been observed as early as 13 days of age in poultry. Therefore, frequent and early treatment for internal parasites is very effective. Treatment entails medicating as many as 4-5 times before production begins and using more than one anti-parasitic medication to prevent resistance. Treating for more than one day may also have benefits; all birds might not get an effective dose with a one-day treatment. Further information regarding histomoniasis prevention can be found in the Ross Note - Histomoniasis (Blackhead).

Inclusion Body Hepatitis (IBH) is mostly reported in broilers and is often transmitted horizontally but can be vertically transmitted from parent stock (PS) and sometimes grandparents (GPs) to PS. Typically, young hens become infected during production and vertically shed the virus to their progeny for several weeks. IBH is caused by several serotypes of Fowl Adenovirus Group 1 (FADV1).

Historically, adenoviruses are present in most chicken houses, and most broiler breeder flocks naturally seroconvert to FADV1 before the onset of production. The issue occurs when pullets are placed in a new or very clean rearing house and are not exposed to FADV1 before the onset of production, leaving them without immunity when exposed to the virus

Fig 2. Cecal worms (Heterakis gallinarum) passed in feces.

in the laying house. For this reason, it is also called "new house" or "clean house" syndrome. In recent years, the risk of pullets seroconverting to FADV1 has decreased due to better biosecurity and cleaning and disinfection practices to control diseases such as Avian Influenza (AI) and avian salmonellosis.

Broiler breeders, not naturally seroconverted or vaccinated in rear but exposed during lay, usually do not show any signs of disease. Still, their progeny is at greater risk of IBH from vertical transmission for 4-6 weeks after the PS flock is exposed. If this becomes a chronic issue, birds must be vaccinated with a killed vaccine containing the specific serotypes seen in the flock.

Avian Influenza (H9N2) is caused by avian influenza virus serotype H9N2 and sometimes H9N3. It is seen throughout Asia, the Middle East and Europe (EU). The virus causes a mild respiratory infection with a slight increase in mortality (0.5-1.0% a week for a few weeks) in broiler breeders. If complications occur with other respiratory diseases such as NDV, IBV, MG/MS and/or bad environmental conditions (too cold or too hot, high ammonia), symptoms could worsen.

A severe egg production drop that never fully recovers to pre-infected levels is seen in unvaccinated birds. Typically, the egg production drop is approximately 30-50% over several days and takes 2-3 weeks to recover. The hens' reproductive tract is also affected, leading to eggshell quality issues such as soft-shelled eggs. If H9N2 becomes prevalent in a region, birds must be vaccinated with a killed vaccine, if an approved vaccine is available. The best protection is achieved using the local area's strains in the vaccine.

Infectious Bronchitis Virus (IBV) could be the most common disease seen in broiler breeders and broilers. Most companies vaccinate for IBV because minor egg drops (usually 5-15%) and cull eggs, along with respiratory signs, are likely to occur without proper protection.

There are many IBV variants seen around the world. If there is evidence of IBV variant strains in a specific area, vaccinations (usually live primers) for these variants should be included, if available, in the vaccination program to increase the spectrum of protection. If there is very early exposure in the first 2-3 weeks to a severe variant (like QX) without proper vaccination, it could lead to non-laying chickens ("blind layers" or "false layers"), caused by early damage to the oviduct.

METABOLIC SYNDROMES AND DISEASES

Many metabolic syndromes have the following predisposing factors related to the transfer of birds from the rear to the laying phase:

- Poor flock body-weight uniformity.
- Lighter than recommended body weight.
- Earlier than recommended transfer to the lay house.

After photostimulation, diet formulas are often changed and feed volumes increased. As a result, the predisposing factors listed above can adversely affect bird metabolism and sexual development. Called an "overfeeding complex", it is associated with various metabolic problems that can occur individually or in conjunction, leading to lower livability of the flock and poor live production performance.

Multiple Follicular Hierarchies result when birds are overfed, causing changes in the ovary and resulting in the overproduction of follicles.

A typical follicular hierarchy in control-fed breeding hens consists of the recruitment and development of no more than eight follicles. This phenomenon is known as multiple follicular hierarchies **(Figure 3)**. These multiple follicular hierarchies

Fig 3. Multiple follicular hierarchies with the ovary.

can result in superovulation and the alteration of egg production. According to scientific research, for every extra follicle at sexual maturity, the bird produces ten fewer eggs during its productive life.

As a result of superovulation, erratic oviposition and defective egg syndrome (EODES) can occur **(Figure 4)**. EODES can progress further to oviduct impaction **(Figure 5)**, setting the stage for abdominal or internal laying and salpingitis- peritonitis **(Figure 6)**.

Peritonitis is the predominant reproductive disease causing mortality in broiler breeders. It is an acute disease with a

sudden increase in mortality, especially at the beginning of egg production, and may persist until after peak. The main

clinical signs are mortality, particularly in the morning hours, of hens in good condition without clinical signs of any

disease. At necropsy, purulent (pus-filled) material around the ovaries and the abdominal cavity is seen. Due to internal/ abdominal laying, it is sometimes referred to as Egg Yolk Peritonitis **(Figure 7)**.

Peritonitis is multifactorial and caused by:

- Poor water quality.
- Primary infections (E. coli, Cholera, Salmonella).
- Secondary infections due to immunosuppressive and respiratory diseases.

Fig 4. Too many follicles as a result of superovulation (EODES).

Fig 5. Salpingitis with caseous egg yolk from the oviduct.

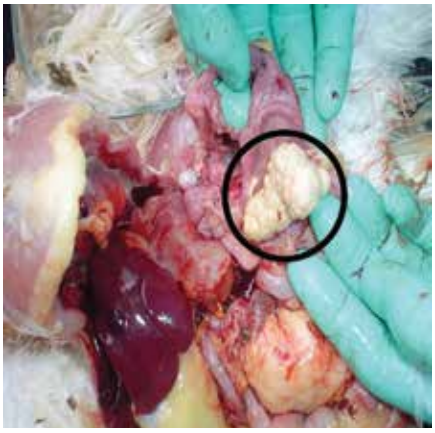

Fig 6. Salpingitis and impacted oviduct.

- Poor house/bird management.
- Multiple Follicular Hierarchy or EODES.

In general, peritonitis can be prevented by:

- Managing litter and nest conditions.
- Vaccinating with a live or killed E. coli vaccine.

To prevent overfeeding and the development of peritonitis, it is critical to control body-weight gain and uniformity during rear.

Prolapse is commonly observed at the onset of production in flocks with poor body-weight uniformity. Prolapse and subsequent peck-out can result in cannibalism and occurs more often in Spring/Summer due to the excessive light stimulus. Feed increases that are too large after photostimulation and before peak production are associated with an earlier than desired start of production and higher rates of double-yolk eggs that can also cause cloacal prolapse. Therefore, small but frequent feed increases to peak feeding are recommended after photostimulation. Prolapse and peck-out have also been observed in flocks 40 to 50 weeks of age with excessive weight **(Figure 8)**. In this case, abdominal fat may alter the correct return of the cloacal mucosa after laying.

Calcium Tetany or hypocalcemia (low blood calcium [Ca]) occurs in broiler breeders that have not started egg production and are fed high Ca levels (>1.2%). The high Ca levels trigger a metabolic mechanism (negative feedback) that limits optimal storage and Ca transport from the bone for eggshell formation. It typically occurs acutely with symptoms and clinical signs early in the morning, at the start of the day. Birds gasp and open their wings when hot, show weakness and depression, progressing towards paralysis and extension of the legs backward; sometimes, seizures can occur. As leg paralysis progresses and hens squat down in the scratching area, over-mating may occur, potentially leading to mortality. At necropsy, lesions are non-specific, often associated with active ovaries (multiple follicular hierarchies) and the presence of partially or fully formed eggs in the oviduct with follicular congestion **(Figure 9).**

Calcium tetany occurs in young broiler breeder hens between 25 and 34 weeks of age, especially flocks with poor uniformity, which have been photostimulated too soon and have been given a production diet with high Ca levels. Although less common, calcium tetany can also occur when production diets are formulated to contain lower than recommended Ca levels.

Hypocalcemia can be treated with Ca supplementation. Ca can be increased in the feed or by manual distribution of oyster shell. It is important to

Fig 7. Egg yolk peritonitis, egg yolk is found around organs upon necropsy.

Fig 8. A peck-out that resulted in the extraction of internal organs. An internal blood clot is often observed upon necropsy.

Fig 9. Calcium tetany - presence of partially or fully formed eggs in the oviduct with lung and follicular congestion.

Fig 10. Ruptured and pale liver; blood clotting around the liver indicates rupturing.

avoid Ca overdoses, as that would cause toxicity and lead to increased mortality. Prevent calcium tetany by correctly balancing the minerals in the diet (calcium to phosphorus ratio, [Ca:P]) and adjusting age and diet changes. It is also critical to maintain the correct body weight and uniformity during rear.

Fatty Liver and Hemorrhaging Syndrome (FLHS) is a syndrome that occurs mainly in commercial laying hens. However, cases are occasionally seen in broiler breeders. Sudden death from liver rupture has been reported in over-fleshed birds after peak production as they get older, gain weight, and the liver gets fatter. An enlarged, fragile and pale liver is observed at necropsy **(Figure 10)**, accompanied by breast muscle paleness resulting from internal bleeding. The liver can rupture spontaneously or due to trauma as birds enter the nests, perch or experience discomfort.

Sudden Death Syndrome (SDS) or Re-feeding Syndrome is associated with the over-feeding complex mentioned earlier. Affected hens develop heart problems and changes in electrolyte balance (mainly phosphorus [P] and potassium [K]) that cause sudden death. The sudden increase in mortality occurs as the flock approaches 30% in production. It decreases when the percentage of production reaches 60 to 70%, lasting 1 to 2 weeks in mild to moderate cases. Some common clinical signs include:

- Less flock vocalization.
- Very fluid fecal droppings.
- Increased feed clean-up times.
- Increased morning mortality.

Necropsy lesions consist of pseudo-prolapse, cardiac hypertrophy, widespread internal congestion and hydropericardium with mild ascites **(Figure 11)**. In addition, birds with SDS commonly have low sexual development and immature ovaries **(Figure 12)**.

Cardiac hypertrophy is defined as a Heart (g)/Body Weight (kg) ratio >3.5. In hypertrophic hearts, there is increased development of the left ventricle and dilation of the right ventricle generating a notch or slit between the ventricles and the atria.

Situations that lead to the development of SDS include:

- Large percentages of immature hens with low sexual development (small combs and wattles) and poor breast fleshing at transfer.
- Rapid and high volume feed increases to achieve early onset and a rapid increase of egg production.
- A rapid body-weight gain in conjunction with heart muscle mass gain. Necropsy reveals over-fleshed hens ("plump breast" and "double-breasted hens", (Figure 13)).
- Mineral requirements, especially P and K, are altered, and an electrolyte imbalance develops due to rapid body weight and cardiac muscle mass gains.
- This deficiency is exacerbated when light birds are fed Breeder 1 diets with higher Ca levels, resulting in heart failure and sudden death.

Contributing factors to SDS include:

- Low protein diets.
- Excessive Ca levels.
- Low K (hypokalemia occurs).
- Low P (hypophosphatemia occurs).

Correct diagnosis is essential as this syndrome is often confused with calcium tetany. If treated erroneously with Ca supplementation, it can create a Ca:P imbalance and hen mortality.

PREVENTING METABOLIC SYNDROMES IN BROILER BREEDERS

1. **Improve body-weight uniformity.** Body-weight uniformity is critical to feed a population of birds accurately. The more uniform the flock, the greater the likelihood that a higher proportion of birds are subjected to optimal feed management and light stimulation. The more variable the weight between birds, the more variable their requirements, reproductive performance and eggshell quality. It is recommended to set targets and indicators and to propose action plans when deviations occur.
2. **Avoid pre-lighting or anticipated move to the hen house.** Consideration must be given to flock age, sexual maturity, uniformity, and light-proof

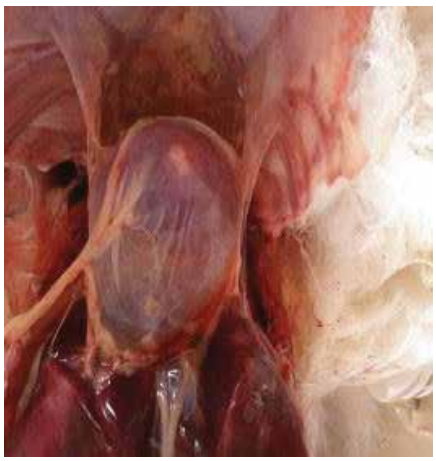

Fig 11. Hydropericardium associatedwith SDS.

Fig 12. Heart with juvenile ovarie (SDS occurs in younger as well as older birds).

condition of housing when planning bird move into production house and the age at photostimulation.

3. **Avoid overfeeding during critical times after photostimulation.** After photostimulation and the resulting increase in circulating sex hormone (estrogen) levels, broiler breeding hens become more sensitive to feed changes. Under this hormonal stimulus, birds convert feed more efficiently, and it is easy to overfeed with increases greater than 3-5 g/week from transfer to the onset of production. After photostimulation, a gradual increase in feed is recommended because the metabolic problems described herein are rooted at this stage.

4. **Adjust feeding program for egg production.** At the onset of egg production, a feeding program should consider small feed increases when there is low production to avoid overfeeding those birds that are not yet laying. In modern broiler breeders, it is essential to prevent excessive breast development and modulate weekly hen mortality. Therefore, it is critical to follow up by performing a field necropsy and assessing each of these syndromes' relative incidence to take corrective action at the right time.

CONCLUSION

Many infectious diseases can be prevented with good biosecurity practices and, when available, vaccination. Metabolic diseases can be prevented by understanding the factors that predispose flocks to these conditions and how to avoid them. As the most prevalent infectious diseases and metabolic syndromes of poultry continue to evolve, good feeding and nutrition management, biosecurity, and vaccination programs must be in place for prevention and eradication to occur.

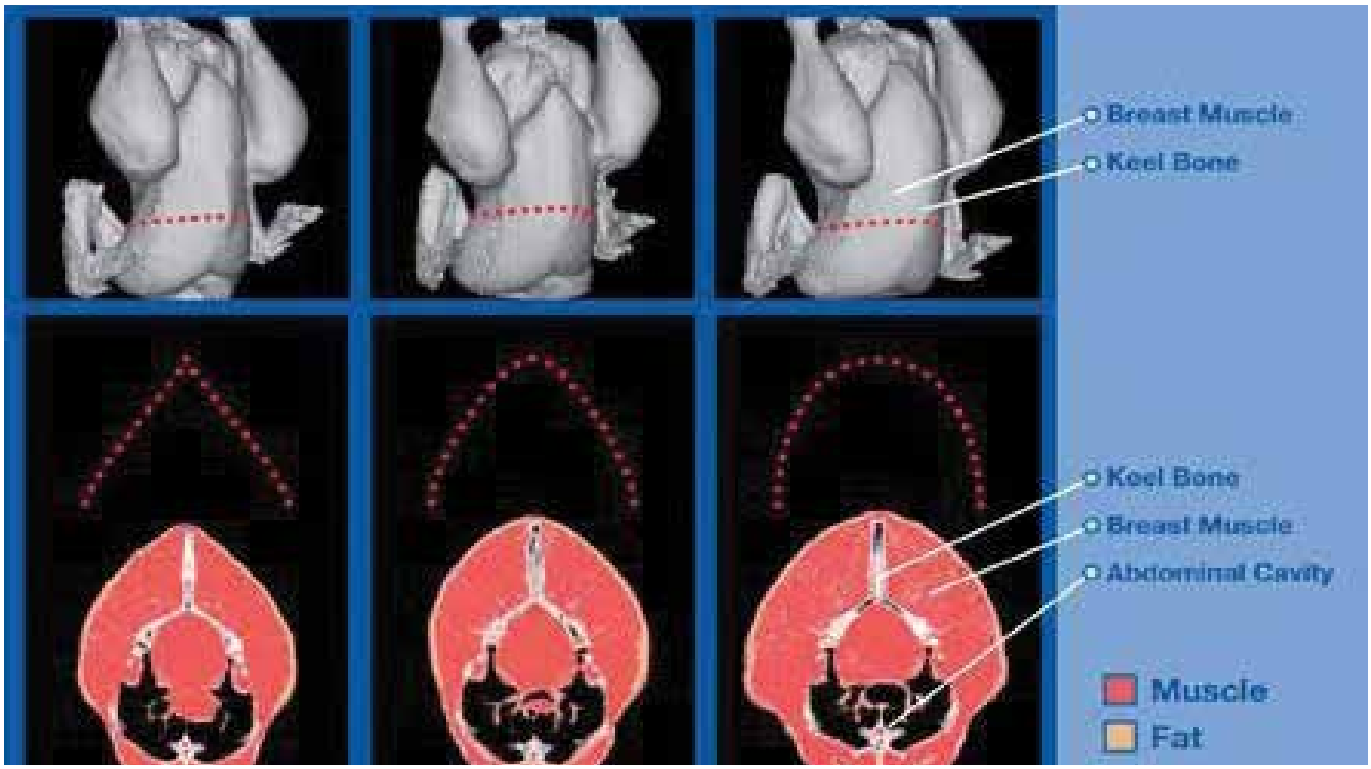

Fig 13. Assessing the shape of the breast in females, under, ideal, and over fleshed.

Assessing the effectiveness of nano-selenium as a mineral supplement for broiler chickens: a dose–response meta-analysis of existing research.

Authored by: Alihossein Piray

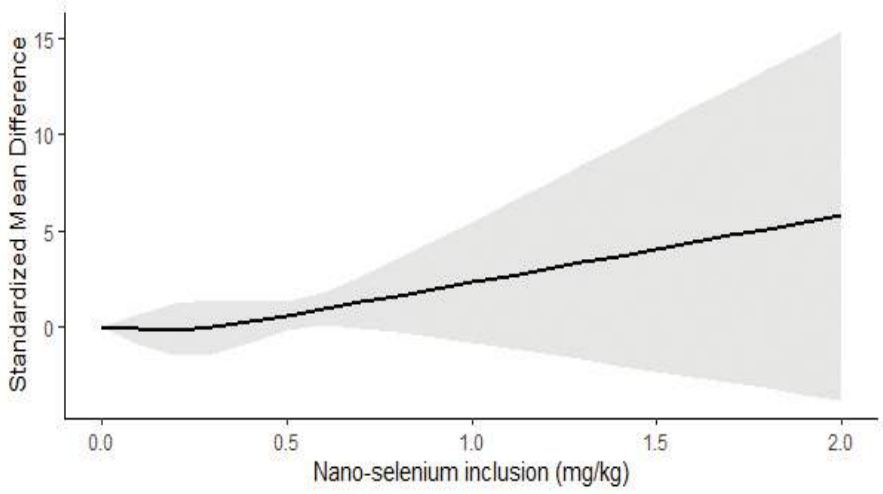

Fig. S1 Combined dose–response association between Nano-Se supplementation and heart proportion (solid line) with 95% confidence intervals (shaded area). Nano-Se supplementation was modeled with restricted cubic splines in a one-stage random-effects meta-analysis. No Nano-Se supplementation (0 mg/kg diet) was used as the referent.

The effects of dietary nano-selenium (Nano-Se) supplementation on broiler chickens fed diets without added selenium remain controversial. This dose-response meta-analysis examined dietary Nano-Se effects on broiler chickens. The meta-analysis results indicated that Nano-Se supplementation up to 2 mg/kg linearly increased feed intake ($p < 0.05$). Nano-Se supplementation improved both body weight gain and feed conversion ratio (FCR, $p < 0.05$). Body weight gain peaked at approximately 0.35 mg/kg (increasing up to 0.90 mg/kg), while optimal FCR was observed at 0.30 mg/kg (improving up to 0.80 mg/kg). Nano-Se addition did not changed carcass, liver, or heart proportions ($p > 0.05$). However, a negative linear association was observed between Nano-Se and abdominal fat proportion at doses ranging from 0.50-1.80 ($p < 0.05$). Nano-Se addition at the levels up to 0.40 mg/kg enhanced breast proportion ($p < 0.05$), with the greatest breast proportion observed at a Nano-Se level of about 0.25 mg/kg. Blood triglyceride levels were unaffected by Nano-Se supplementation ($p > 0.05$). However, supplemental Nano-Se reduced blood cholesterol levels at doses of 0.10 and 0.20 mg/kg, while increasing them at doses exceeding 0.40 mg/kg ($p < 0.05$). Nano-Se supplementation enhanced blood GPx activity ($p < 0.05$), and the optimal Nano-Se dose was determined to be 0.63 mg/kg. While the addition of Nano-Se did not change the spleen index ($p > 0.05$), Nano-Se levels between 0.20 and 0.50 mg/kg boosted the antibody response to the Newcastle disease vaccine ($p < 0.05$). However, Nano-Se administration did not impact ileal villus height or crypt depth ($p > 0.05$). This study suggests that the optimal dietary Nano-Se inclusion for broiler chickens may lies within the range of 0.20–0.63 mg/kg. A critical knowledge gap exists regarding the mechanisms by which Nano-Se is converted into selenoproteins, necessitating further investigations.

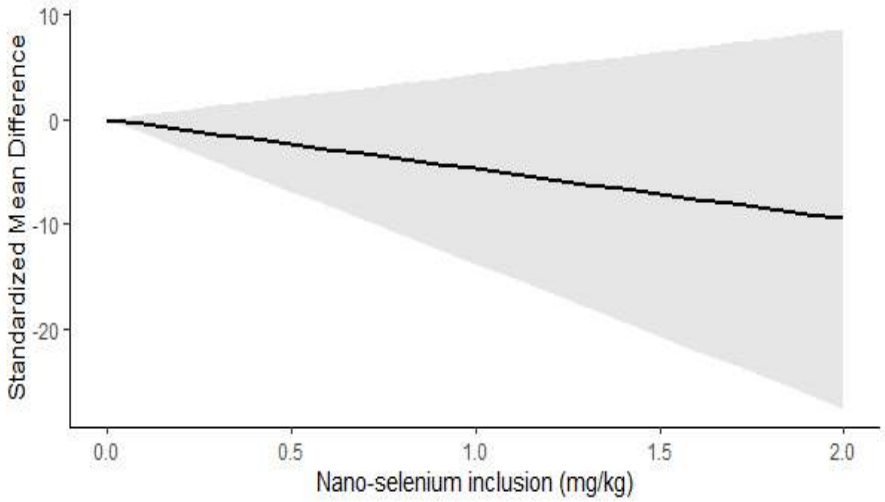

Fig. S2 Combined dose–response association between Nano-Se supplementation and liver proportion (solid line) with 95% confidence intervals (shaded area). Nano-Se supplementation was modeled using linear model in a one-stage random-effects meta-analysis. No Nano-Se supplementation (0 mg/kg diet) was used as the referent.

Source by: www.tandfonline.com

The role of bioavailable silica in supporting poultry growth and development

Silicon has been commonly used in animal feeds in the form of hydrated aluminosilicate (zeolite) as an adsorbent of unwanted substances, such as plant fungal toxins and excess nitrogen compounds (Papaioannou *et al*. Citation2005).

Authored by E. J. Burton, D. V. Scholey, S. Prentice, D. J. Belton, A. Alkhtib & C. C. Perry

Summary
Silica is known to be an important essential ultra-trace mineral which does not currently have a recommended level for supplementation in poultry, beyond avoidance of deficiency. The chemistry of silicon dictates its bioavailability, and depending on source and concentration, solubility varies widely. This review details the chemistry and biology of silica and the potential mode of action for improving bone health while also bringing together research from human and other animal fields. The poultry sector has investigated the effect of supplementation with several silicon containing compounds with inconsistent outcomes. This may be due to the large variability in bioavailability of differing silicon containing compounds, so this is also discussed. Finally, the authors consider whether bioavailable silica should have a recommended supplemented level for poultry to maximise performance and skeletal integrity in the future, and if so, should this be of a known bioavailable form.

Introduction
It has been reported that 66 billion broilers are slaughtered every year in the world, with most birds being produced in the United States, China and Brazil (Phibbs *et al*. Citation2021). This leading role in global meat supply means the broiler sector is under significant pressure to improve productivity and efficiency to cope with an increasing demand for chicken meat. Rapid growth and a high proportion of edible meat associated with the most resource-efficient strains of poultry have led to an increased risk of lameness, particularly under large-scale farming systems (Mottet and Tempio Citation2017). Lameness in broilers raises welfare concerns as it is associated with pain (Mcgeown *et al*. Citation1999) and restricts the ability of birds to reach food and water (Sanotra *et al*. Citation2002) which negatively affects growth performance (Gocsik *et al*. Citation2014) and increases mortality rate (Wideman *et al*. Citation2012). Currently, genetic selection, adjusting housing conditions and nutritional interventions are used to prevent lameness or to decrease its negative impact on poultry welfare (Phibbs *et al*. Citation2021). Both Ca and P nutrients are critical to poultry skeletal integrity, and the role of Ca and P in bone mineralisation is extensively reviewed (Li *et al*. Citation2017; Matuszewski *et al*. Citation2020). However, little consideration has been given to dietary bioavailable silica supplements.

Silicon has been commonly used in animal feeds in the form of hydrated aluminosilicate (zeolite) as an adsorbent of unwanted substances, such as plant fungal toxins and excess nitrogen compounds (Papaioannou *et al*. Citation2005). However, silicon is known to be an important essential ultra-trace element which does not currently have a recommended level for supplementation of poultry, beyond avoidance of deficiency (Tran *et al*. Citation2015). Historically, bioavailable silica has been linked to roles maintaining bone health and connective tissue metabolism. However, analysis of the effect of silica on poultry performance has been inconsistent due to the variability and lack of clarity surrounding the element's bioavailability and mode of action. In view of the frequency of skeletal integrity issues in poultry, this review brings together disparate background knowledge on the chemistry and biology of silica, research performed in the area and considers whether addition of silica to feed is a potential benefit for the industry in the future both in terms of its impact on production efficiency and bone health. To avoid confusion, we define the different forms of silicon containing molecules and materials relevant to the discussion below.

Si: The chemical symbol for the element and the generic term used when the nature of the specific silicon compound is not known.

$Si(OH)_4$: Orthosilicic acid (OSA), the fundamental building block used in the formation of silicas and the bioavailable form of silicon together with the anionic form $Si(OH)_3^-$ found at significant levels at pH values above 3 and the dominant species above pH 9. We refer to this as soluble silicon. Alternative names include monosilicic acid, sometimes shortened to MOSA in the literature.

$SiO_2.nH_2O$ or $SiO_{2)-x}(OH)_{2x}.2\,H_2O$: Amorphous, hydrated, polymerised

material found in biogenic silicas including grains. The pK_a of silanol groups on the surface of the material is ca. 6.8 which means that silicas are often negatively charged. Size and form affect solubility.

Polymerisation: The mutual condensation of silicic acids to give molecularly coherent units of increasing size.

TMOS, TEOS: Alkoxy silanes, tetramethoxysilane and tetraethoxysilane, are used as precursors for supersaturated orthosilicic acid solutions.

Silanol: Hydroxyl group bonded to a silicon atom.

Silicate: A chemically specific ion having negative charge (e.g. SiO_3^{2-}), a term also used to describe salts (e.g. sodium silicate, Na_2SiO_3). Silicates have been used to generate solutions containing high levels of monomeric silicon species (SiO_3^{2-}) but are usually highly caustic.

Zeolite: Often, but not exclusively, a highly porous-hydrated aluminosilicate of alkaline or alkaline earth cations which can be man-made or naturally occurring. Composition and form affect solubility.

Silicon as a mineral

Silicon (Si) is a non-metallic element with an atomic weight of 28 which occurs naturally as oxides or silicates. Si is the most abundant component of minerals, with only 8% of the earth's crust being non-silicate material (Iler Citation1979). It is not found in its elemental form in nature as it is highly chemically reactive and has a high affinity for oxygen. Silicon is very scarce in the hydrosphere, and its bioavailability is low (Iler Citation1979). However, soluble silicon can be released from stable silicates through biochemical reaction by plants and weathering (Jugdaosingh *et al*. Citation2008), therefore rendering these minerals bioavailable in water at low concentrations (Birchall Citation1995). The chemical composition of individual silicates also affects its solubility (Powell *et al*. Citation2005). Highly condensed silicas (such as fumed silica generated by high-temperature processes) are less soluble than hydrated silica generated at lower temperatures; additionally, crystalline silica is less soluble than amorphous (Gunnarsson and Arnórsson Citation2000). Size and shape play a role in solubility, with smaller, irregularly shaped particles showing higher solubility than larger, regularly shaped particles (Alexander Citation1957). The presence of metal ions in the silica matrix at trace levels also increases dissolution rates (Dove Citation1999).

Once in solution, Si from soil minerals forms soluble species by way of hydrolysis, the most stable of which is monomeric silica with formula $Si(OH)_4$ which is water-soluble with a pK_a of 9.6, however, this only remains soluble at a total Si concentration below 2 mm (Arthur Citation2008; Iler Citation1979). This means that at physiologically relevant pH values the molecule carries little charge though, as pH increases, the presence of anionic species such as $Si(OH)_3O^-$ will increase. Polymerisation which occurs above 2 mm Si reduces solubility leading to lower bioavailability (Jugdaosingh *et al*. Citation2008). Only monomers and perhaps very small molecular condensates (dimers) are thought to be bioavailable. Silicon from plant sources mainly includes species that produce grains such as oats, barley and rice as well as legumes and fruits such as bananas which have higher silicon content as compared to food from animal sources (Henriet *et al*. Citation2006). It should be noted, however, that the bioavailability of the element may not correlate with the total silicon content (Robberecht *et al*., Citation2008; Dejneka and Lukasiak Citation2003). Thus, the bioavailability of silicon from different sources should always be determined since bioavailability is a measure of potential effectiveness of a nutrient and is determined as the proportion of the material utilised from the total amount of a nutrient provided for normal metabolism in the body (Fairweather-Tait Citation1999).

Assessment of soluble silicon concentrations

Solution silica concentrations are usually determined by one of the two methods. First, by inductively coupled plasma with either optical emission (ICPOES) or mass spectrometric (ICPMS) detection. The plasma generated is hot enough in this process to completely ionise the silica present, so the method is unable to distinguish between monomeric true solution and suspended polymeric species in the system. Ultrafiltration is sometimes used to remove suspended particulate (Magnusson *et al*. Citation2021) but cannot realistically be used to remove material in the sub-3 nm range with silica particulates of 1 nm containing a minimum of 27 Si atoms still potentially present but not bioavailable. Where this distinction between monomeric and polymeric forms needs to be made, for example, in measuring 'bioavailable' silicon, a second colorimetric molybdenum complexation method can be employed (Coradin *et al*. Citation2004). In this method, a single monosilicate anion resides in the central cavity of a so-called Keggin structure in which the ion sits tetrahedrally co-ordinated at the centre of a 12 membered molybdic heteropoly acid unit (the silicomolybdic acid (yellow) complex) typically measured in a spectrometer at 400 nm. Since the cavity can accommodate a single anion, only the monomer or silicate species that dissociate to the monomer in the molybdate complexation reaction time will be measured. Where higher sensitivity is required, the complex can be reduced chemically using mild reducing agents such as stannous chloride, sulphur dioxide or sulphites to the silicomolybdous (blue) complex, which has a significantly higher absorbance extinction co-efficient at 810 nm. To assess whether a silicon containing material

is bioavailable, it is imperative that concentrations of the soluble form under conditions matched to those experienced in the living organism are measured.

The biological role of silica

Plants and lower organisms including diatoms, dinoflagellates and sponges utilise Si for the formation of exoskeletons made of biogenic silica, hydrated SiO_2 (Perry Citation2009). They intake monomeric silicic acid from a range of freshwater and saline water environments and process the mineral to generate complex composite mineral:biopolymer structures that provide, as a minimum, structures that support and protect the organism. The organisms are clearly able to process the element at all stages from monomer through to mineral via a wide range of biochemical processing and further, they can control the level of hydration and spatial organisation (Parambath *et al*. Citation2022).

Orthosilicic acid [$Si(OH)_4$] constitutes more than 90% of dissolved silicon and is reported as the primary form absorbed by humans and can be found in body tissues, such as the bone, kidney, tendons, aorta and liver (Martin Citation2013). However, the majority of Si present in the diet is not in this monomeric form, but condensed into polymers that cannot be absorbed. The chemistry of Si dictates its bio-availability, depending on solubility, and this varies widely with source and form (Martin Citation2013). Absorbance of monomeric Si within the gastrointestinal tract can be demonstrated due to its penetration of body fluids and tissues, with elevated concentrations found in bone and parenchymal tissues (Carlisle Citation1984) but the mechanisms involved in absorption, metabolism and excretion are generally poorly understood (Jugdaohsingh Citation2007). Absorption requires the breakdown of materials ingested into soluble orthosilicic acid which is uncharged and therefore mobility and permeability across the mucosal layer of the intestine is successful. The rate and efficiency of absorption also depend on concentration, as higher concentrations permit polymerisation and reduced permeability (Anderson *et al*. Citation1998). This makes supplementation with higher Si levels problematic. Development of silica supplements that remain bioavailable has therefore become a focus area for researchers.

An alternative route to maintaining bioavailability of silica has considered the use of monomethylsilanetriol (MMST) in mammalian studies (rats and mice) (Jugdaosingh *et al*. Citation2015). The researchers explored the potential for vitamin D combined with soluble silicon supplements and found a positive correlation between serum silicon levels and bone quality was observed for female rats. In contrast, other research on rats using purported silicon chelates (data for the presence of silicon in a bioavailable form not provided) formed by mechano reaction between rice husks containing polymerised silica and green tea containing catechins (Bychkov *et al*. Citation2022) only found small changes in one biochemical marker of mineralisation, alkaline phosphatase (ALP) and no effects on bone formation itself.

Silicon has been established as an essential trace nutrient (Birchall Citation1995; Carlisle Citation1988; Seaborn and Nielsen Citation1994) with these early studies using minimal diets postulating its involvement in early calcification, growth and skeletal development, connective tissue metabolism, wound healing and immune response. Further investigations into the biochemical role of silicon in bone development showed silicon influenced mineralisation, trace metals utilisation and prevention of aluminium toxicity (Jugdaosingh *et al*. Citation2008). More recently, it has been proposed that the role of silicon in bone tissues is in its involvement in the synthesis of osteoblast and extracellular matrix components with a structural function as a crosslink between procollagen molecules in collagen production (Dinjaski *et al*. Citation2017; Martín-Moldes *et al*. Citation2018).

The role of silica in bone formation and calcification

Early studies on both chickens (Carlisle Citation1972) and rats (Schwarz and Milne Citation1972) using deprivation diets with silicon added as sodium silicate (a source which provides monomeric silicon but which is highly caustic unless heavily diluted or treated with acid to neutralise) demonstrated that silicon significantly affects growth and skeletal development. Si deprived chicks had significantly lower weight gain with abnormal skeletal development comprising shorter leg bones of smaller circumference and thinner cortex, as well as easily fractured tibia and femur (Carlisle Citation1972). Bone development appeared to be affected in both chicks arlisle Citation1972, Citation1981a) and rats (Schwarz Citation1973; Seaborn and Nielsen Citation2002) with both animal types showing reduced calcification and skull deformities. However, it should be noted that the early experiments on animals used purified diets made from purified starch and crystalline amino acid-based diets which are likely to be compromised in other aspects nutritionally required to support growth, but the inclusion of silicon in these diets alleviated some of the symptoms and a series of studies by Elliot and Edwards (Citation1991), and using both purified and practical-type diets did not reveal an impact of diet type. From early studies, these bone formation effects also seem to be independent of vitamin D levels (Carlisle Citation1981b).

Benefits of silicon to bone formation are well documented, particularly

to osteoblast cell culture across paired tibial cartilaginous epiphyses, chondrocytes and paired frontal bones of broiler chicks (Carlisle and Alpenfels Citation1984; Carlisle and Suchil Citation1983). Support for Si supplementation leads to increased bone mineral density, reduction in bone fragility and promotion of bone resorption (Hott *et al*. Citation1993). *In vitro* studies on tibias of rats found silicon localised in the active calcification region and were involved in the initiation of mineralisation of pre-osseous tissue involving hydroxyapatite (Carlisle Citation1970) where hydroxyapatite is important, enabling compressional strength in bone to develop (Rath *et al*. Citation2000).

In contrast to the results discussed above where silicon supplementation led to an increase in bone properties, other studies, however, have observed that high silicon supplemented rats and turkeys had lower bone size and lower strength parameters (maximal load and elasticity) of both femur and tibia bones (Kayongo-Male and Julson Citation2008). These researchers suggested that an interaction between silicon and minerals, such as calcium and magnesium, affects mineralisation of the bone and thereby the mechanical properties of the bones. These contrasting results could possibly be explained by the difference in the amount of supplemented silicon or the form in which silicon was supplied to the animals. As examples, studies by Carlisle supplemented sodium metasilicate at either 100 or 250 ppm, however (Elliot and Edwards Citation1991) supplemented chicks with 50, 150 or 250 mg/kg sodium metasilicate and (Kayongo-Male and Julson Citation2008) reported high inclusion levels of silicon at 500 ppm/kg in the form of tetraethyl orthosilicate (a molecule that hydrolyses to give one equivalent of orthosilicic acid and four equivalents of ethanol) in diets. Further evidence that silica enhances osteogenesis was provided from preliminary studies with human mesenchymal stem cells (hMSCs) that showed support of porous silica particles in the 100 nm – 2 micron size range supported on silk films towards cell attachment and upregulation of osteogenic gene markers (Mieszawska *et al*. Citation2010).

In rats supplemented with silicon in the form described as 'silanol', most likely monomethylsilanetriol, the rate of mineral apposition and bone formation was observed to increase by 30%, therefore improved trabecular bone volume with a reduction in metaphyseal bone resorption, possibly through stimulatory formation of cross-link between collagen and proteoglycans or bone matrix stabilisation (Hott *et al*. Citation1993). Therefore, silicon is thought to be important in the formation of cross-linkages between collagen and proteoglycans in bone formation (Hott *et al*. Citation1993) where the collagen matrix allows tensile strength sustainability of the bone (Rath *et al*. Citation2000). *In vitro* studies found that human osteoblasts responded to silica gel to form nodules which were eventually mineralised (Anderson *et al*. Citation1998). Dietary silicon intake was found to be significantly and positively correlated with cortical bone mineral density in pre-menopausal women (Jugdaohsingh *et al*. Citation2004). Furthermore, retrospective studies where osteoporotic, post menopausal females were administered intramuscular injections of 50 mg silicon as monomethyl trisilanol twice a week for 4 months induced significantly higher bone mineral density as compared to pharmacological drug usage (Eisinger and Clairet Citation1993). In contrast to these findings, a controlled study on overi-ectomised rats fed calcium-replete diets did not increase bone mineral density (Bu *et al*. Citation2016). More significantly, however, the study affirmed an earlier hypothesis that, silicon not only significantly stimulates bone formation but also functions to inhibit bone resorption (Rico *et al*. Citation2000).

The biochemical influences of silicon regarding bone formation ultimately affect cartilage composition and calcification of active growth sites, typically within the osteoid layer (Arora and Arora Citation2017). This indicates a direct link to osteoblast proliferation (Shie *et al*. Citation2011). Additionally, osteoclast formation and bone resorption are inhibited by silicon caused by interactions of intra- and inter-cellular signalling pathways (Mladenović *et al*. Citation2014). This evidence supports the concept that orthosilicic acid directly effects osteoclastogenesis to promote positive ossification. The precise stage of involvement, at least for RAW264.7 cells (cells that do not require co-culture with other cell types for osteoclast formation), was identified by increased expression of osteoclast phenotypic genes within the first 24 h of osteoclastagenesis (Magnusson *et al*. Citation2021).

Use of silica in poultry nutrition

The importance of silicon was first established by dietary deprivation studies conducted by Carlisle (Citation1972) and Schwarz and Milne (Citation1972). A deleterious effect on growth has been reported to be significant in silicon-deprived animals (Carlisle Citation1986; Schwarz and Milne Citation1972; Seaborn and Nielsen Citation1994, Citation2002); however, without a clear dietary deficiency, no significant effect of Si on growth has been reported (Carlisle Citation1981b; Elliot and Edwards Citation1991; Seaborn and Nielsen Citation1994). In early studies, Si was thought to be inert and pass through the digestive tract with little biological or toxicological impact (Nielsen Citation1991) and was recommended for addition to poultry diets only under specific experimental conditions (NRC Citation1994). Bio-available Si has been implicated in a variety of important roles,

but the mechanisms of action lack clarity (Perry and Keeling-Tucker Citation2000).

Research in poultry initially focussed on inclusion of silica in diets as a mineral, but issues with minimal bio-availability made identification of its mode of action and, therefore, production of a viable supplement difficult (Carlisle Citation1984, 1986). A very small (*n*-15 birds) study explored the use of sodium metasilicate as a source of bioavailable silicon and found that, while blood alkaline phosphatase was increased in bird-fed diets containing 300 g sodium metasilicate per kg diet, several metabolic biomarkers were also significantly raised, suggesting some liver damage may be associated with feeding such a caustic form of silicon at high levels (Tekeli and Zohuri Citation1998) and renal damage has been associated with high-level silica diets using tetraalkoxyorthosilanes as the silica source (Nakashima Citation1994). Another potential source of silicon, activated crystalline silicon dioxide (Silica+), generated by subjecting micronised silica to electromagnetic radiation, in conjunction with betaine supplementation at 200 ppm and 0.12%, respectively, has been reported to improve the growth performance and egg production of quails, though it should be noted that the silicon in this product is not bioavailable and allegedly operates through the long-lasting effects of its prior treatment to radiation (Ratriyanto *et al*. Citation2021). Further studies have been conducted on different poultry and other animals, but the mode of action is still not understood

Multiple studies have investigated the addition of silicon to diets in the form of zeolites though these materials have also been used as adsorbents to improve litter quality. Zeolites are highly porous materials composed of hydrated aluminosilicates that can accommodate a wide variety of cations including sodium, potassium and calcium. They possess an infinite, three-dimensional crystalline structure that is able to dehydrate and rehydrate and exchange ions without major structural change, and due to this they have been extensively used as adsorbents within numerous industries (Shariatmadari Citation2008). The most common zeolites used in the poultry industry to improve litter quality and feed efficiency are Zeolite A, a synthetic zeolite with the chemical composition $Na_{12}[(AlO_2)_{12}(SiO_2)_{12})].24\,H_2O$ (Leach *et al.* Citation1990; Roland *et al*. Citation1993) and a natural zeolite, clinoptilolite, with the chemical composition $CaNa_4K_4(AlO_2)_5(SiO_2)_{30}.24\,H_2O$, though in principle other minerals with a wide range of Al:Si compositions could potentially be used.

Zeolite A has been found to solubilise in the digestive tract and both Si and aluminium within the compound are partially absorbed (Roland *et al*. Citation1993). Supplementation with Zeolite A has been shown to significantly increase the oral and intramuscular absorption of calcium, which was found to decrease the severity and occurrence of tibial dyschondroplasia in broilers (Ballard and Edwards Citation1988). Further, Zeolite A has been found to increase the bone ash percentage of broilers with a secondary effect of decreasing litter moisture, thus reducing the severity and occurrence of hock and breast burn (Leach *et al*. Citation1990). Of the three mineral elements in zeolites, it has been suggested that Si is the most likely to have caused the beneficial results found (Roland *et al*. Citation1993), potentially due to the zeolite selectively binding to calcium, which is partially bound to phytate, a storage form of phosphorus in plants. It is, therefore, thought that this improves the actions of the enzyme phytase by allowing it to release phosphate from the phytic acid/phytate salt more effectively, increasing phosphorus availability (Edwards Citation1988). Inclusion of silicon as sodium aluminosilicate in a pH neutral form at a level of 0.75% of the diet was found to improve egg production (Roland Citation1988). Unfortunately, zeolites are generally high in aluminium, which is toxic, both to the bird upon ingestion and, potentially, to the environment upon excretion. Huff *et al*. (Citation1996) found that aluminium toxicity (at levels equivalent to 0.32% of aluminium in diets when introduced as alum) in broilers led to significantly reduced body weight gain, bone ash percentage and reduced serum phosphorus levels, and concluded that aluminium toxicity should be avoided in broilers. Additionally, the addition of 1% natural zeolite, which will add 0.15% aluminium, was found to be toxic to poultry (Shariatmadari Citation2008).

Variability in results, concerns over adverse effects and problems with diet formulation raise doubts as to the usefulness of zeolites as a feed additive (Shariatmadari Citation2008). There is also a lack of understanding of the interactions between the various mineral ions contained within zeolites and those already present in the digestive tract of poultry (Watkins and Southern Citation1992). The high ion exchange is associated with enhanced calcium utilisation as discussed below (Watkins and Southern Citation1992). Most recently, in 2021, the EFSA panel on additives and products or substances used in animal feed (FEEDAP) was still not in a position to conclude on the safety and efficacy of the additive sodium aluminosilicate (EFSA Citation2020).

In addition to zeolites, there are many potential sources of bioavailable silicon, but these have not, as yet, been used to supplement the diet of birds in a commercial setting. These include Horsetail (*Equisetum arvense*) which is often used as a source of Si in human supplements but has been shown to be non-bioavailable when tested *in vitro* (Scholey *et al*. Citation2018). Choline stabilised

orthosilicic acid and colloidal silica are available as supplements and claim to be bio-available. However, when compared to the levels naturally available in tap water (approximately 13 ppm), they contained only 26 ppm and <10 ppm, respectively, making their levels of bio-available Si unlikely to yield a biological response.

A number of Si supplements have been considered for use in poultry production, but the concept of differentiating response through bioavailability is relatively new. An older review by Shariatmadari (Citation2008) concluded silicon supplements were of limited efficacy in poultry, but a review of wider species suggested this was due to their low absorbance unless "they are presented in a caustic, unpalatable form" (Jugdaohsingh Citation2007). More recently (Pritchard and Nielsen Citation2024) systemically reviewed a range of silicon forms used to date for animal studies and concluded that Si consistently positively influences bone and mineral metabolism when around 139 mg Si/kg bird weight/day or more is provided. The authors also noted insufficient detail was reported in many studies, indicating that mechanistic insights into the mode of action for silicon-based effects on bone cannot be made via meta-analysis approaches. Research on male broilers, where poultry diets were supplemented with Si in a bioavailable format at silicon doses of 16–80 mg/day, is beginning to unveil some of the factors behind the variable efficacy of silicon-based supplements in enhancing skeletal integrity (Burton *et al*. Citation2020; Scholey *et al*. Citation2018) The key finding of these studies is that the silica must remain in a monomeric form for efficacy. When bioavailability is high through stabilisation of monomeric silica, the supplement level is positively correlated with serum silicon levels, improved bone mineralisation and bone breaking strength (Scholey *et al*. Citation2018). Further studies have now begun to more systematically determine biological response in current strains of broilers (Burton *et al*. Citation2020). Although positive effects of a bioavailable silicon (monomeric silicic acids) containing supplement have been found a clear understanding of the mechanisms by which Si acts, and an effective delivery method for supplements has yet to be discovered.

Bioavailability of silica

Whilst the total Si content of a sample can be quantified with relative ease, the bio-available component/fraction is more difficult to estimate due to high variability in product behaviour between animal species and indeed variability within different samples of the same ingredient. Alongside dosage and form of Si supplemented, the bio-availability must also be considered as the various forms of Si all vary in their bio-availability. As examples, tetraethyl orthosilicate is hydrolysed during digestion to form monosilicic acid (Kayongo-Male and Julson Citation2008) with a by-product of four equivalents of ethanol. This monomeric form of Si has been shown to be more readily absorbed in the gastrointestinal tract of humans when compared to oligomeric Si, although this has not been confirmed in other species (Jugdaohsingh *et al*. Citation2000). Other factors which could possibly affect the effect of silicon supplementation are sex (Nielsen Citation2008) and age (Jugdaohsingh *et al*. Citation2004) of the animal which also need to be considered, especially when supplementing animals which are rapidly growing, such as broilers.

Nielsen (Citation2008) observed that a novel organic complex arginine silicate inositol (ASI) is as effective as inorganic sodium metasilicate ($NaSiO_3$) in responding to collagen-induced inflammatory response. Supplementation of arginine silicate inositol complex (comprising 49.5% arginine, 8.2% silicon and 25% inositol) to quail during the late laying periods resulted in significantly improved bone mineral density. A recent study on male broilers found little effect of silica supplementation (dosed as Siliforce at 13 and 804 mg/day), but it is unclear as to the provenance of the bioavailable silica in this study and it may not be easily absorbed in the bird (Pritchard *et al*. Citation2020).

The complementary effect of other factors can affect the bioavailability of silicon. For example, supplementation of choline-stabilised orthosilicic acid complementing the effect of calcium/vitamin D_3 was found to improve bone collagen and femoral bone mineral in humans (Spector *et al*. Citation2008). This may be of relevance in poultry, particularly for laying hens as a treatment for osteoporosis.

However, it is difficult to accurately measure bioavailable silica. Elliot and Edwards (Citation1991) commented that analytical values of silicon may possibly be affected by the solubilisation of insoluble silicon material present in the diets making accurate determination difficult. We describe methods to measure monomeric silica above and a recent study by (Prentice Citation2019) developed a practical protocol to assess soluble, bioactive silicon levels in complex materials, such as poultry diets.

Conclusion

Silica can have a positive effect on bone health in poultry, but there are several factors which need to be considered to ensure a favourable result. These include the source of the silica and its bioavailability, the level of supplementation and how it is provided to the birds (i.e. in water or feed). Dietary formulation may also play a role. There is evidence that modern broilers would benefit from additional supplementation of silica in feed, but this needs to be of a bioavailable form, and supplied in sufficient qualities to support skeletal health, with further research being needed to establish a definitive range.

Source: https://www.tandfonline.com/

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Chicken Portioning Machine

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Solar Incubators

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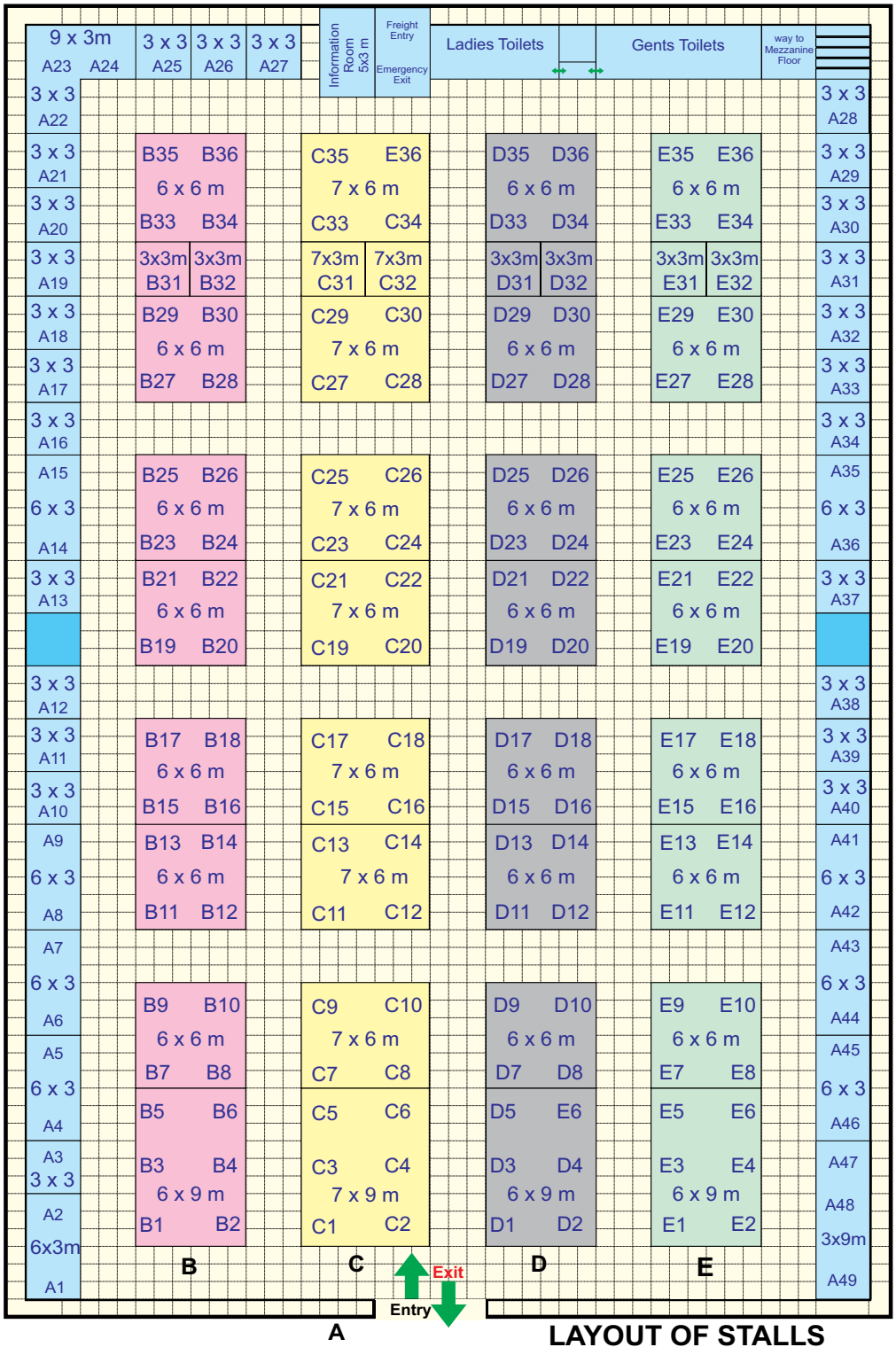

LAYOUT OF STALLS

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