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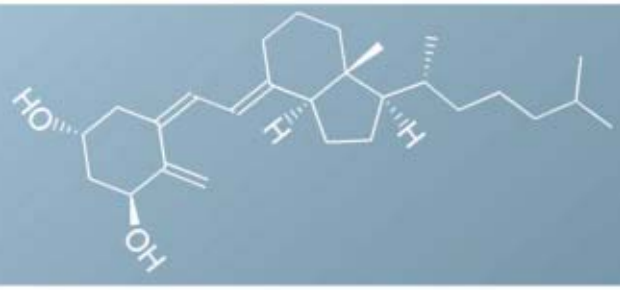

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POULTRY LINE
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INDEX OF ADVERTISEMENTS

Avian Urolithiasis (Visceral Gout): An Economically Important Metabolic Syndrome in Broiler Chickens

A. B. Parmar, V. R. Patel, J. M. Patel, Y. D. Padheriya and S. U. Usdadia
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Introduction: "Avian urolithiasis'' or Gout is a metabolic disorder occurs in poultry and other domestic birds related with kidney dysfunctions. It is characterized by high level of uric acid in the blood (hyperuricemia) and leads to deposition of urates on the surface of visceral organs or various joints particularly hock joint (articular gout). In avian, uric acid is end product of protein or nitrogen metabolism due to absence of uricase enzymes (Amaravathi *et al.,* 2015). In gout, blood levels of uric acid are higher than the normal when it exceeds 10mg/dl lead to gout. It can be as high as 44mg/100ml compared to 5-7mg/100ml in a normal bird. The syndrome occurs usually in two separate form visceral gout and articular gout. Visceral gout is a condition in which white chalky uric acid or urate crystals (tophi) (monosodium urates) deposits are seen in soft tissues of various organs in body (Phalen *et al.*, 1990; Vishwakarma, 2014). Due to its striking lesions, visceral gout has also been describe as acute toxic nephritis, renal gout, kidney stones, nutritional gout and nephrosis. It is responsible for high morbidity and mortality in fast growing and high producing broilers. Visceral gout has emerged as a syndrome of major concern causing heavy economic losses in broiler industry, particularly of broiler chicks and poses a challenge to control because of its multi factorial etiology (Chaudhary, 2016). The syndrome occurs worldwide which is most common cause of mortality in growing broiler chickens. In worst situation mortality had been seen up to 90% in past. However, 8-15 % mortality is most common in broilers.

Prevalence: The visceral gout in fowls was first time described in India by Iyer (1941). Visceral gout is a condition of chickens that has been recognized for more than 30 years. This condition can occur as an individual problem at any age but outbreaks are seen in young chicks in the first or second week of life (baby chick nephropathy) and could be of multi factorial origin. Year wise incidence of the disease ranged between 4.01 to 9.37% with an overall average relative incidence of 7.15% (Chaudhary, 2016). Sayed (2001) reported the incidence of visceral gout was increased during winter months which were attributed to environmental cold stress, making the birds more susceptible to visceral gout followed by summer and monsoon. The highest incidence 93.07% was recorded in colder season in broilers by Shrivastava (2001). He reported higher susceptibility of this condition in broiler between 0-3 weeks of age. Greater the severity of gout resulted in poor feed conversion ratio (FCR) and lower body weight gain. Visceral gout assumes prime economic importance in poultry industry due to increased incidence causing production loss, mortality and lack of availability of specific treatment (Dhara *et al.,* 2010).

Etiology: Visceral gout is a metabolic disease and multi etiological factors alone or in combination are known to influence occurrence of this syndrome. This comprises of

Nutritional and metabolic causes

1. Excess dietary calcium and vitamin D3 with low phosphorous supplementation in the diet of immature pullets.
2. Rearing diets that contain limestone and sodium bicarbonate in particle form which may results in excess calcium intake and imbalance of Ca: P ratio.
3. Marginally low available phosphorus in rearing diets has been associated with higher gout incidence.

4. Sodium bicarbonate can contribute to gout by making the urine more alkaline, which, with high levels of calcium, is an ideal medium for the formation of kidney stones.
5. Vitamin A deficiency over a long period of time can cause damage to the lining of the ureters, which leads to urethral ducts get occluded by the desquamated metaplastic squamous epithelium preventing the excretion of uric acid and facilitating its accumulation in the blood (Ali *et al.*, 2012).
7. Excess of dietary protein (30–40 %)
8. High amount of salt (more than 0.3 %)
9. Poor quality of protein (High amount of non-essential amino acids)

Managemental causes

1. Water deprivation either because of mechanical malfunction or less water in the diet (dehydration).
2. Consumption of hard water with a high amount of minerals (i.e., calcium and copper sulfate).
3. Brooding management (type of brooder, temperature).

Infectious causes: Viral agents known to be involved in gout are infectious bronchitis, avian nephritis virus, reo virus and astro virus (Sathiyaseelan *et al*., 2018). Nephropathogenic or nephrotropic strains of infectious bronchitis have a special predilection for the kidneys in young poultry causing enlargement of kidney and distended with urates.

Toxins: Products used on a routine basis that have potential for human error and resulting toxicity are antibiotics, anti-coccidials, minerals, vitamins, manufactured chemicals and pesticides. Fungal toxins (Mycotoxins, ocharatoxins, aflatoxins, oosporein etc.) in poultry feed are nephrotoxic (Eldaghayes *et al.,* 2010).

Other causes includes heavy metal poisoning and the inappropriate use of antibiotics (such as gentamycin, nitrofurosones and sulfonamides etc.), anti-coccidials, chemicals, pesticides, disinfectants (i.e., cresol and phenol) etc (Auda, 2013).

Development of disease / Pathogenesis

The kidney is a vital organ of the bird with diverse metabolic and excretory function viz. maintaining the chemical composition of body fluids, removal of metabolic waste products, regulation of blood pressure and blood volume and conservation of fluids and electrolytes. Avians are uricotelic due to that they are more prone to gout. As that uric acid is the main excretory end product of protein or nitrogen metabolism in the absence of uricase enzymes in birds. Gout is mainly due to damaged kidneys (nephropathy), it leads to accumulation of uric acid in blood (Hyperurecaemia). There is precipitation of monosodium urate monohydrate (MSU) crystals in joints called articular gout and on visceral surfaces called visceral gout (Lumeij, 2008). Visceral gout is an acute form of deposition of urate crystals. These crystals stimulate phagocytosis by neutrophils and initiate the inflammatory cascade (Arun and Azeez, 2004).An elevated serum urate level, together with local factors, can result in the deposition of urate crystals into the joints is more advanced stage and found rarely. Its crystallization depends on the concentrations of both urate and cation levels. Chronic cumulative urate crystal formation in tissue fluids leads to MSUM crystal deposition (tophus) in the synovium and cell surface layer of cartilage. These “crystal shedding” facilitates crystal interaction with synovial cell lining and residential inflammatory cells, leading to an acute gouty flare (Ali *et al.,* 2012).

Signs and pathological lesions

- Chalk-like urate deposits on pericardial sac and liver capsule
- Increased thirst (polydipsia)
- Dehydration and sometimes greenish diarrhea
- Joints may be enlarged, stiff and painful, shifting weight from one foot to the other and have a shuffling gait
- The bird may be unable to perch, spending most of his time on the floor of the cage.

- If the wings are affected, the bird may be unable to fly
- Birds often have reddened, swollen feet that progress to blisters and sores. Joint become painful and joint immobilization due to depot of urate crystals
- Gouty Plaques are found (shiny, raised, whitish deposits) under skin
- Decreased appetite
- Lethargy
- General Debility and Weight Loss
- Feather plucking, Dull Plumage and Self-trauma
- Abnormal droppings with chalky urates in their stool.
- Change in temperament

The gross lesions include woolen pale kidneys with urate deposits and dilated ureters filled with chalky white material. The kidneys are congested and greyish white with a soft in consistency. The other noticeable findings observed are presences of chalky white masses surrounding the heart, kidneys, liver intestines, peritoneum, spleen, lungs, air sacs, muscles and inner lining of proventriculus. Generally no inflammatory reaction in synovium or visceral surfaces has been observed. Microscopically, the kidneys shows severe lesions characterized by moderate to severe tubular dilation, necrosis and large deposits of radiating fine needle shaped crystals in the tubular lumen and in the interstitium and also in myocardium. These deposits are surrounded by a zone of granulomatous inflammation (Sathiyaseelan *et al*., 2018). The crystals appeared black against a yellow background on DeGalantha staining confirming theme to be of urates and the cases of gout (Ansar *et al*., 2004; Feizi *et al*., 2011; Auda, 2013). Kidney lesions were mainly of nature of visceral gout characterized by granular degeneration, vacuolation and desquamation of tubular epithelium, foci of necrosis and massive infiltration of heterophils in the interstitium in acute stage of the syndrome (Vegad and Katiyar, 2001).

Managemental approaches to prevent gout/ Prevention and control

As described visceral gout is of multifactorial origin when incidence occurs identifying the cause is often difficult. Different managemental strategies can alleviate the problems in poultry flocks.

Housing management

Minimize the stress from the hatchery level to the chicks up to all life stages. With minimizing dehydration. Maintain proper ventilation, brooding temperature and humidity (60-70%) during early chick stage. Provide adequate number of drinker to the flock with appropriate height.

Nutritional management

Preventive measures concern with nutrition includes

1. Ensure adequate hydration. Water deprivation should be avoided in rearing of boiler and laying flocks.
2. Use of Jaggery 2 to 5 grams per liter of water or recommended electrolyte doses in water.
3. Feed pullets should not contain more than 1 per cent calcium in powdered form up to 16 weeks of age. High calcium intake in immature pullets can cause serious kidney damage.
4. Available phosphorus levels should be 0.45–0.50 per cent in rearing diets. Insufficient phosphorus predisposes the kidneys to calcium damage.
5. Pre-lay ration should not be used before 16 weeks of age, or when the flock shows signs of sexual maturity (blooming of the combs). A calcium content of 2.50–2.75 per cent should be sufficient.
6. If sodium bicarbonate is used to improve egg shell quality, use the minimum recommended level and only when needed. A flock with gout should not be medicated with sodium bicarbonate or fed a ration that is highly alkaline (high levels of sodium or potassium).
7. Review all calcium and phosphorus levels in the feeding program. Pullet and layer feeds

should be routinely analyzed for calcium and phosphorus level.

8. Feed samples are assayed for the presence of the mycotoxins like citrinin, ochratoxin and oosporein routinely.
9. Avoid a diet with higher protein content than the recommended level as per the age group of poultry. Depending upon severity manipulate the diet with low protein for few days.
10. Adequate level of phosphorus should be supplied as per the recommended level in concern with calcium to balance Ca: P ratio.
11. Birds with incidence of gout may be supplement or rear on natural vegetables, some of the fruit and plant based compounds such as flavonoid due to richness of vitamin A, antioxidant and anti-inflammatory actions.
12. Supply adequate amount of vitamin A as per recommendation and additional supplementation is needed when gout is prevalent in flock (Omega-3 fatty acids).
13. Use toxin binders and liver tonics to keep minimum levels of fungal toxins in feed. Use recommended levels of aluminum-free Sodium bicarbonate (baking soda) in feed during high temperatures.

Other measures:

Field cases and research reported the interaction between infectious bronchitis (IB) and nutritional as well as managemental factors for triggering visceral gout in poultry. Considering this point as per recommendations and following standard of vaccination schedule for IB vaccines should be administered in poultry birds. Kept in mind for various serotypes of bronchitis vaccines in endemic areas and specifically against nephropathogenic strains will improve immunity of birds against this infection. Some of antiviral drugs should also be helpful for immunity elevation. In broiler breeder and broiler farms infectious bronchitis virus vaccination programme should be review.

Treatments

- Based on history and incidence occurrence in flock the supportive treatment should be given to the birds which cannot be corrected completely kidney damage but may help full to alleviate from this condition and turns to normal functioning of kidney.
- This condition of kidney damage is linked with loss of water and electrolytes so check proper hydration and give fluid therapy and electrolyte supplementation intravenously or in drinking water.
- Techniques involved for reducing gout by using urine acidifier preparations, such as ammonium chloride, DL-methionine, ammonium sulfate, potassium chloride and methionine hydroxy analogue (MHA) which acidifies the urine and increases the solubilization of calcium and urates crystals in urine.
- Use some of the diuretics preparations like Lasix, Zyloric have also been used.
- Use some the pain relieving medication generally of non-steroidal anti-inflammatory (NSAIDs) compounds like meloxicam, aspirin and Celebrex *etc.*
- Use some of the herbal compounds like coconut water is of a good diuretic action.

Conclusion: The incidence of visceral gout in chicks is indicative of kidney damage occurred at an earlier stage in the poultry. As per the research findings, strongly inkling this syndrome with nutritional causes of Ca:P imbalance and the viral infection of IB as principal cause of visceral gout in broilers leads to mortality. Other factors also likely to be an underlying cause include dehydration, electrolyte imbalance and mycotoxins possibly need to recognize. The prognosis of affected flocks with visceral gout is generally poor that cannot be cured but proper nutritional and housing management and proper endemic strain specific vaccination can alleviate the problems which reduces mortality in broiler chicken flocks.

References- Available on request.

Avian Encephalomelitis – An Emerging Disease in Poultry

M.Sivakumar[1] and C.Lavanya[2]

[1 –] SRF, Veterinary College and Research Institute, Orathanadu, [2-] Graduate Assistant, Veterinary College and Research Institute, Namakkal (TANUVAS).

Avian encephalomyelitis (AE) is a viral disease of young chickens, turkeys, Japanese quail, pheasants, and pigeons. Turkey and quail are very less susceptible than chickens, as they develop only very mild form of disease but act as a natural carrier. Avian encephalomyelitis is characterized by neurologic signs that result from infection of the central nervous system.

Synonym

- Epidemic tremor

Etiology

- *Hepatovirus* - RNA virus in the family Picornaviridae

Susceptible age group

- Chickens of all ages are susceptible to the virus.
- Nervous symptoms are manifested only in young chicks, between one tofive weeks of age.

Transmission

- Infection occurs via both vertical and horizontal transmission.
- Vertical transmission – Through infected breeder flock to offspring.
- Horizontal transmission - Infected birds shed the virus in their faeces for a few days to a few weeks, which serves to spread the infection to hatch mates through contaminated feed, litter, or water.
- AE virus is resistant to environmental conditions and may remain infectious for long periods.

Clinical manifestation

- Vertical infection – signs appear at first week after hatching, although signs may be present in a few birds at hatching.
- Horizontal infection -clinical signs appear later (2 – 4 weeks of age) in hatch mateswhen infected by the faecal-oral route.
- Vertical infection followed by horizontal infection causes a characteristic biphasic mortality pattern.

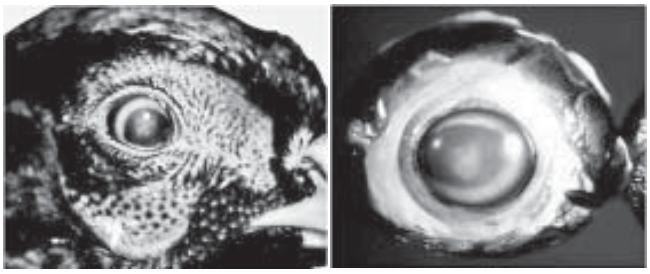
Clinical signs

Vertical infection

- Ataxia
- Incoordination
- Leg weakness
- Sitting on hocks to paresis that progresses to paralysis and recumbency
- Fine tremors of the head and neck are evident and are characteristic of the disease
- Severely affected birds lay on their side and exhibit intermittent fine tremors of the head, neck, and legs
- Surviving birds maybecome blind due to cataract

Ataxia and Incoordination

Tremors in head and neck paralysis



Cataract

Horizontal infection

- In laying chickens, there is a sudden, 5%–10% drop in egg production, which usually lasts for about 2 weeks, followed by a return to normal production.

Morbidity and mortality

- Morbidity and mortality rates vary and depend on the level of egg transmission and degree of immunity in the flock.
- In severe outbreaks, both morbidity and mortality may exceed 50%.

Lesions

- No gross lesions are seen in the brain of infected birds.
- Young chickens are pale areas (Grey to white foci)in the cut surface of proventriculus and gizzard muscles, but no bigger than a pinhead.
- Opacity of eye lenses (cataracts)
- Degeneration and necrosis of neurons, perivascular lymphocytic cuffing, and gliosis with formation of glial nodules in brain and spinal cord.
- Diffuse or nodular lymphocytic infiltrates in the gizzard muscle, muscular layer of the oesophagus and proventriculus, myocardium, and pancreas.

Diagnosis

- Based on history, clinical signs and characteristic histopathologic lesions in the brain and spinal cord.
- Confirmed by isolation and identification of the virus.
- Tissues collected for virus isolation is the brain and duodenum with the pancreas.

Differential diagnosis

- Bacterial or mycotic encephalitis
- Rickets
- Nutritional encephalomalacia

Prevention and Control

- Immunization of breeder pullets at 10–15 week of age with a commercial live vaccine prevents vertical transmission of the virus and provides progeny with maternal immunity.
- Vaccination of table-egg flocks is also advisable to prevent decreases in egg production.
- Affected chicks and poults are ordinarily destroyed because they rarely recover.

Conclusion

Avian encephalomyelitis is an emerging disease particularly in broiler production. This disease is not commonly reported in growers and adults because of the insignificant clinical signs. However, this may lead to horizontal transmission of disease to entire flock. Proper vaccination protocol has to be followed to eliminate the disease at breeder stock level and essential steps to be taken to control the disease in poultry industry.

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The importance of antioxidants in poultry feed

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Head Technical for Camlin Fine Sciences, India

The consumption of poultry meat has increased in both developed and developing countries in recent years leading to rise in the world production of poultry. The continued growth and competitive nature of the poultry industry has been attributed to a variety of factors, some being improvements in intensive production and processing, while others include the more recent development of a wide range of value-added, further processed products that meet both the direct consumer demand and the rapid expansion of fast food outlets.

Poultry products are universally popular and the meat itself is perceived as wholesome, healthy and nutritious, being relatively low in fat with a more desirable unsaturated fatty acid content than other meats. While the consumption of poultry meat rises worldwide, the industry will remain responsive to the demands of the consumers, both in the range and nature of the products that are developed, and quality will continue to remain the watchword.

Consumers define quality, but they actually want to know the developments and improvements in the scientifically measurable quality parameters of colour, flavour and texture. One of the main factors affecting the quality and acceptability of meat and meat products is lipid oxidation…a process that leads to the deterioration of many quality characteristics such as colour, flavour, texture, nutritive value and safety of foods.

Poultry meat is particularly susceptible to lipid oxidation due to its high content of polyunsaturated fatty acids.

The food (feed) provided to animals contain considerable amount of proteins, fats, vitamins, minerals and other additives which need to be protected from getting oxidized due to various factors. The deterioration of fat primarily occurs from two chemical reactions – hydrolysis and oxidation. Hydrolysis of fats occur when water reacts with the triglyceride to form glycerol, mono- and diglycerides and free fatty acids. Hydrolysis is more prevalent in high temperature processing of feed with high water content. Oxidation is the most common problem responsible for limiting the shelf life of feed. On exposure to heat, light, metal ions, and oxygen, the oxidation of unsaturated fats is initiated with the formation of free radicals.The detrimental effects of oxidation can be perceived in lower nutritional quality of the feed and rancid odour. Knowing the fact that lipid oxidation is an irreversible process, it therefore becomes priority to safeguard the feed from oxidation by using appropriate additives which can stop the continuous chain reaction initiated by oxidation, thereby also improving the animal performance to give desired quality meat.

Antioxidants play a crucial role in controlling the formation of fat free radicals by arresting the oxidation process in fats, thereby preventing the fat from getting rancid and generating off flavours. And hence antioxidants must be added to fats as early as possible for maximum benefit.

Synergists like certain organic acids support the antioxidant mechanism by complexing with metal ions, which act as oxidation catalysts.

Camlin Fine Sciences Limited, India, is a leading manufacturer of antioxidants and antioxidant solutions for the food and feed market. The range of Xtendra Shelf Life Solutions offered by CFS Camlin are carefully blended antioxidant mixtures, in appropriate proportion with suitable synergists for safeguarding the nutrition provided to animals.

Xtendra 89, Xtendra 98 are two unique blends of BHA, BHT and Ethoxyquin in a suitable powder

carrier system providing protection to feed and premixes.

Xtendra 90 is powder form of Ethoxyquin especially designed for high fat ingredients.

Xtendra 97 is a combination of BHA, BHT and Ethoxyquin in a suitable liquid carrier system

Xtendra 534 is a combination of TBHQ and BHT in a suitable liquid carrier system designed especially for oil and fat protection.

Variety of poultry feed were treated with different antioxidant solutions to ascertain the efficacy. Few of these studies conducted by CFS Camlin Fine Sciences Limited on different substrates are being illustrated in this article.

Study 1

Meat cum bone meal (MBM) is used as a protein and fat source in animal feed, and it is highly susceptible to oxidation, thus the MBM needs to be adequately protected with antioxidants and synergists agents to prevent the formation of off odours. The MBM is further processed and formulated with other additives to make the animal feed. Hence, if oxidation in MBM is arrested and controlled as early as possible the animal feed formulated will have better stability and shelf life and adequate nutritional quality.

Xtendra 97 was used for treating MBM at a dosage of 0.1% (1 Kg / MT of MBM). The Xtendra 97 is a liquid and was pumped and sprayed onto the MBM at a measured flow rate. Samples of MBM were collected for shelf life study before and after the treatment. The analytical results are given in Table 1.1, Graph 1.1.

The MBM has about 9 to 11% fat content, which was extracted and tested for Peroxide Value (PV) and Anisidine Value (AV) and Shelf life (OSI IP hours @ 100C)

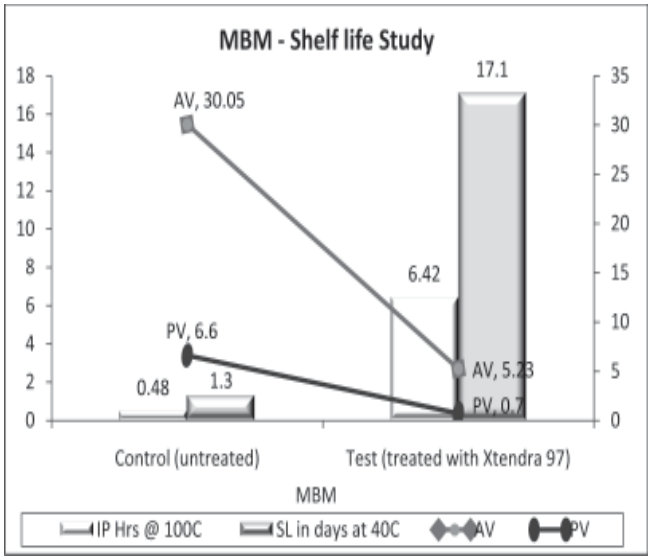
The Oxidative Stability Instrument and Oxipres were used for the evaluation of shelf life of the extracted fat and MBM as such respectively. The principle of both these instruments is shared as the end of this article.

Table 1.1

MBM Sample	IP Hrs @ 100C	SL in days at 40C	AV	PV	% Acidity
Control (untreated)	0.48	1.3	30.05	6.6	0.36
Test (treated with Xtendra97)	6.42	17.1	5.23	0.7	0.3

The analytical results pf PV and AV indicate that the treated MBM has improved stability profile. The extracted fat of the treated MBM has 6 times better shelf life than the untreated control.

Graph 1.1



Xtendra 97 was effective to increase the shelf life of the MBM from 203 days to about 17 days.

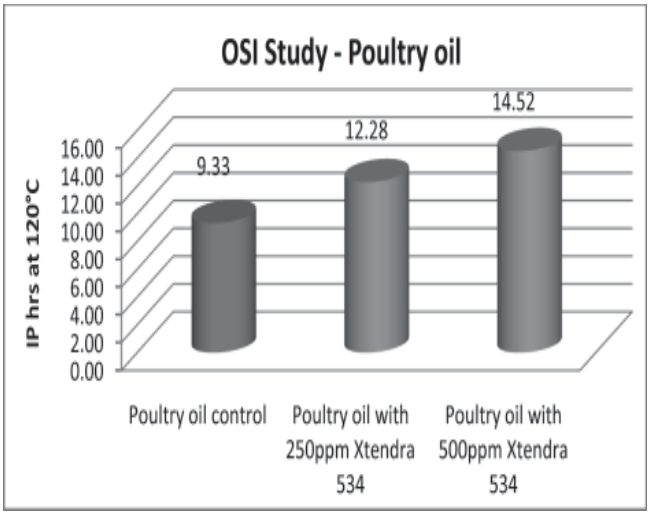
Study 2

Poultry oil was evaluated for shelf life after treatment with Xtendra 534 at 250g/MT and 500g/MT dosage. The IP hours indicating shelf life are given in Table 2.1 , Graph 2.1

Table 2.1

Sample details	OSI hrs at 120°C	Shelf life at 25°C, in Months	Protection factor
Poultry oil control	9.33	9.25	1.00
Poultry oil with 250ppm Xtendra 534	12.28	12.17	1.32
Poultry oil with 500ppm Xtendra 534	14.52	14.39	1.56

Graph 2.1



The treatment withXtendra 534 at 250ppm and 500ppm of Poultry oil helps in improving the oxidative stability which is shown by the increase in OSI hours by about 3 hours and 5 hours respectively as compared to the untreated Poultry oil.Xtendra 534 at 250ppm provides 1.3 times oxidative protection to the Poultry oil.Xtendra 534 at 500ppm provides 1.6 times oxidative protection to the Poultry oil. Thus, Xtendra 534 is an effective antioxidant solution to increase the oxidative stability of Poultry oil.

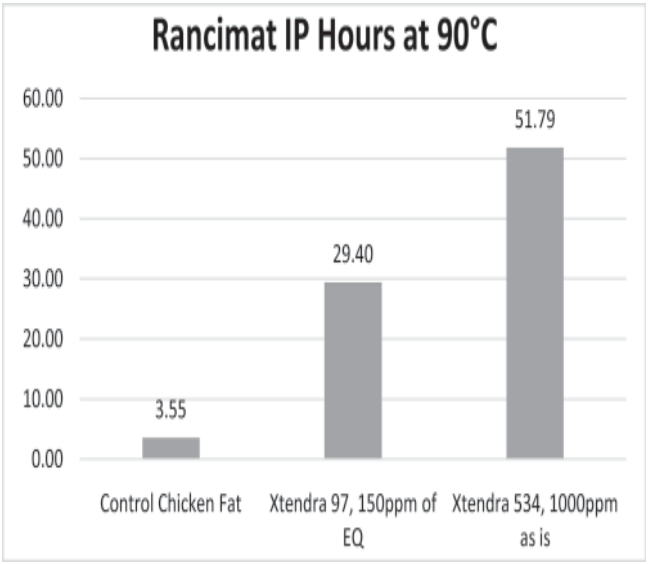
Study 3

Chicken fat was used as a substrate to test the antioxidant effectiveness of different antioxidants. In one treatment the Chicken fat was treated with 375ppm Xtendra 97 (equivalent to 150ppm Ethoxyquin) and in another treatment Chicken fat was treated with 1000 ppm Xtendra 534 (equivalent to 200ppm TBHQ + 80ppm BHT). The Oxidative stability of the treated sample against control chicken fat was evaluated in terms of IP hours at 90C, the results are given in Table 3.1, Graph 3.1.

Table 3.1

Sample details for Rancimat	IP hours at 90°C	Protection Factor (PF)	Days at 40C
Control Chicken Fat	3.55	--	4.7
Xtendra 97, 150ppm of EQ	29.40	8.29	39.2
Xtendra 534, 1000ppm as is	51.79	14.6	69.1

Graph 3.1



Xtendra 97 at an inclusion rate of 150ppm Ethoxyquin gives the best oxidative stability to Chicken fat when compared Xtendra 534 at 200ppm TBHQ + 80ppm BHT. Xtendra 97 is recommended as the best antioxidant solution for extending the oxidative shelf life of Chicken fat. The recommended dosage of Xtendra 97 for getting 1 month shelf life extension is 1000 ppm.

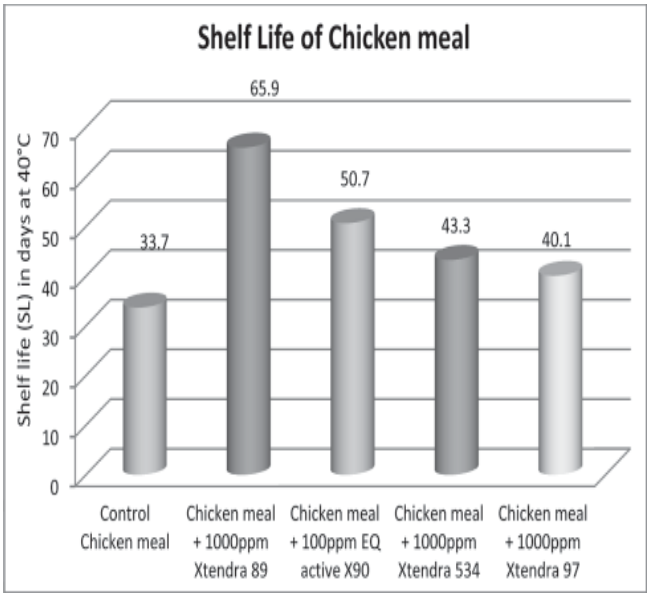
Study 4

Chicken mealwas treated with Xtendra 97, Xtendra 534 and Xtendra 89 at 1000 ppm level of incorporation and with Xtendra 90 at 100ppm Ethoxyquin active level. The meal samples were then tested in the Oxipres for the evaluation of oxidative stability in terms of increased shelf life against control (non-treated Chicken meal), the results are given in Table 4.1, Graph 4.1

Table 4.1

Sample Name	Oxipres, IP hrs at 90°C	Shelf life in days at 40°C
Control Chicken meal	25.3	33.7
Chicken meal+ 1000ppm Xtendra 89	49.4	65.9
Chicken meal+ 100ppm EQ active X90	38	50.7
Chicken meal+ 1000ppm Xtendra 534	32.5	43.3
Chicken meal+ 1000ppm Xtendra 97	30.1	40.1

Graph 4.1



Xtendra 89 at 1000ppm inclusion level gives maximum protection to the Chicken meal(66 days). Whereas Xtendra 90, Xtendra 534 and Xtendra 97 give, 17 days, 9 days and 6 days extension in shelf life to the Chicken meal as compared to untreated Chicken mealwhich has oxidative stability of about 33 days. Xtendra 89 is suggested as a suitable antioxidant for increasing the oxidative shelf life of Chicken meal. The recommended dosage of Xtendra 89 for getting 1 month shelf life extension is 1000 ppm or 1 Kg per 1 MT meal.

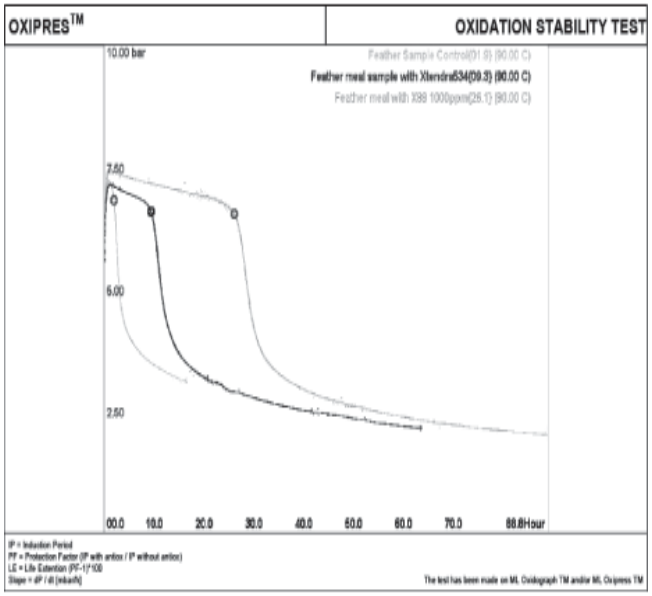
Study 5

Feather meal was treated with Xtendra 89 and Xtendra 534 at 1000ppm level of incorporation to evaluate the increase in shelf life. The shelf life prediction was achieved from the IP hours at 90C of the treated samples in the Oxipres instrument. The results are given in Table 5.1, Graph 5.1.

Table 5.1

Sample Name	IP hrs at 90°C	Days at 40°C
Feather meal Control	1.9	2.5
Feather meal + 1000ppm Xtendra 89	26.1	34.8
Feather meal + 1000ppm Xtendra 534	9.3	12.4

Graph 5.1



The Oxipres results indicate that Xtendra89at 1000 ppm level of inclusion is a better antioxidant than 1000ppm Xtendra 534 for extending the shelf life of feather meal by about 1 month.It is recommended to use Xtendra 89 in feather meal, at about 1500ppm to get about 45 days oxidative shelf life.

Antioxidants play an important role in protecting various feed substrates from the harmful effects of oxidation, and thus are pivotal in supporting the nutritive health of animals, which is the key to quality meat desired by consumers. Camlin Fine Sciences Limited works in close coordination with Feed formulators to determine their objectives for improving the nutritional health of animals, works out the suitable antioxidant formulations for various feed substrates by following scientifically designed testing protocols, carried out in a technical environment.

The Principle of Oxidative Stability Instrument (OSI):

The oxidative stability of fat samples is analysed using OSI Instrument from ADM. The OSI

instrument follows the principle of forced air circulation at elevated temperature to oxidise the test sample. The induction period in hours (IP) achieved is directly co-related with the oxidative stability of the test sample. If antioxidant is used in the test sample then it indirectly gives the performance of the antioxidant in terms of IP hours and Protection Factor (PF).

The Principle of Oxipres Instrument:

The oxidative stability of the test food product is analyzed by measuring the Induction Period. The Food sample is under pressure of oxygen (about 5 atm) and is heat treated simultaneously at a specific temperature. The oxidative stability is expressed as the duration (hours) for oxidation process to be initiated. When oxidation of the food sample starts the oxygen pressure reduces and the change in oxygen pressure is recorded by a transducer. The Induction Period (IP) is calculated as the number of hours required for a sharp drop in the oxygen pressure.

The Shelf life of the food product is then predicted based on IP hours at a specific temperature.

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Oxidation in foods and beverages and antioxidant applications – Vol.2: Management in different industry sectors – Eric A. Decker, Ryan J. Elias and D. Julian McClements

Food Additive User's Handbook - Blackie

Moulting of layers

K. Selvarasu and S. Malmarugan
Veterinary University Training and Research Centre, Parakkai, Nagercoil.

Natural Moulting

Moulting is a normal physiological process of shedding and renewing feathers in feathered species and it occurs in both sexes. In the wild state, birds usually shed and renew old, worn plumage before the beginning of the cold weather and their migratory flights. Birds normally shed their old feathers and grow new feathers once a year, which is controlled by the gonads and the thyroid gland and is associated with a drop in estrogen levels and a decreasing rate of egg production. Natural moults in commercial layer normally occur after 8 to 12 months of egg production. The loss of feathers is an orderly process with the head feather being shed first, followed by the feathers on the neck, body, wing and finally the tail.

Factors affecting moulting

Several factors affect the onset and length of moulting. The important factors are,

1. Weight and physical condition of the bird.

2. Length of light exposure.

3. Nutrition of the bird.

4. Environmental temperature and humidity.

Purpose of force moulting (flock recycling)

1. To minimize the cost to bring the flock into production.

2. To increase the length of egg production.

3. When the current egg prices are low with anticipation of higher egg prices after the flock returns to production.

4. Lack of available cash to maintain the flock.

5. Availability of empty laying houses.

Force (Induced) Moulting requirements

Under forced moulting, a layer flock is induced to shed and replace its feathers at a time selected by the flock manager. An induced moult causes all of the hens in a flock to go out of production for a period of time. During this period, regressing and rejuvenation of the reproductive tract occur, accompanied by the loss and replacement of feathers.

The three main factors involved in Force Moulting are:

Initiating the Moult

All moulting programs require that egg production be reduced to zero, which is usually accomplished by fasting (no feed) the flock or by limiting critical nutrients such as protein, calcium or sodium until or beyond the time of production ceases. Artificial lights should be turned off in open-sided houses and reduced to not more than 8 hours in environmentally controlled houses.

Resting the Flock

Once the flock is out of production, it may be held out of production for as little as 1 week to as much as 4 to 5 weeks depending on the requirement and the feeding program implemented during this period. The level of nutrition can regulate the length of the resting period. Low-protein or low-calcium diets will generally keep a flock out of production.

Returning the flock to production

When the flock is to be returned to production, a layer diet should be fed and lights should be returned to the normal lighting program for layers. A 50% rate of lay should be reached in 2 to 3 weeks and the peak should follow in an additional 2 to 4 weeks.

Types of Force Moulting (Flock recycling) programs
Two cycle moulting program

This program involves one moult and two egg production cycles. The hens are moulted after about 10 months of egg production, brought back into egg production and then sold at about 24 months of age

Multiple-cycle moulting program

This program involves two or more moults and three or more cycles of egg production. The hens are first moulted after about 9 months of production, then held through successfully shorter cycles and sold at 30 or more months of age.

Force Moulting methods
Low Nutrient Diet program

Many countries do not allow egg producers to use the fasting methods because of concern for the welfare of the flocks. In such instances, the producer must use feeding programs which will achieve zero egg production without resorting to the complete removal of feed.These methods include,

- Full or limited feeding of low protein or low nutrient diets
- Pullet diet - calcium and phosphorus levels
- No water restriction
- Reduction of day length

Conventional force moulting program

This is otherwise known as on again/ off-again program

Days	Feed	Water	Light
1	None	None	8 Hours
2	None	None	8 Hours
3	45g/ hen	Water	8 Hours
4	None	None	8 Hours
5	45g/ hen	Water	8 Hours
6	None	None	8 Hours
7	45g/ hen	Water	8 Hours
8	None	None	8 Hours
9	45g/ hen	Water	8 Hours
10 through 55-60	Restricted feeding-about 75% of full feed intake	Water	8 Hours
61	Full-feed layer ration	Water	14 – 16 Hours

Note: Inducing moulting of Chicken through starvation is banned in India.

Moulting by feeding zinc

About 20g of zinc per kg in the layer diet (25kg of zinc oxide per ton feed) is used for a period of 5 days along with reduced photoperiod. Then the birds are subjected to a regular laying ration containing 50 mg of zinc per kg diet (Normal level) and increased light period (14 to 16 hours). While on the high zinc program, hens will eat less than 10% of the normal amount of feed and will lose from 450 to 340g of their original weight within the first 7 to 10 days. Egg production should stop by the fifth day after zinc feeding is started. Birds will come back into production about 7 days after the high zinc diet is removed and peak egg production (75 to 80%) occurs depending upon the age at moult.

Use of drugs and other compounds

Compounds such as methalibure, enheptin, progesterone, chlormadinone, aluminium, iodine and others have been shown experimentally to effectively produce a moult.

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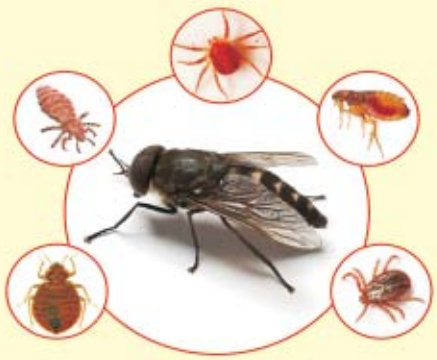
NATIONAL EGG CO-ORDINATION COMMITTEE

DAILY / MONTHLY EGG PRICES DECLARED BY NECC AND PREVAILING PRICES AT VARIOUS PRODUCTION CENTRES (PC) AND CONSUMPTION CENTERS (CC) APRIL 2019

Name Of Zone \ Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Average
NECC Prices																															
Ahmedabad	335	337	340	342	344	346	348	348	352	355	358	360	360	360	360	360	350	350	350	345	340	340	330	330	330	330	330	335	335	338	344.6
Ajmer	290	290	290	290	290	290	292	298	298	298	298	293	293	393	293	293	290	287	287	285	285	275	265	265	265	265	365	265	273	280	291.36
Banglore (CC)	335	337	337	337	340	340	345	345	350	350	355	355	355	355	355	360	360	360	360	350	340	340	325	325	325	325	325	330	330	335	342.7
Chennai (CC)	350	350	350	350	355	355	365	365	370	370	370	375	375	375	375	380	380	380	380	380	365	365	350	350	350	350	350	350	350	360	363
Chittoor	343	343	343	343	343	348	358	358	363	363	363	368	368	368	368	373	373	373	373	373	358	358	343	343	343	343	343	343	343	353	355.83
cochin	320	308	305	305	310	310	318	318	318	318	318	318	313	313	313	313	313	313	313	307	307	305	285	285	285	285	285	285	285	290	305.36
Delhi (CC)	315	310	310	310	310	310	310	312	315	317	318	318	318	318	318	318	318	318	310	305	300	300	300	290	285	280	280	280	280	280	305.1
E.Godavari	315	317	318	319	320	321	322	323	325	327	329	331	333	335	335	335	330	330	320	320	320	305	295	295	280	280	280	280	283	290	313.76
Hyderabad	282	284	286	288	290	292	294	297	300	303	305	307	309	311	311	305	305	305	295	295	285	275	275	275	275	275	275	278	283	290	291.66
Miraj	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mumbai (CC)	335	337	340	342	344	346	348	348	352	355	358	360	362	364	364	366	360	360	360	350	350	350	335	335	335	335	335	335	335	338	347.8
Mysore	337	337	337	342	342	347	347	352	352	352	358	358	361	361	365	363	363	363	363	350	350	335	335	335	335	335	340	340	345	345	348.16
Nagapur	290	290	297	300	300	300	302	305	307	307	307	307	307	307	307	305	300	295	285	285	382	380	270	265	260	-	-	-	-	-	302.4
Namakkal	342	342	342	345	345	350	350	355	355	355	360	360	360	360	365	365	365	365	365	350	350	335	335	335	335	335	340	340	345	345	349.7
Pune	325	327	329	330	332	334	338	338	344	348	352	355	357	360	360	361	355	355	355	340	340	340	330	320	320	310	310	310	310	325	337
Punjab	-	298	292	294	294	294	294	294	302	302	302	302	302	300	300	297	-	-	-	-	-	-	-	-	-	-	-	-	-	-	297.8
Vijayawada	315	317	318	319	320	321	322	323	325	327	329	331	333	335	335	335	330	330	320	320	320	305	295	295	280	280	280	280	283	290	313.76
Vizag	335	337	338	339	340	341	342	343	344	345	345	345	345	345	345	345	345	345	330	330	330	315	305	305	290	290	290	290	292	297	327.6
W.Godavari	315	317	318	319	320	321	322	323	325	327	329	331	333	335	335	335	330	330	320	320	320	305	295	295	280	280	280	280	283	290	313.76
Warangal	383	385	287	289	291	293	295	295	300	303	306	308	310	312	314	314	308	308	308	298	298	288	278	278	278	278	278	278	281	286	300.93
Prevailing Prices																															
Allahabad (CC)	328	328	328	326	324	333	333	333	333	333	338	338	338	338	338	338	338	333	328	328	324	324	319	319	319	314	309	314	314	319	327.63
Barwala	296	296	296	296	296	296	296	302	304	305	305	305	305	305	300	292	285	285	285	285	285	272	265	265	265	265	250	255	263	272	286.4
Bhopal	312	315	315	315	316	310	316	316	316	320	325	315	315	315	315	320	320	320	320	320	320	320	320	320	300	295	295	285	293	300	312.8
Hospet	300	302	302	302	305	305	310	310	315	315	320	320	320	320	320	325	325	325	325	315	305	305	290	290	290	290	290	295	295	300	307.7
Jabalpur	314	316	317	318	318	318	318	318	318	322	323	324	325	327	329	329	329	329	319	310	310	310	310	305	300	295	295	285	295	302	314.26
Kanpur (CC)	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	338	324	324	324	324	324	309	309	309	332.76
Kolkata (CC)	353	353	353	353	357	359	361	366	368	370	372	372	376	378	378	373	365	357	348	348	343	340	330	315	315	315	307	307	315	330	349.23
Luknow (CC)	360	350	350	330	350	350	350	350	333	333	333	343	350	350	350	350	350	350	350	350	350	350	350	340	340	333	333	333	333	333	344.23
Raipur	322	324	325	327	320	328	331	332	335	336	337	337	338	338	338	338	330	330	320	320	320	310	312	312	305	305	305	305	313	320	323.76
Varanasi (CC)	353	353	353	353	353	353	353	356	356	356	360	360	357	357	357	350	350	343	343	343	343	340	333	327	320	320	313	313	323	333	344.13



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*D. Michael Fry - Department of Avian Sciences, University of California, Davis, California - Environ Health Perspect 103(Suppl 7):165-171 (1995)

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The importance of maintenance nutrient requirements during periods of high feed prices

Author: **Dr Neil Gannon,** Regional Product Manager - Gut Performance, BIOMIN Asia-Pacific

Animal production around the globe is continually subjected to challenges around sourcing feed ingredients at the right price, and/or of the desired quality and/or with consistent supply. If periods of high feed ingredient prices also occur at the same time as depressed meat prices, as is currently seen in many parts of the world, the animal producer is placed under considerable financial stress

Because feed is the most significant contributor to the costs of production, many strategies are set in place to optimize feed costs and feed conversion when profits are low. Sometimes the strategies employed in pork production are to decrease nutrient density ('cheapen up the feed' through use of less energy or nutrient dense raw materials such as by-products) and/or reduce feed intake. On the surface this may appear to be a cost effective strategy for saving on feed costs (and in certain circumstances is the best approach) but the strategy ignores the importance of 'maintenance nutrient requirements'. This article discusses the importance of the contribution of 'maintenance' to overall feed efficiency and why maximizing, not restricting, swine feed intake and growth rates should be considered as an economic strategy when feed prices are high.

In simple terms, animals need (require) nutrients such as carbohydrates, fats, amino acids, water, vitamins and minerals for two purposes – either 'maintenance' or 'production'. Maintenance nutrient requirement refers to the quantity of nutrients to keep the animal alive in a thermo-neutral environment (that is, their ideal comfort zone where they are not too hot or too cold) at 'steady state' such that the animal is neither gaining nor losing body weight. Maintenance requirements incorporate all of the nutrient needs for vital activities such as breathing, blood circulation, normal kidney, brain and cell functioning but with no real allowance for physical activity. Nutrients required for 'Production' relate to all the nutrient needs associated with growth, gestation or lactation, depending on the stage of life of the animal. When an animal consumes feed, the nutrients in the feed have to be utilized first for maintenance purposes and any surplus can then be used for productive purposes. From this brief explanation of nutrient utilization it is hopefully clear that many situations such as stress, disease (and the subsequent immune responses), hot or cold environments, increased activity such as walking to the feeder or fighting, will increase the quantity of nutrients needed to keep the animal alive and therefore decrease the quantity of nutrients available for production.

As knowledge of the maintenance nutrient requirements is critical to determining the effective

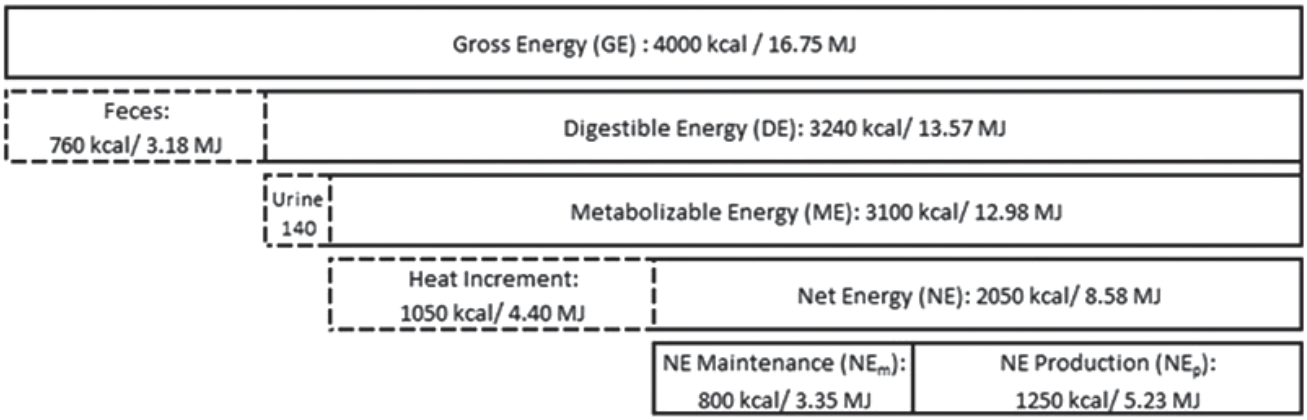

Figure 1. Energy partitioning in growing pigs consuming corn and soybean meal based feeds

feeding programs of livestock, many research organizations using sophisticated techniques have developed algorithms for calculating maintenance energy and amino needs for animals of different weights and stages of production. These algorithms can be readily found in the scientific literature. For the purpose of the current discussion and in an attempt to summarize a large body of work into some simple statements, a typical estimate for the maintenance energy needs of growing pigs under normal commercial conditions is approximately 25% of the metabolizable energy intake (or 20% of total energy intake). *Figure 1* shows the energy utilization of growing pigs fed corn - soybean meal-based feeds (adapted from Kil *et al* 2013).

As the requirement for amino acids for protein deposition (muscle) in the growing pig is quite dominant, the maintenance requirement for lysine and other amino acids is fortunately quite small and in the range of 3-10% of the individual digestible amino acid intake.

Why is all this relevant when feed prices are high? Hopefully the answer can be seen when we look at the typical feed intake of a finisher pig with a liveweight of about 100 kg. Although the absolute number will vary depending on breed, housing and feed ingredients etc, a 100 kg finisher pig would be expected to eat about 2.5 kg of feed per day. If we assume from the discussion above that approximately 20% of the energy in this feed is needed for maintenance, this means 0.20 x 2.5 kg or 500g of feed per day is required for maintenance and leaves 2500-500=2000g of feed available for production. If the pig is growing at a typical growth rate of modern genotypes of 1000 g/day, the effective feed conversion ratio for the productive component of the feed is 2000g/1000g or 2.0. If the same 100 kg pig has a 'restriction' put on the amount of feed pig it can consume through physical feed reduction and/or offered rations that are less energy dense through the use of by-products, the pig may now be only consuming the equivalent of 2.0 kg per day. The maintenance energy requirement of the pig does not change and this component is still about 500 g which means there is now only 2000-500 g=1500g of feed available for growth. Assuming the same productive feed efficiency of 2.0 is possible, the pig can now only grow at 750 g/day (250 g less or a 25% reduction compared to the full fed pig).

After a week on his regimen, the finisher pig would be estimated to be 1.75 kg lighter in weight. The

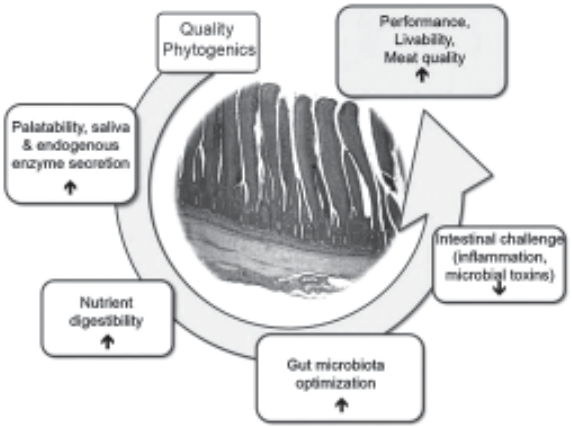

Figure 2. Mode of action of quality phytogenics

price of feed and the price of pig meat varies widely around Asia but it is possible to calculate what the expected impact of reducing the nutrient density or feed intake of the finisher pig would have on profitability in a particular country. By way of example, assuming finisher feed costs US$500 per tonne, and a low pork meat price of US$1.75 per kg, feed savings would need to be approximately US$50 per tonne of feed to offset the slower growth rate from reducing the density or feed intake.

The 'hypothetical' analysis above makes some assumptions and generalisations that can be discussed further and fine-tuned, but hopefully serves to illustrate the importance of considering maintenance requirements in livestock production. In addition to the nutrients required to keep the animal alive and functioning, there are considerable nutrient needs that are not considered in the above analysis of maintenance resulting from significant factors such as disease, coping with temperature and humidity effects and many other stressors that occur in animal production. These factors are well known to rob the animal of nutrients and further reduce growth, lactation and gestation performance and ultimately profitability and are worthy of mitigation.

More recently, as animal protein producers strive to reduce the reliance on antibiotics, there has been a greater understanding of the role that gut inflammation processes play in consuming nutrients that otherwise could be used for productive purposes. Quality phytogenic feed additives such as Digestarom® from BIOMIN have been shown to significantly reduce the over-stimulation of the immune system. The essential oil components in Digestarom® have also been proven to assist with maximising feed intake, stimulation of digestive enzymes to improve nutrient availability and positively modulating the gut microbiota. *Figure 2* shows the combined effects of Digestarom® and how the use of phytogenic feed additives can lead to improvements in animal performance.

In conclusion, this article has hopefully identified the importance of the nutrient requirements for maintenance and how an increase in maintenance requirements or un-productive processes can significantly limit the performance potential of animals. In situations of high feed prices, and subject to other valid financial considerations, it is proposed that maximising feed intake and diet density to get animals to slaughter as quick as possible may be a strategy worthy of consideration to optimise profitability. The use of quality phytogenic feed additives such as Digestarom® from BIOMIN may also assist in optimising the efficiency of use of nutrients for productive purposes during periods of high feed prices.

Mycotoxicosis and its control in poultry

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Mycotoxicosis is a disease condition caused by consumption of toxic metabolites of certain fungi. Mycotoxicosis is one of the most common and unreported toxicity in poultry. This condition decreases feed conversion efficiency and growth rate of poultry birds leading to decreased production and enormous economic losses. In India, mycotoxicosis is responsible for huge economic losses in poultry industry. The fungal contamination of poultry feed ingredients is a matter of major concern as it effects the economy of poultry industry by decreasing productivity and product quality.

Mycotoxins are secondary metabolites produced by toxigenic fungi mainly belonging to genera; *Aspergillus, Fusarium* and *Penicillium*. Molds infect the grains or crops in field or during harvesting and storage and produce mycotoxins. These toxins are produced in various feeds, cottonseed, peanuts, corn *etc.* during storage and at the field during drought or high temperature.

Among spectrum of mycotoxins encountered; aflatoxins which are responsible for aflatoxicosis are of major concern in the poultry industry. Aflatoxin B1, B2, G1 and G2 are prevalent form of aflatoxin. The different types of mycotoxicosis encountered in poultry are described in Table 1.

Table 1: Types of mycotoxicosis in poultry

S. No	Mycotoxicosis	Mycotoxin	Source	Adverse Effect
1.	Aflatoxicosis	Aflatoxin	*Aspergillus flavus* *Aspergillus parasiticus*	• Haemorrhages in liver and kidney • Carcinogenic and teratogenic • Liver damage • Increased mortality • Decreased feed intake
2.	Fuminosins toxicosis	Fuminosin	*Fusarium verticillioides*	• Reduces immunity • Poor growth rate
3.	Ochratoxicosis	Ochratoxin	*Aspergillus ochraceus* *Penicillium verrucosum*	• Carcinogenic • Teratogenic • Nephrotoxic • Hepatotoxic • Reduced hatchability
4.	Citrinin toxicosis	Citrinin	*Penicillium citrinum* *Penicillium expansum* *Aspergillus niveus* *Aspergillus oryzae*	• Nephrotoxic • Embryotoxic • Teratogenic • Poor growth rate • Decreased productivity
5.	Trichothecenes toxicosis	Trichothecenes	*F. graminearum* *F. sporotrichoides*	• Regression of Bursa • Gizzard erosion and oral lesion • Decreased feed intake and immunity
6.	Moniliformin toxicosis	Moniliformin	*Fusarium moniliforme*	• Cardiotoxic • Damages kidney and liver

Control of mycotoxin contamination in poultry feed: The contamination of feed with mycotoxins can occur at any of the three stages of harvesting. The fungal growth needs to be controlled both in fields prior to harvest and during storage at post harvest stage before giving for consumption to poultry.

Pre Harvest: Pre harvest control is practically difficult to achieve but several practices can be adopted to keep the conditions unfavorable for fungal growth in the field. These practices include:

a) Development of fungal resistant varieties of crops by genetic modification.

b) Use of fungicides for preventing fungal growth.

c) The cereal grains contaminated by the fungal spores should be treated and destroyed at pre-harvest level.

d) Removal of fungus contaminated seeds.

Post Harvest:

a) Storage of grains and other feed commodities at appropriate conditions such as at low temperature for preventing fungal growth and further inhibiting mycotoxin production.

b) Lowering of moisture content of the grains to minimum level after harvesting and during storage.

c) Use of approved insecticides for preventing insect infestation in stored bulk grains.

d) Inactivation or detoxification of mycotoxins formed in the stored grains/feed.

Mycotoxins in the feed can be removed or detoxified by various physical, chemical and biological methods to prevent, inactivate, destroy or remove the mycotoxins.

The physical methods include thermal inactivation and irradiation using ionizing radiations whereas the process of chemical detoxification consists of wide range of chemicals such as acids, bases, oxidizing agents, reducing agents, chlorinating agents *etc.* to reduce, inactivate or destroy mycotoxins. These chemical agents are acetic acid, propionic acid, lactic acid, sodium hydroxide, sodium bisulfite, sodium hypochlorite *etc.*

The available physical and chemical methods for the detoxification of crops contaminated with mycotoxins have safety issues. This has led to the increased demand of biological methods such as use of certain strains of *Lactobacillus*, *Streptococcus, Flavobacterium,* allicin from garlic and onion extracts, chitosan from crustacean shell, cinnamon extract, clove oil *etc.*

In conclusion, awareness on the occurrence of mycotoxins in feed and their negative impact on the growth and production of poultry birds and use of available modern techniques such as LC-MS/MS to analyze their presence in feed are the ways to safely eliminate their occurrence from the feed.

Role of poultry meat in human diet

Contributed by technical team of Rossari Biotech Limited AHN Division -
Dr. Shruti S., Dr. Vishal Surve, Dr. Aashaq Hussain, Dr. Nagarajan L., Dr. C. Seenivasan, Dr. Anish Kumar & Mr. Edward Menezes

What constitutes the basis of a balanced diet?

A balanced diet is the one that provides adequate growth, development and health. It is necessary to include variety in the food to ensure the intake of all essential nutrients. No single food can supply all the nutrients that a human body needs. An adequate diet provides all necessary nutrients obtained by judicious combination of different foodstuffs from varying food groups, rich in different essential nutrients. For health we need to supply our body with energy, 20 amino acids and a plethora of different vitamins and minerals. This is the reason that every culture involves consumption of a combination diet (for maintaining proper balance of nutrient intake that can't be obtained from consuming a single food ingredient). For instance, if a person decides to go on a complete 'only potato' diet, it would fulfil his need for the essential amino acids required to build protein, repair damaged cells/tissues and fight diseases; however, the body will experience mineral and vitamin deficiencies. Furthermore, potatoes being rich in carbohydrates, it will spike the blood glucose levels straining the insulin system.

A balanced diet must provide all the nutrients in required amounts and proper proportions. It can easily be achieved through a blend of the four basic food groups, viz.

1. Cereals, millets & pulses
2. Vegetables & fruits
3. Milk & milk products, egg, meat, fish
4. Oils & fats, nuts & oilseeds

A balanced diet would comprise of food from every food group providing around 50-60% of total calories from carbohydrates, preferably from complex carbohydrates, about 10-15% from proteins and 20-30% from both visible and invisible fat.

Role of poultry meat in balanced diet

The correlation between consumption of meat and human health is multifaceted. Poultry meat is an important component of a healthy and well balanced diet due to its nutritional richness with moderate energy content, highly digestible proteins of good nutritional quality, unsaturated lipids (mainly found in the skin and easily removed), B-group vitamins (mainly thiamin, vitamin B6, and pantothenic acid), and minerals (like iron, zinc, and copper). Consumption of poultry meat as a part of a rich vegetarian diet reduces the risk of cardiovascular disorders, type 2 diabetes mellitus and obesity. The relevance of poultry meat in human diet has also been recognised by the FAO (UN Food & Agricultural organization). The FAO considers poultry meat as widely available, relatively inexpensive and of particular importance in developing countries that experience shortfalls in available nutrient contents due to food shortage or poor quality of foodstuff. Research conducted worldwide has proven that poultry meat consumption improves the overall quality of the diet, especially of those diets rationed for specific physiological stages like prior to conception, during pregnancy & breastfeeding, in geriatric age etc. It is the ideal food for people with a need for high caloric and protein diet (bodybuilders, athletes etc).

Majority of the population in the world depend on cereal grains as their staple food. For instance, several countries have maize (corn) as their staple food. Maize is highly deficient in niacin & its consumption without niacin supplementation would lead to pellagra. Supplementing maize with chicken meat would balance the diet by countering the deficits. Invariable almost all cereal grains are deficient in one essential amino acid or the other which makes it imperative to include meat in a cereal based diet.

Nutrient Composition of Broiler meat

Mineral composition in Broiler meat

(Stadelman et al., 1988)

Minerals	mg/100g of edible meat portion
Calcium	11.00
Iron	0.90
Magnesium	20.00
Phosphorus	147.00
Potassium	189.00
Sodium	70.00
Zinc	1.31
Manganese	0.02
Copper	0.48

Vitamin Composition in Broiler meat

(Stadelman et al., 1988)

Vitamins	per 100g edible meat portion
Vitamin A IU	41
Vitamin C mg	1.60
Vitamin B_1 mg	0.06
Vitamin B_2 mg	0.12
Niacin mg	6.80
Pantothenic acid mg	0.91
Vitamin B_6 mg	0.35
Folic acid µg	6.00
Vitamin B_{12}µg	0.31

Protein composition in poultry meat

The gross protein content in poultry meat is about 18.60g/100g of edible portion.

Amino Acid composition of Broiler meat

(Mountney and Pankhurst, 1995)

Amino Acid	% of protein
Arginine	6.7
Cysteine	1.8
Histidine	2.0
Isoleucine	4.1
Leucine	6.6
Lysine	7.5
Methionine	1.8
Phenylalanine	4.0
Threonine	4.0
Tryptophan	0.8
Tyrosine	2.5
Valine	6.7

The protein component in poultry meat is defined as 'high quality'. **Protein digestibility-corrected amino acid score** (**PDCAAS**) is a method of evaluating the quality of a protein based on both the amino acid requirements of humans and their ability to digest it. Animal-derived foods have a Protein Digestibility Corrected Amino Acid Score (PDCAAS) value equivalent to or slightly below

Lipid composition of Broiler meat

(Stadelman et al., 1988)

Lipids	g/100g of edible meat portion
Saturated Fat	4.50
Monounsaturated Fat	6.73
Polyunsaturated Fat	3.16
PUFA/Saturated Fat ratio	0.28
Cholesterol	0.075

one. Conversely, plant-based foods have a less favorable protein profile as they generally lack in one or more essential amino acids and are more difficult to digest. Thus, they have a substantially lower PDCAAS value (e.g. 0.75 for beans and 0.5 for wheat) when compared to meat.

Poultry meat quality attributes

Quality is a relative term; for instance, a seller will view the quality of product in terms of what attracts the buyers and how much people are willing to pay for it. A nutritionist on the other hand would measure quality of the meat based on its nutrient content. It is however he consumer's perspective of quality that matters. Appearance is the key to initial consumer selection followed by texture as the second most important sensory characteristic that affects the consumers' final assessment. Meat colour, skin colour of meat, pinkness of cooked meat and appearance defects like bruises and haemorrhages affect the consumers' assessment of quality meat. For poultry meat to meet the consumer's expectation, it is imperative to follow and maintain proper management conditions at every stage of the bird's development, from fertilized egg through production and processing to consumption.

Conclusion

Freshness is the key to maintain/retain quality of meat. When compared with other animals reared for meat, chicken meat would always be fresh meat owing to its low body weight (less meat) promoting quicker consumption. On the other hand goat produces more meat which promotes storage of excess meat thereby losing its freshness. For this reason poultry meat is an important part of quality nutrition. For a consumer, quality meat is basically the presence of all desired characteristics acceptable for consumption. It is also rich in essential amino acids and has less saturated fats. Besides the meat, the organs of chicken are also rich in minerals and vitamins. Poultry meat has thus gained an important position in a balanced diet, both because of its nutrient quality and comparatively cheap source of animal protein.

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Coccidiosis

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Introduction: Coccidiosis in poultry is still considered as one of the main diseases affecting performance of poultry reared under intensive production systems. It is an intestinal disease that occurs when a microscopic parasitic organism (called a protozoa) attaches itself to the intestinal lining of a chicken. The coccidia are in the phylum Apicomplexa and may be grouped into numerous genera consisting of more than a thousand species; however, this discussion will be restricted to the genus Eimeria, which infects chickens and turkeys. Based on a compartmentalized model, cost of coccidiosis in poultry in Sweden was estimated to be • 0.023 per kg live weight. Extrapolated to assess the worldwide impact of coccidiosis, and assuming 50 billion broilers of 2 kg live weight annually produced this cost is probably more than 2.3 billion •

Etiology: Coccidiosis is unique in that it affects almost every animal species, yet individual species of coccidia are host specific. Seven species of *Eimeria* (*E. acervulina, E. brunetti, E. maxima, E. mitis, E. necatrix, E. praecox* and *E. tenella*) are recognized as infecting chickens. *E. tenella, E. brunetti* and *E. necatrix* are the most pathogenic ones. Other species such as *E. maxima* and *E. acervulina* are less pathogenic.

Morphology: Generally when the oocysts are expelled in the faeces they are spheric in shape and not embryonated. They measure 16 x 42 um. During sporulation 4 sporocysts are formed each containing two sporozoites.

General life cycle of coccidian: Stages of coccidia in chickens appear both within the host as well as outside. The developmental stages in the chicken give rise to a microscopic egg (called an oocyst) that is passed out in the droppings. Under proper conditions of temperature and moisture, the oocyst develops within one to two days to form a sporulated oocyst, which is capable of infecting other chickens. At this stage, the oocyst contains eight bodies (called sporozoites), each of which is capable of entering a cell in the chicken intestine after the oocyst is eaten. When sporozoites enter the cells, they divide many times producing either a few or many offspring (merozoites). The numbers produced depend on the species of coccidian involved. Each merozoite, in turn, may enter another intestinal cell. This cycle may be repeated several times. Because of this cyclic multiplication, large numbers of intestinal cells are destroyed. Eventually, the cycle stops and sex cells (male and female) are produced. The male fertilizes the female to produce an oocyst, which ruptures from the intestinal cell and passes in the droppings. Thousands of oocysts may be passed in the droppings of an infected chicken; therefore, poultry raised in crowded or unsanitary conditions are at great risk of becoming infected.

Clinical sign: The most easily predictable clinical sign of severe cecal coccidiosis is the presence of bloody droppings. Dehydration may accompany cecal coccidiosis. Coccidiosis caused by *E. tenella* first becomes noticeable at about 3 days after infection. Chickens droop, stop feeding, huddle together, and by the fourth day, blood begins to appear in the droppings.

Prevention and control coccidiosis: Anticoccidial drugs mixed in the feed are used to limit high levels of infection. Keep chicks, feed

Table 1: Eimeria spp. species of importance infecting chickens

S. no	Species	Predilection	Macroscopic lesions	Severity site
1	*E. brunetti*	Posterior part of small intestine	coagulation necrosis, mucoid and bloody enteritis	Very pathogenic
2	*E. necairix*	Small intestine	ballooning, white spots petechial haemorrhages, mucoid blood filled exudates	Very pathogenic
3	*E. tenella*	Caeca	Haemorrhages into lumen, thickening whitish mucosa, cores of clotted blood.	Very pathogenic
4	*E. acervulina*	Posterior part of small intestine	In light infection- whitish round lesions, In heavy infection- plagues coalescing, thickened intestinal wall	Pathogenic
5	*E. maxima*	Intestine	Thickened intestinal wall, mucoid exudate, petechial haemorrhages	Pathogenic

Table 2: Emeria spp. species of importance infecting turkeys

S. no	Species	Predilection	Macroscopic lesions	Severity site
1	*E. adenoides*	Caeca, lower intestine	Caecal cores consisting of caseous material, whitish appearance, petechial haemorrhages, swollen and oedematous wall, mucus - Secretion.	Very pathogenic
2	*E. meleagrimitis*	Caeca	Cream coloured caseous cores, Thick mucosa, petehical haemorrhages.	Slight pathogenic
3	*E. galloparvonis*	Posterior small intestine	Inflammation oedematous intestine, soft white caseous necrotic material in lumen	Pathogenic
4	*E. dispersa*	Mid part of small intestine	Dilation of intestine with secretion of cream coloured mucoid mateeial, odema congestion of capillaries necrosis of villi	Slight pathogenic

and water away from droppings. Roost birds over wire netting if brooding arrangements make this possible. Place water vessels on wire frames to eliminate a concentration of wet droppings, in which the chicks can walk to pick up or spread the disease. Keep litter dry and stirred frequently. Remove wet spots and replace with dry litter. Avoid overcrowding. If coccidiosis does break out, start treatment immediately. Use drug like Amprolium, Chlortetracycline, Oxytetracycline, Sodium sulfachloropyrazine monohydrate, Sulfamethazine (sulfadimidine), Toltrazuril.

Efficacy of Frankolin (Tiamulin 10%) & Bremulin 80 (Tiamulin 80%) on Egg Production in Layers of Namakkal Region: Customer Feedback Report

Dr S Muthukumar, Technical Manager-Zydus AH, Namakkal

Introduction: The modern strains of commercial layer chicken with their genetic potential to lay greater number of eggs during laying period make them susceptible to different types of reproductive tract disorders. In Namakkal, most of the layer farms are affected with Mycoplasmosis, which causes severe production drop and egg shell apex abnormalities leading to huge economic losses. Zydus AH has devised LMC program based on baseline titer level of *Mycoplasma synoviae* in IDEXX platform, unique pharmacokinetic properties of pleuromutilin derivates and robust monitoring tool to reduce risk of mycoplasmosis in layers. The present review is customer feedback report of LMC program highlighting efficacy of Frankolin (Tiamulin 10%) and Bremulin 80 (Tiamulin 80%) in layers of Namakkal region.

Mycoplasmosis – Briefreview: Mycoplasmas are members of the class Mollicutes, Order I, Mycoplasmatales. Genus I, *Mycoplasma,* has more than 120species, a DNA G+C content of 23–40%, a genome size of 600–1350 kb, requires cholesterol for growth, occurs in humans and animals, and has a usual optimum growth temperature of37°C. Avian mycoplasmosis is mostly caused by *Mycoplasma gallisepticum* (MG) and *M. synoviae* (MS), were most important to cause clinical and economical losses. MG infection is a chronic respiratory disease of chickens and causes infectious sinusitis in turkeys. Symptoms include respiratory rales, coughing, nasal discharges and, in turkeys, frequently include sinusitis. MS infection is commonly known as infectious synovitis, an acute-to-chronic disease for chickens and turkeys involving primarily the synovial membranes of joints and tendons sheaths. However, during recent years, MS has been less frequently associated with synovitis, while, more incidences of egg-shell apex abnormalities and egg production drop were caused by emerging salpingotropic (oviduct tropism) MS strains(Khalifa et al., 2013). Transmission of the etiological agent occurs through transovarian route, respiratory aerosols and direct contact. Following infection birds become persistently infected with MS and remain carriers for life. With the expansion of poultry farms and the concentration of large, multiage production complexes within a restricted geographic area, it is becoming more difficult to maintain flocks that are free of MS. It is leading to tremendous economic losses in poultry production as a result of decreased hatchability and egg production, reduced quality of day-old chicks, reduced growth rate, increased costs of eradication procedures (site cleaning and depopulation), and increased costs of medication and vaccination (Ferguson-Noel and Williams, 2015).

Effect of Tiamulin on Mycoplasmosis: Tiamulin hydrogen fumarate is a semisynthetic derivative of the diterpene antibiotic pleuromutilin (Egger and Reinshagen, 1976) and is effectively used in the treatment of airsacculitis, which is primarily caused by *Mycoplasma* spp. Recently, MIC data from Europe (Pridmore, 2008) on 32 isolates of *M. gallisepticum* and 21 isolates of *M.synoviae* showed that Tiamulin was highly active against these etiological agents. After oral

Effect of Tiamulin on Mycoplasmosis

Sr No.	Antimycoplasma agent	Class	Tissue distribution (active metabolite)			
			Upper Respiratory Tract	Lower Respiratory Tract	Genital organs (oviduct)	Egg
1.	Erythromycin	Macrolide	+++	+	+	- (Inactive metabolites only)
2.	Azithromycin	Macrolide	++++	++	+	- (Inactive metabolites only)
3.	Tylosin	Macrolide	++++	++	++	+
4.	Tilmicosin	Macrolide	+++++	++	+	- (Inactive metabolites only)
5.	Tylvalosin	Macrolide	+++++	++	++	+
6.	Tiamulin	Pleuromutilin	+++++	+++	+++	++ (50% active)

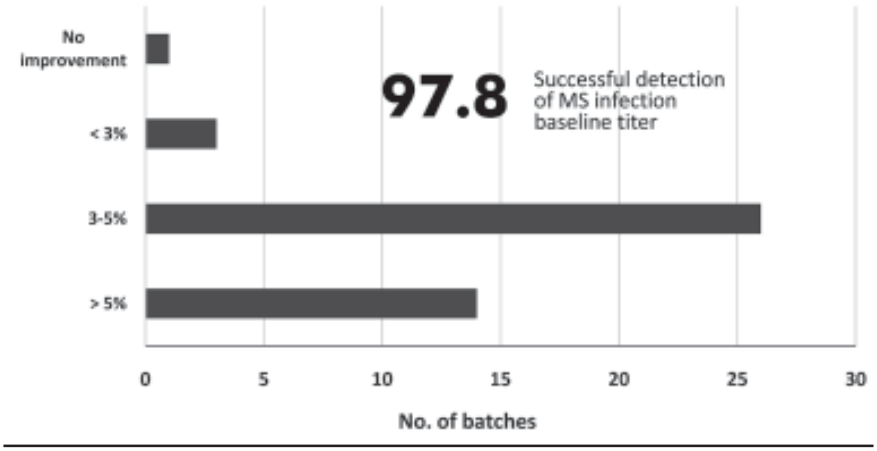
gavage of the medicine at 25 and 50 mg/kg of BW, Tiamulin rapidly reaches peak serum concentrations of 1.7 and 3.6 ìg/mL, respectively, in chickens at about 2 h; the levels declined over a 12- and 24-h period depending on dose (Laber and Schutze, 1977).With predominance of salpingotropic MS strain (oviduct tropism), it has become indispensable to select anti having higher tissue distribution in genital organs besides respiratory tract. In this context, following are the tissue distribution analysis of two leading classes of antibiotics.

Tiamulin has impressive tissue distribution in both respiratory & genital organs where in later it has highest tissue distribution. In laying & breeder hen, 50% deposits in its active form (Tiamulin) and 8 -alpha-hydroxymutilin, hence, effectively counteracts MS tropism in oviduct and thereby production drop. In addition, advantage of least MIC value range against different *M.synoviae*isolates as 0.006 – 0.5, Tiamulin is proven to be least resistant over longer duration (Valk and Burch, 2002; Islam et al., 2009). Only Tiamulin residues in egg do not conflict with human food chain as it (pleuromutilin) is not used in human antibiotic medication. On the contrary, antimycoplasma agents like Tylosin, Tilmicosin&Tylvalosin poses resistance threats through its residues below MIC value over longer duration and higher trends of cross resistance (macrolides for human use).

Layer Mycoplasma Control program: An overview in Namakkal

Zydus AH has devised layer mycoplasma control (LMC) program based on critical baseline titer against MS in IDEXX platform, unique pharmacokinetic properties of pleuromutilin &macrolides in combination at different phases of layer and robust monitoring tool as tracker. The value proposition of the program for layers are immense in terms of efficacy, return on investment and avoidance of resistance by preventing indiscriminate use of antibiotics during rearing period. The program stresses on periodic monitoring of MS infection status in flock and treatment in right dosage is recommended only wheninfection status (titer) crosses the critical baseline for MS. Layer mycoplasma control (LMC) program has been successfully adopted by many layer farms in India with impressive customer satisfaction and feedback.

In Namakkal, total 13 farms and 47 batches used adopted LMC program (either Bremulin 80 or Frankolin) where post adoption egg production improvements were classified into three categories, viz, >5 %, 3 – 5% and< 3%. In



summary, > 5%, 3-5% and < 3% improvement in egg production were recorded in 14, 26and 6 batchesrespectively. The success rate of prediction for MS infection status based on baseline titer level > 10000 (IDEXX) and thereby positive response to treatment accounted to 97.8%.

Conclusion: Namakkal contributes largely to egg production in India. The tremendous pace of growth in egg production also accounts for simultaneous losses owing to uncontrolled proliferation of *Mycoplasma synoviae* (salpingotropic strains) in laying hens. Furthermore, the interactions of Newcastle Disease Virus, Infectious Bronchitis Virus, Mycotoxinswith *Mycoplasma synoviae* worsen production losses in layers. In this context, Zydus AH devised LMC program strategically control mycoplasma in chicks, growers and layers through right combination of antibiotics at therapeutic concentration and evaluation of stressors (interaction of NDV, IBV, Mycotoxins & managemental problems) in flock beyond mycoplasmosis with periodic monitoring.

Mineral complexes in feed for higher bioavailability of microminerals

Dr. Onkar Pawaskar* and Dr. Mangeshsagar**
* Managing Director-Volschendorf Enterprise Pvt Ltd
** Director (Sales & marketing) -Volschendorf Enterprise Pvt Ltd

Trace minerals are, generally, uncommon minerals that practically all organisms need in minute quantities in order to trigger the production of enzymes and hormones for growth, reproduction and healthy maintenance of the animal or plant body. Nutritionally speaking, trace minerals by definition are those which are required by the body in micro amounts.

All efforts are been made to make these micro minerals available in required quantities and in effective, bioavailable form.

One major problem associated with mineral supplements is their poor absorption from the gut because of their inorganic form. The inorganic form of minerals is very cheap however, they do not get absorbed well into the body. The mineral complexes as against the inorganic ones are highly bioavailable.

The increase in demand on all aspects of nutrition has led to the use of new ingredients better able to meet the animal's growing needs. In the case of trace minerals, this has come in the form of organic minerals. 'Organic minerals' describes mineral sources bound in some way to an organic ligand. Chelated trace mineral technology allowed commercial application of these products to improve trace mineral status in the dairy herd with wide-ranging benefits.

The chelation technology is only possible with the transition metals (iron, copper, manganese, cobalt and zinc).

Minplex a product of Volschendorf, is specially formulated mineral complex supplement designed to improve absorption of the essential minerals into the body. All minerals present in Minplex are in complex form with amino acid resulting in their improved bioavailability. These are bioavailable forms of essential trace minerals such as copper, iron, manganese, and zinc. After reaching to the organs and tissues, these help in production of enzymes and hormones which in turn are responsible for production of more eggs and meat. Minerals complex promote better mineral uptake and enhancement of the immune response.

Animals digest, absorb and use mineral complex better than inorganic minerals. In addition, animals fed complex sources of essential trace minerals excrete the same in lower amounts in their faeces, so there is less environmental contamination.

A trial was conducted in broiler birds with 14000 birds and 3500 birds in each group.

Group A: Birds fed with inorganic minerals at recommended dosage (1kg per ton of feed)

Group B: Birds fed with organic minerals at recommended dosage (500 gms per ton of feed)

Group C: Birds fed with Minplex @ 750gms per ton of feed

Group D: Birds fed with Minplex @ 1000gms per ton of feed

The results in the group fed with Minplex minerals complex were found highly promising.

With the below trial, a new and a cost competitive alternative is now available with the feed manufacturers' and farmers to make their birds more healthy, immunity stronger and more productive.

The trial report is given below.

	Group A (with inorganic mineral mix)	Group B (without inorganic mineral & with organic min. mix @ 500ppm)	Group C (without inorganic mineral & with Minplex @ 750ppm)	Group D (without inorganic mineral & with Minplex @ 1000ppm)
Number of birds	3500	3500	3500	3500
Avg. Feed consumed (gm)	3470	3398	3354	3384
Avg. weight gained (gm)	2029	1997	2096	2197
FCR	1.71	2.24	1.60	1.54
Mortality (%)	4	5	4	3
Return on investment (ROI) Rs	2.71	2.95	3.22	4.89

For more details please contact:

Volschendorf:

302, Siddeshwar arcade, Opp. Surajwater park, Ghodbunder road, Thane (West)-400607. Tel: 022-25976100/400 E-mail: ipms.sales@gmail.com

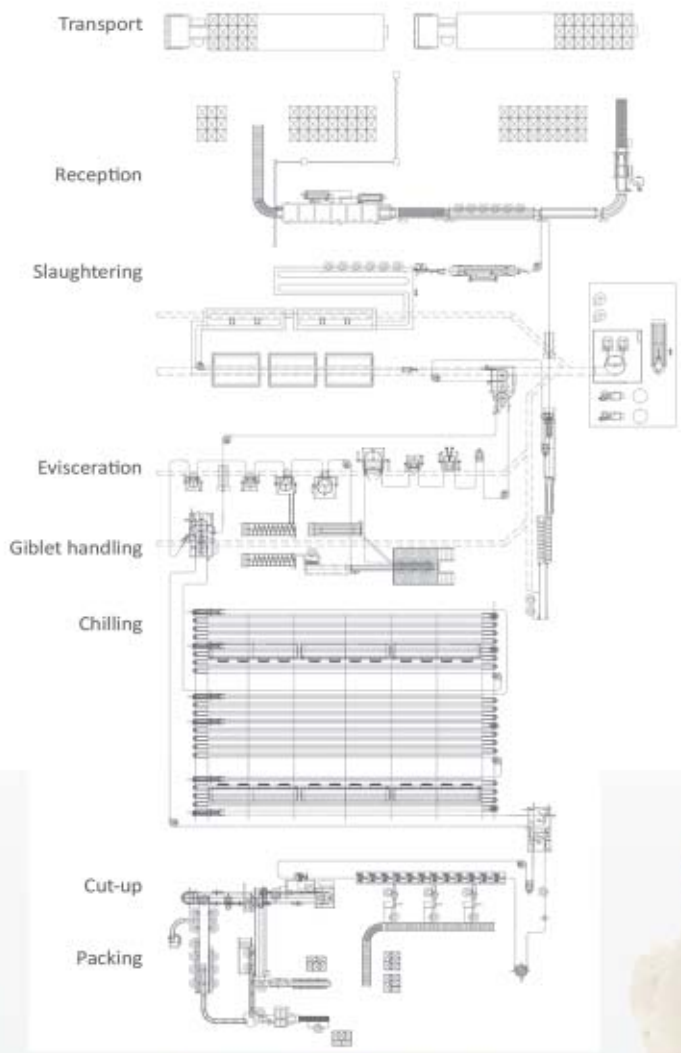
BROILER LIFTING RATES FOR THE MONTH OF MARCH 2019

place	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Hyderabad	73	73	73	73	75	77	79	79	79	80	80	82	82	84	86	86	91	91	95	105	110	110	110	110	110	103	103	95	95	95	95
Karimnagar	73	73	73	73	75	77	79	79	79	80	80	82	82	84	86	86	91	91	95	105	110	110	110	110	110	103	103	94	94	94	94
Warangal	73	73	73	73	75	77	79	79	79	80	80	82	82	84	86	86	91	91	95	105	110	110	110	110	110	103	103	95	95	95	95
Mahaboobnagar	73	73	73	73	73	75	77	77	79	80	80	82	82	84	86	86	91	91	95	105	110	110	110	110	110	103	103	95	95	95	95
Kurnool	73	73	73	73	73	75	77	77	79	80	80	82	82	84	86	86	91	91	95	105	110	110	110	110	110	103	103	95	95	95	95
Vizag	71	71	71	71	71	71	73	73	73	75	75	77	77	79	80	80	85	85	90	95	100	100	100	100	100	95	95	95	95	95	95
Godavari	67	67	67	67	67	67	70	70	70	72	72	74	74	76	78	78	83	83	88	95	100	100	100	100	100	95	95	95	95	95	95
Vijayawada	71	71	71	71	71	71	74	74	74	76	76	78	78	80	82	82	85	85	89	96	101	101	101	101	101	97	97	97	97	97	97
Guntur	72	72	72	72	72	72	75	75	75	77	77	79	79	81																	
Namakkal	65	65	63	63	63	63	66	69	71	71	71	73	73	73	73	68	68	68	70	76	81	81	84	84	84	84	84	84	82	81	81

BAADER Food Processing Machinery

LINCO FOOD SYSTEMS

Poultry Processing Solutions



Example of a 3000 - 6000 bph solution

Flexible solutions to meet customer needs

BAADER LINCO is dedicated to offering poultry processing solutions that include gentle live bird handling, effective stunning, killing, scalding, picking, evisceration, chilling, cut-up, deboning, grading and packing.

We focus on best quality, highest food safety and excellent services to ensure the highest benefit for our customers. The benefit of all our partners also gives us our benefit and motivation to succeed.

Want to know more?

For more information or enquiries, please contact your local Sales Manager, Pradeep Kolte by phone +91 9423005159 or e-mail pradeep.kolte@baader.com.

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TECHNICAL RELEASE

Maintaining Egg Shell Quality

Dr.S.P. Kalaskar, BVSC &AH, MVSC(Nutrition), Nutritionist,Vetrix Nutrition Pvt Ltd. Ph: 09890942732

Dr. S.P. KALASKAR

The egg is highly complexed reproductive cell, as yolk is surrounded by albumen, this entire mass issurrounded by two membranes and an external covering we calledit egg shell.The shell provides a proper shape to the egg and is meant forconserving the valuable nutrients within the egg.Hen egg contains approximately77% water,12.2% protein,10.4% lipids and rest vitamins, minerals and carbohydrates.

Egg Shell:

The outer cover of the egg, the shell comprises 9-10 % oftotal egg weight.On an average the eggshell weighs 4-5g, with remarkablemechanical properties of breaking strength and is 300-350micrometer thick. The calcium content of the eggshell is approximately

1.7-2.6g.

Composition of Egg Shell:

- Calcium carbonate: 94-96%
- Phosphorus: 0.31%
- Magnesium: 0.22%
- Sodium, Potassium, Manganese, Iron andCopper: traces
- Organic matter:<2%

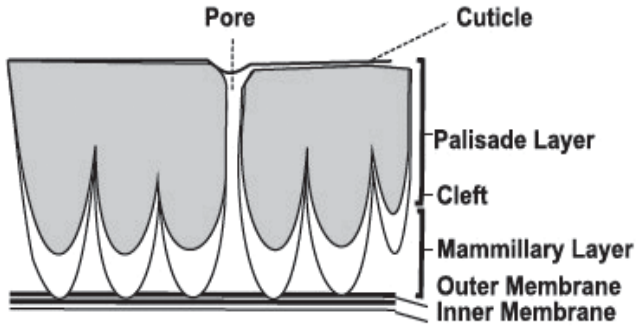

Fig. 1: Structure of the egg shell

Shell Quality:

For commercial layer and breederoperations, shell quality means increased

shell thickness and shell breaking strength to reduce number of cracked eggs,and increased number of saleable / hatchingeggs.

Methods to Measure ShellQuality:

Egg shell quality can be measured as:

- Egg size and visual shell defects
- Specific gravity
- Shell color
- Shell breaking strength
- Percentage shell (Shell weight X 100/Eggweight)
- Shell thickness (mm)

Specific Gravity:

The specific gravity of an object equals the weight of its volumerelative to the weight of an equal volume of water,(when both are at thesame temperature.)The specific gravity of an egg is equal to the egg's density relative towater.

The specific gravity of all four parts of the egg is different

Shell: 2.324,

Yolk: 1.031,

Albumen: 1.037,

Shell membranes: 1.074.

Since the specific gravity of shell is more than two times higher thanthe other parts of the egg, the percentage of the shell has majorinfluence on the specific gravity of whole egg. As the amount of shell increases, the specificgravity of the egg increases, Egg specific gravity, therefore, is a good indicatorof percentage shell and shell quality.The incidence of breakage is above normal, if thespecific gravity of a flock averages less than 1.077.

Shell Quality Defects:

These defects are obvious from externalobservation / candling and are important for evaluationfor the producer and consumer. These may be as:

(A) Mis-shaped Eggs:

If albumen quality is very poor and there is no soundfoundation upon which to build the true shell, the shell may break in the shell gland during theformation process.

Mis-shaped eggs are due to any factor which causes disturbance to the birds

10-13 hours before the egg is laid is likely toincrease the incidence of this fault.

B) Coated Shell

Any stress or disturbances at the time egg is due to be laidwill encourage the bird to retain the egg,typically these faults are caused by the egg remaining in the shellgland for an extended period.Often young flocks just coming into production are very susceptible tothis defect.

(C) Rough Shelled Eggs

In some cases, two eggs may be in the shellgland at the same time which can cause a formof rough shelled egg.

(D) Soft & Weak Shelled Eggs: Soft and weak shelled eggs can be common in older birdsespecially those which are nearing the end of the laying period.If an egg is retained in the shell gland for too long, the nextovulation takes place at the usual time but before the previousegg is laid ,So the second egg may spend less time then normal in theshell gland and the result is a soft or shell-less egg.

Cracked Eggs:

Egg shells can easily be damaged after the egg islaid and cracking is one of the most commonreasons for downgrading, It may be due to an inadequate egg shell being laid or to poor handling which may occur duringcollection, grading or transportation.

Three main types of cracks are identified.

Hairline Crack :

Hairline Cracks are the most difficult to identify,particularly in very fresh eggs.

Hairline cracks are often caused by an eggcolliding with an inflexible surface.

Star Crack:

May often be visible under normal light althoughthey are more easily seen during candling.A central point of impact may be seen and it mayoften due to collisions between eggs.

Pin-hole &Toe-hole Crack :

Can be caused either by the birds themselves or byany sharp protrusions which may come into contactwith the egg.

Dirty & Glazed Shells:

After the egg is laid, it canbecome affected withnumerous contaminants, all of these lead to eggsbeing downgraded.High standards of hygieneand management and pest

control bust be maintained toovercome this defect.

Factors Influencing ShellQuality:

Thickness:

The thickness of the shell is determined by theamount of time it spends in the shell gland (uterus)and the rate of calcium deposition during shellformation, If the egg spends a short period in the shell glandthe thickness will be less.

Diseases:

Diseases like infectious bronchitis (IB), Newcastle disease (ND),Avian influenza (AI) and

Egg Drop Syndrome (EDS) affect shell gland.EDS Virus affects only the shell gland but with ND or IB, everyportion of the reproductive tract can be affected virus causes soft/rough shelled eggs, discoloration andwrinkling of the shell.

Management:

Poor housing, high ambient temperature,rough handling of the eggs will affect the

eggshell quality.Since large eggs are more prone to cracks, the egg size must be managed through propernutritional and lighting management.

Age of Birds:

As the hen ages, the thickness of the shell usually declines. Older Flocks lay larger eggs, which break easily. (The hen isgenetically capable of placing only a finite amount of calcium inthe shell.)Hen loses some of her ability to mobilize calcium from the bone, and is less able to produce the needed calciumcarbonate. The absorption and mobilization of calcium decreases to lessthan 50% of normal after 50 weeks of age.

Water Quality:

Many studies showed that saline drinking water,including tap water, underground bore watercontaining sodium chloride, has an adverse effect oneggshell quality,while having very little effect onfeed intake, egg production or egg weight.

Stress:

The shell is formed by the activity of cells lyingthe oviduct and uterus. Under stress the secretions of these cellsbecome acidic and the cells can be damaged ordestroyed.In extreme cases stress induced effects canresult in eggshells that have excess deposits ofcalcium and results in misshaped eggs.

EnvironmentalTemperature:

During exposure to high temperature, the henreacts by increasing its rate of breathing (panting) inorder to cool itself. This causes the lowering of CO2in the blood.("respiratory alkalosis").The PH of the blood becomes alkaline and theavailability of calcium for the eggshell is reduced.This disturbance in acid-base balance causes an increase in soft-shelled eggs during summer.

Nutrition:

There is a complex relationship between calcium, phosphorus, vitamin D3 and the hormonal system ofthe layer in calcium metabolism during lay. Calcium and phosphorus balance is critical forproper egg production and eggshell quality.Layer ration should be formulated with correctamount of calcium and phosphorus.(usually 3.8– 4.0% calcium,0.38– 0.44% phosphorus)

Calcium:

Both excess and deficiency of calcium willnegatively affect the egg shell quality.An egg contains almost 2 grams calcium; hence anaverage of 4 grams of calcium intake per day isrequired by a layer to maintain good shell quality.(since only 50-60% of dietary calcium is actuallyused in shell formation.)

During the last 15 hours of shell formation, calcium movementacross the shell gland reaches a rate of 100-150 mg/hr.This process draws calcium from two sources: diet and bone.Normal blood calcium level is about 20-30 mg with a normallayer ration of 3.56% calcium or higher,while layers on a 2% calcium diet ,30-40 % of the Calcium is

derived from the bone.It is therefore important to have pullets, prior to lay, on a high level of calcium to store it on body.

when the shell gland is inactive Intestinalabsorption of calcium in the diet is about 40%, butreaches 72% when active. (This time closelycoincides with late afternoon or the dark hours, forthe layer.)Having higher calcium levels in the gut during thistime is important to ensure calcium is being takenfrom the diet and not from bone.Large particle sizes of calcium sources allowcalcium to be metered throughout this time.

Phosphorus

The phosphorus content of the eggshell is small i.e. 20mgcompared with 120mg in the egg contents. There is also uneven distribution of the phosphorus in the inner

and outer layers of the shell. High levels of phosphorus in the blood will inhibit the

mobilization of calcium from bone. The absorption of calcium and phosphorus are interrelated andcan be influenced by…. Source and form of Ca and ph. Calcium source and particle size plays a role in calcium level in thegut when needed.

Intestinal pH: Phosphorus absorption is optimal at pH 5.5-6.0. When the pH is higher than 6.5, absorption of phosphorusmarkedly decreases.

Ca and Ph ratio: High calcium of phosphorus levels in theintestine reduce the absorption of both.

High calcium increases the pH in the gut and phosphorusabsorption is decreased along with zinc and manganese

Vitamin D3 is vital for absorption and mobilization of calciumduring shell synthesis.

Vitamin D3 is the major control element in stimulating calciumabsorption from the intestine.

How to Improve ShellQuality?

Vitamin C (Ascorbic Acid) is essential for synthesis oforganic matrix (tropocollagen) of eggshell.Ascorbic acid alleviates the ill effects of heat stress byreducing the plasma cortisone level in the bird.Ascorbic acid is a co-factor in the conversion of Vitamin D to

the active hormonal metabolite"Calcitriol" (1.25 (OH)2D3) whichstimulates intestinal absorption of calcium and thus elevatesplasma calcium to a level that supports normal mineralizationof bones.A dietary level of 250 mg ascorbic acid/Kg diet improves the

egg production and eggshell quality by enhancing intestinalcalcium absorption.

Sodium Bi Carbonate (NaHCO3)Supplementation of NaHCO3 to laying hens at high temperatures is ameans of improving eggshell quality. (as hens consume the additional

bicarbonate during the period of active shell formation.)The addition of sodium bicarbonate has shown toelevate the dietary electrolyte balance,improved acid-base balance andhas a positive effect on eggshell quality.

Minerals: Zinc, Manganese and copper are compounds involvedin the metabolic process of eggshell formation.These trace minerals work as co-factors of enzymesinvolved with shell matrix formation.

Calcium: Provide extra calcium to the older hens @ 1 g/bird inthe form of shell or stone Grit (over and above normalrequirement in summer.)Maintain the desired particle size of calcium source.The minimum size of calcium source to improvegizzard retention is about 1 mm. Magnesium content of calcium source must be as lowas possible.

Management: Reducing egg breakage at farms requires constantattention to management details and properequipment maintenance. Some methods to reduce the percentage of broken eggs are:

1)Provide cushioning at the front of egg collectionarea of the cages.

2)Collect the eggs at least twice a day and moreoften if possible.

3)Maintain egg collection wires/trays in goodcondition.

4)Ensure that eggs do not pile up.

5)Routinely check the quality and condition of theegg trays.

6)Train Egg collection workers for carefully pickingthe eggs from the cage area. (gently placingthem in the collection trays without slowing downthe collection process.)

6)Procure good quality feed ingredients without contaminants and mycotoxins and provide wholesome water at all times to the birds.

Maintaining eggshell quality is a far more complex activity.We can however make significant reductions in thenumber of eggs lost due to poor shell quality. Thiscan be achieved if werealize that no singlefactor is responsible for egg breaking. Manyfactors are known to be co-related with eggshell qualityincluding flock health problems, managementpractices, environmental conditions and adequacyof nutrition.

PRESS RELEASE

Latest series of BIOMIN Mycotoxin Academy held in Nepal, creating strong imprints

Following the series of successful BIOMIN Mycotoxin Academies in India and Myanmar, innovative animal nutrition company BIOMIN expanded this knowledge transfer initiative to Nepal, where over 150 delegates participated in two more academies.

11March 2019 – Having gained a reputation for imparting knowledge and awareness on mycotoxin risk management, the much recognized BIOMIN Mycotoxin Academy was rolled out in Nepal in February this year with the first event held at Chitwan on February 12. This was closely followed by another event held at Kathmandu the next day. The BIOMIN Mycotoxin Academies, which facilitates knowledge transfer between BIOMIN experts and stakeholders stands testimony to the commitment by the innovative feed additive company in creating awareness on mycotoxin risk management and also by providing innovative and sustainable solutions to help the farmers.

Dr. Justin Tan, Regional Technical & Marketing Director, BIOMIN Asia-Pacifictook lead in the Academies and presented on 'Mycotoxin Risk Management in Animal Production.' His technical session was interspersed with information like prevalence of mycotoxins detectedin Nepal, and the regional and global trends.

The session was sharply divided into three sections, Mycotoxin Occurrence, Effects of

Mycotoxins and Mycotoxin Risk Management. "Digestive disorders, carcinogenicity, impairment of the reproductive system, neurotoxicity and hepatotoxicity are some of the main effects caused by mycotoxins such as Aflatoxin, Zearalenone, ergot alkaloids, Trichothecenes, Fumonisinsand Ochratoxin A," he elaborated.

Quoting leading research publications, Dr. Justin Tan pointed out that even at low concentrations mycotoxins cause immune suppression. "And all of these effects will ultimately lead to a decrease in animal performance which will be directly reflected in economic losses for the livestock industry," he said.

According to him, the most effective strategy against mycotoxins is to adopt a three-pronged strategy of mycotoxin control, namely

biotransformation, adsorption and bioprotection, which is the science behind Mycofix®product line from BIOMIN.

It may be noted that the Mycofix® is an unique combination of patented specific enzymes and biological components that deactivates mycotoxins in contaminated feed into non-toxic, environmentally-safe metabolites.

Dr. GanggaWidyanugraha, Regional Technical Sales Manager-Poultry, BIOMIN Asia-Pacific in his presentation on 'Feed Testing and Necropsy-Challenges in Nepal' highlighted the prevalence of mycotoxins in Nepal from the field postmortem analyses he conducted in the country.

"The best action plan I would recommend is Mycofix for breeder and layer feed, broiler pre-starter feed as well as broiler grower/finisher feed," he said and added that this EU authorized product from BIOMIN is at the forefront of mycotoxin risk management.

Apart from the technical sessions, Edward Manchester, Regional Director, BIOMIN Asia-Pacific explained the audience about the core values of BIOMIN, which is Pioneers-Partners-Performers. "Mycotoxin Risk Management and Gut Performance Management are our two pillars," he said and added that R&D is one of the cornerstones of BIOMIN.

Earlier Dr. Sujit Kulkarni, Managing Director, BIOMIN India in his welcome address explained about how the BIOMIN Mycotoxin Academies benefited hundreds of farmers and industry leaders in India.

Keerthivasan Chandrasekar, Digital Marketing Executive, BIOMIN India in his presentation explained about the digital initiatives taken by BIOMIN and how farmers can get benefited by following the company's social media pages and subscribing to newsletters.

Kampoj Badal, Managing Director of Big "B" Vet Trading, supply chain partner for BIOMIN in Nepalin his vote of thanks thanked BIOMIN for organizing Mycotoxin Academies in Nepal and pointed out that this shows the company's commitment for Nepal feed and livestock industry. He also thanked the attendees for their overwhelming response.


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- Work as tonic following multifactorial ***Infectious, Nutritional Deficiencies and Stress Factors***

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PRESS RELEASE

EW Nutrition highlights Optimization of Feed Cost in Challenging Period

Today, poultry industry is facing a major challenge in terms of rising prices of feed ingredients and limited availability of quality raw material. EW Nutrition India hosted a technical seminar in Jabalpur on 29th March, 2019 to discuss on the optimization of feed cost through nutritional intervention in this challenging period. The key speaker in the program was Dr Mahendra Chaudhari who is leading poultry consultant with over 26 years of experience in the industry. The program was jointly inaugurated byMrSumit Kalia andMrsGaura Dubey, Director, Phoenix Poultry.

The event was kick started by a welcome address delivered by Dr. Sadanand Karale, Zonal Business Manager (West).

Dr. Chaudhari with vast experience and nutritional expertise deliberated on the choice of right ingredients, replacement options and suggested nutritional interventions for enhanced performance to keepthe feed cost under control. Thiswas followed by question and answer session. The audience enquired about feed optimization and nutritional manipulations during heat stress. This was explained and resolved by the technical team of EW Nutrition.

Dr Shirish Nigam, Managing Director, EW Nutrition South Asia,infused confidence in the audience by addressing them as “Partners in Progress”. He highlighted the importance of services offered by EW Nutrition likeRoutine Technical Services in Field, Audit of farm, hatchery audits, disease diagnosis, Mycotoxin risk assessment at doorsteps and also other services including Gut Health Surveillance- FITC markers etc. He assured that EW Nutrition would always stand in thick and thin situation with its customers and work towards achieving the goal, thus achieving a win-win situation for all.

Another major highlight of the event was the discussion on the importance of probiotics in early life of chicks, whichwas explained by Dr Amrita Singh from the Product Management Team. Apart from this, an innovative and advanced probiotic applicatorrecently developed by the EW Nutrition was also showcased.

The delegates included technical staff and members from Phoenix Poultry Jabalpur includingDr S.C Mishra, Mr Bharat Lal Patel and Mr Prabhakar Ayer.Mr Jayant Chaudhary fromJoy Poultry farm,Mr Raj Kumar Bajaj from Bajaj poultry

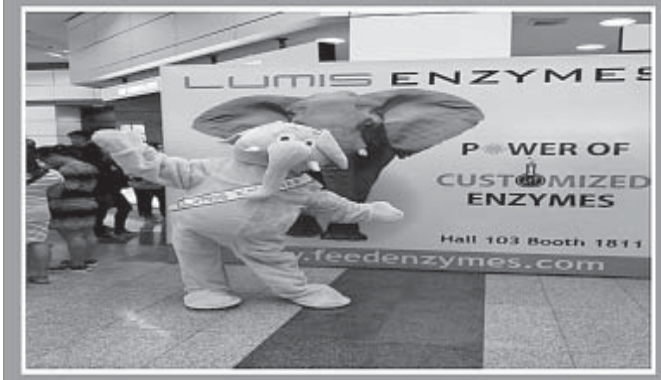
farm and MrPravesh Verma of Jabalpur region were also a part of the esteemed gathering. The event was further enlightened bythe presence of dignitariesfrom Jabalpur Veterinary College Dr J.L Vegad and Dr R.P.S Baghel.Mycotoxin Analytical Reader was also displayed and was a center of attraction for customers.Mr Sunil Bhindwale from Phoenix group extended the vote of thanks to the distinguished guests before concluding the event.

LUMIS ENZYMES

EXHIBITS AT VIV, ASIA

LUMIS ENZYMES

EXHIBITS AT VIV, ASIA



LUMIS ENZYMES

EXHIBITS AT VIV, ASIA

LUMIS ENZYMES

EXHIBITS AT VIV, ASIA

Optimising feeding for egg production

Feeding birds in the context of an antibiotics ban brings challenges, but also opportunities. Nutrition is about more than offering nutrients to meet requirements for maximum performance. Nutrition's role goes beyond this to embrace raw materials, feed additives selection and ideal bacterial ecology. All this supports top digestion and absorption, along with balanced microflora, and an adequate immune response. Ensuring an optimal function of the gastrointestinal system is vital to successful egg production.

People are aware of food safety issues due to high profile food scandals linked to animal production. Nowadays, the public, government regulatory agencies and the animal food industry are working to fulfil expectations for the production of quality, safe products. The shift towards less antibiotic use worldwide brings new opportunities for improving gut health through nutrition to promote health in the egg industry.

In order to express an animal's genetic potential, the digestive tract must support an optimal digestion and absorption of nutrients, minimising gastrointestinal illness, stabilising and/or positively modulating the microbial ecology, and enabling the bird to mount an effective immune response. Opportunities to optimise gut health of the pullets and layers, preventing pathogenic insults that may directly or indirectly affect performance are often overlooked.

Gut health challenges in egg production

In the rearing house, birds are exposed to continuous stressors (vaccination programs, beak trimming, medical treatment, etc.) this results in feed intake depression. In addition, the focus is on flock uniformity, body weight and sexual maturity at the expected age. The gut development (physiologically and immunologically) and the microbial ecosystem are often not considered. In some cases, birds are systematically treated with antibiotics in their first five days of arrival, when their digestive tract is still in an immature state, and microbiome establishment is an up-hill struggle.

The challenges inherent in egg production, combined with physiological stress due to hormonal changes, make it difficult to accomplish optimal feed utilisation and maximum production while maintaining egg quality. Moreover, the reality is that many flocks in production suffer a lack of uniformity, bacterial enteritis, necrotic enteritis (NE), dysbiosis (microbial imbalance) and focal duodenal necrotic. Later in the production cycle, further challenges are faced with a leaky gut and reduction in villi length associated with reduction of nutrient absorption, mainly minerals. As a result, increased cracked eggs, micro cracks and dirty eggs are seen, plus a reduction of total eggs.

Coccidiosis was ranked as the most important threat during rearing, regardless of the housing system (cage or non-cage), according to a survey conducted in 2014 by the Association of Veterinarians of Egg Production in USA. It also highlighted colibacilosis as the main issue in cage-housed layers. The survey's participants indicated that gastrointestinal problems are responsible of 50 percent of health issues of the flock when birds are in production and 40 percent when they are growing. Other health problems also mentioned were viral diseases related to the respiratory system. It's important not to overlook the fact that such challenges may drive secondary bacterial diseases, leading to performance losses.

If the gut function is impacted by pathogens, there is not only an immunological response but also a change in passage rate, digestion, mucin secretion, and an increase in turnover rates of the intestinal epithelium. As a result of reduced feed intake, there is a higher maintenance nutritional requirement, as nutrients are diverted to bolster the immune system. Energy and nutrients expended to mount a strong enough immune response to defeat disease, as a consequence of a disturbed microbial ecosystem, reduce absorption and digestion of nutrients - increasing Feed Conversion Rate (FCR) - overstimulating the immune system. As a consequence they trigger enteritis and noticeable performance losses.

Laying hens can maximise feed utilisation efficiency for egg production, when a healthy gut is developed. A healthy gut can be defined as 'a steady state where the microbiome and the intestinal tract exist in symbiotic equilibrium and where the welfare and performance of the animal is not constrained by intestinal dysfunction'. Not only is the gut the major organ for nutrient digestion and absorption, it also works as the first protective mechanism to exogenous pathogens which can colonise and/or enter the host cell tissues. The gut is the largest immunological organ in the body, therefore a more robust gut should make for a healthier animal which can optimise nutrients better.

Managing gut health through nutrition

Crude fibre has been regarded as an inert nutrient in

monogastric animals. However, this is not the case, as it can have roles in improving gut health, enhancing nutrient digestion and modulating behaviour. A minimum constraint should be established, for instance five per cent in diets for laying hens. Besides the fibre content in the diet, there are benefits to the digestive system of birds when coarse particles are fed. Flocks fed with larger particles will develop larger and more muscular gizzards and longer intestinal tracts. Coarser feed particles require more time in the gizzard to be ground into smaller particles, before they can enter into small intestine. Increased retention time stimulates pH drop, which has a bacteriocidal effect. Larger feed particles have a longer transit time through the gut, which improves the length of microvilli and increases the absorptive surface area in the intestine, and thereby positively affects digestibility and nutrient absorption.

Layers have a preference for larger particles, and the preference becomes stronger with age. Therefore, hen behaviour also improves, not only due to birds having to spend more time eating, but also because they have less time for vices such as feather pecking / cannibalism. Feeds containing high levels of powdery raw materials should be avoided. Birds find it more difficult to consume fine grist; and, once consumed, there is a direct outflow through the gizzard without utilisation. Hence a feed of larger grit size is desirable. An addition of two per cent oil also assists in achieving a homogenous feed with optimal particle distribution.

Dietary 'protein' has significant effect on the gut health

The primary role of amino acids from feed for animals is for growth and development of organs and tissues, mainly to serve as building blocks in protein synthesis. However, amino acids are also essential in many metabolic pathways to regulate physiological functions and modulate response in the body's immune system; mucin, epithelial cells, antibodies, enzymes, hormones, etc.

Nonetheless, a proportion of amino acids and non-amino acid nitrogen offered through the feed is not well processed in the digestive tract, generating substrates for microbes and toxins for the animal. This material can thus insult the ileum, causing overgrowth of pathogenic bacteria, imbalance in the gut ecosystem, gut irritation, dysbacteriosis and in some cases subclinical necrotic enteritis. Large and insoluble protein particles which are not assimilated by the animal, go to the large intestine, leaving the digestive system through the faeces. However, small/soluble protein particles pass through the ileocecal junction into the cecum, where their breakdown (putrefaction) takes place and ammonia, amines, indoles and branched chain fatty acids are produced. These compounds can be toxic and problematic.

Excess of 'protein' not only increases production costs, it also generates health problems in the bird. However, reduction of crude protein (total nitrogen) in feed must be accompanied by the balancing of the amino acid profile and supply according to the requirements of the birds. Precise (amino acids) nutrition implies raw material (amino acid) knowledge, digestibility, awareness of poor processing of protein sources, and the use available pure amino acids. This approach can then meet the demand of maintenance, health challenges and egg production without excess of nitrogen. The correct balance of digestible amino acids – also called: 'Ideal Amino Acid Profile' – is shown Table 1.

Table 1. Recommendations for standardiaed ileal digestible amino acids for laying hens. AMINOHen®, % of diet & daily amino acid intake/mg

	Lys	Met	Met+ Cys	Thr	Trp	Arg	Ile	Val
Ratio to Lys	100	50	91	70	21	104	80	88
Intake, mg/d dig AA	831	415	756	582	174	864	665	731

*Digestible amino acid demand for laying hens and optimal contents in feed (100g) daily feed intake.

Supporting the above, Drew, MD et al. 2004 studied the effects of dietary protein source and level on intestinal populations of Clostridium perfringens in broiler chickens. Two studies demonstrated that the level of dietary crude protein (230 and 400 g/kg) and protein source (soy protein concentrate or low-temperature-dried fishmeal) of diets affect the growth of C. perfringens populations in the lower intestinal of the broiler chicken.

A significant interaction between protein source and level was observed where the number of C. perfringens present in the ileum and cecum increased as the level of crude protein in the diets increased in the birds fed fishmeal-based diets, ($P < 0.05$) but not in the birds fed soy protein concentrate based diets. This suggests that the level of crude protein, protein source, and amino acid content of diets might all be predisposing factors to outbreaks of clinical necrotic enteritis.

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