avitech technical bulletin

June 2007

FORMULATING FEED IN CHALLENGING TIMES

Nutritionists have to face many challenges whilst formulating feed such as varying weather conditions (Summer / Winter), high altitude, high disease pressure, fluctuating market conditions and poor-availability or high price of raw materials used in feed.

1. Weather Conditions (High Temperature & Humidity)

Poultry production efficiency is adversely affected by high ambient temperature and humidity. The change in the weather from warm to cold or from cold to warm requires due consideration and appropriate measures for poultry to withstand these seasonal fluctuations. A conducive environment should be provided for effective management of animals so as to improve the efficiency of production performance in different seasons. It is essential that the birds be provided with proper nutrition. Balanced poultry rations have to be made which are specifically formulated to provide the essential nutrients. Any deviation in the feed nutrients from what is required by poultry will result in lower production, greater chances of disease prevalence and lower profit margin. Feed formulations require several adjustments during summer to take care of the reduction in feed intake, improving the tolerance of the bird towards hot weather, reduction of specific dynamic heat of metabolism and increasing the passage time of nutrients in the intestine through macro and micro formulation changes.

Increase in the energy content of the feed is required to take care of the reduction in the feed intake in spite of the fact that in summer, the maintenance energy requirement of the bird is comparatively less. The increase in energy is best achieved by adding fat (oil) that stimulates feed intake and improves the palatability of feed. Fat also reduces the rate of passage of ingesta within the digestive system. (At the same time the daily intake of energy by the bird should also be reduced).

ther nutrients need to be increased proportionately alongwith the energy level.

Minimizing excesses of amino acids improves feed intake. A diet with lower protein levels but supplemented with limiting amino acids will help to reduce stress to the kidney as also control ammonia levels in poultry houses.

Ammonium chloride through feed improves the weight gain, as maintenance of blood pH is critical for growth rate. Inclusion of potassium chloride (KCl) at 0.5 Kg / MT feed in pre-starter and starter diets is also useful.

The table below shows the effect of KCl on heat stressed broilers.

Table 1. Effects of water temperature and KCl effects on heat stressed broilers[1]

Water Temp (°F)	ADG (G)		Daily Water Cons (ml)		Body Temp (°C)	
	Control	+0.5 Kg.KCl	Control	+0.5 Kg.KCl	Control	+0.5 Kg.KCl
55	55.4	60.2^{b}	364^{b}	470^{a}	42.8^{ab}	42.7^{b}
88	50.3^{c}	56.5^{ab}	359^{bc}	466^{a}	43.1^{1}	42.9^{ab}
108	47.0^{cd}	42.5^{d}	364^{b}	340^{c}	43.3^{1}	43.1^{a}

[1] Three trials combined.
[a-d] Means within a classification, with unlike superscripts differ (P<0.05)

Sodium bicarbonate supplementation through diet at 1.5 Kg / MT of feed also helps in maintaining the acid-base balance.

Electrolyte balance in feed should be maintained more than 250 mEq especially during summer. (The bicarbonate ions coming from sodium

bicarbonate should also be considered while balancing)

Usage of Vitamin C (coated) at a minimum dose of 100g / MT of feed is advisable. Vitamin C can also be administered through drinking water (1g ascorbic acid/L). Vitamin C and E supplementation helps to improve the laying hen performance as shown in Table 2.

Table 2. Effects of supplemental vitamin C and E on performance of laying Japanese quails reared at high ambient temperature (n=30)

	Treatments				
Parameter	C	Vit C	Vit E	Vit C+E	SEM
Live wt, g	218[a]	228[b]	226[b]	237[c]	24
DMI**, g/d	25.1[a]	29.5[b]	28.3[b]	33.0[c]	1.5
Hen-day egg production %	68.3[a]	75.3[b]	74.1[b]	81.6[c]	1.6

[a, b, c, d] mean value within a row with no common superscript differ significantly (P<0.05),
C : control (basal)diet,
Vit C : control diet +250mg of L-ascorbic acid/kg of diet,
Vit E : control diet +250mg of -tocopherol acetate/kg of diet,
Vit C+E : control diet +250mg of L-ascorbic acid/kg+250 mg of -tocopherol acetate/kg of diet,
** : Dry matter intake.

Addition of electrolytes (Summer mix) without disturbing the electrolyte balance of the diet is of much use to alleviate the summer stress. Vitamin and electrolyte in the drinking water also helps to reduce the heat stress.

Organic trace minerals usage is also advisable.

Inclusion of a cocktail enzyme is preferable during summer months. Phytase addition (5000 FYT/g) (40 - 100 g / MT) depending on the feed formula is very useful in reducing stress to the birds.

Increased levels of vitamins and trace minerals are advisable in summer since it not only take care reduced feed intake, but also for the increased requirements in summer.

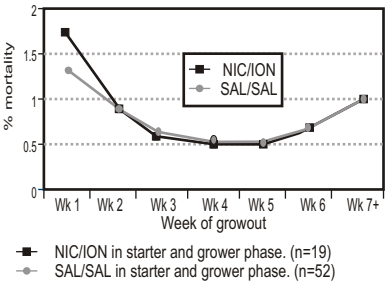
TABLE 3. Average anti-SRBC antibody response (primary and secondary) of broilers fed under thermoneutral (TN) and heat stress (HS) condition[1]

Treatment	Primary			Secondary		
	Total Antibody[2]	IgM[2]	IgG[2]	Total Antibody[2]	IgM[2]	IgG[2]
Temperature						
TN	5.53[a]	3.57[a]	1.96[a]	6.96[a]	1.92[a]	5.04[a]
HS	4.03[b]	2.49[b]	1.54[b]	4.88[b]	1.43[b]	3.45[b]

[a, b] Means within columns with different superscripts differ significantly (P<0.05).
[1] Values are least square treatment means. Data are from 18 birds per treatment.
[2] Data represent means of $\log_2$ of the reciprocal of the last dilution exhibiting agglutination.

Nicarbazin Usage:

Nicarbazin has been documented to increase mortality during high ambient temperature by numerous investigators. Wiernusz and Teeter (1991) observed that a combination of narasin and nicarbazin (50 ppm each), reduced bird survivability during heat stress. The mode of action for nicarbazin toxicity appears to be related to increased heat production (Wiernusz and Teeter, 1995). Although nicarbazin is an effective anticoccidial drug, its use should be avoided during hot weather, regardless if it is used in combination with another anticoccidial. Weekly percentage mortality in broilers fed salinomycin and nicarbazin is depicted as follows.



NIC/ION in starter and grower phase. (n=19)
SAL/SAL in starter and grower phase. (n=52)

2. High Altitude / Low Temperature

At higher altitudes one of the most common observations is reduced weight gain. This is due to increased basal metabolic rate and reduced feed intake. The energy intake to maintain body weight / growth at high altitude is significantly higher than that required at sea level. Therefore, the energy intake at high altitude should be higher than at sea level, despite a possible lack of appetite. Studies have shown that high carbohydrate intake can reduce effects of altitude on performance. This is most likely due to the fact that carbohydrate requires 8-10% less oxygen for use, compared to fat and protein. Therefore, a ideal fuel at high altitude is carbohydrate.

Fluid need of the birds are increased at high altitude due to Increased sodium and water excretion and also due to the cool dry air, as each inspired breath needs to be warmed at body temperature before reaching the lungs and each expired air contains water and

heat, which is lost to the environment. Given that carbohydrate requirements are also increased and water alone is a poor re-hydrator, it is practical to provide water with electrolytes (Sodium), which will help to minimize urinary losses and maintain the extra cellular fluid space.

Micro Nutrient Requirements at High Altitude.

Since the basal energy need of the birds are increased at high altitude the need for vitamins also increased. Further high altitude is associated with increased oxidative stress caused by increased ultra violet light, added stress of reduced oxygen particle pressure, and increased metabolic rate, hence it is essential to increase the levels of Vitamin E and synthetic antioxidants in the feed. The availability of iron is crucial for oxygen carrying, as one of the functions of iron is to deliver oxygen to cells and to facilitate the use of oxygen by cells. It is essential to review the levels of iron and its availability in the feed.

3. High Disease Pressure

The current trend of intensive poultry keeping and omnipresent disease threats requires specific attention towards improving the immune status of the bird through nutrition. Under commercial conditions, birds are usually exposed to a wide variety of stress factors, which might alter the requirements for nutrients. In prevailing high disease challenge environments, it is essential to rear poultry with competent immune system. It is already known that most nutrients are involved in the development of the immune system and its responses. The effectiveness of this system is largely dependent on dietary conditions and it can be adversely affected by inadequate supply of nutrients. It is clear that a well-fed animal is immunologically more competent than a poorly fed animal. Nutrition and nutritional status have direct effects on the immuno-competence of birds and their resistance to various infectious diseases.

A number of dietary components can have direct and / or indirect implication on the intensity and efficacy of the immune responses. Some are capable of increasing the immune responses while others are capable of decreasing immune responses. There is no question that poultry on well balanced diets are more immunologically competent and able to cope up better with disease challenges. It is imperative that most nutrients that are necessary for optimal growth (energy, amino acids vatamin and mineral etc.,) are also necessary for optimal immunocompetence. The following factors have to be looked into for improving immunity through nutrition.

A well-balanced feed with adequate energy and amino acid profile.

Proper dietary arginine concentration. Dietary arginine and Vitamin E help in improving the immunity as depicted in Fig. 2.

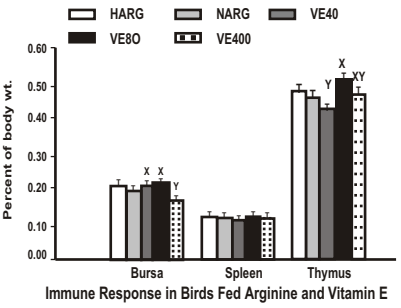


Fig 2. Relative lymphoid organ weights of 6 week old broilers (Cobb 500) fed 2 levels of arginine: normal (NARG, 1.2% in the feed) and high (HARG, additional 0.3% ARG in the drinking water); and 3 levels of vitamin E(40, 80, 400 IU/Kg feed). Relative lymphoid organ weights were calculated as percentages of body weight.

[1] Different superscripts indicate significant differences amoung VE levels.

Proper sodium and chloride levels.

Levels of vitamin A, E and C.

Optimum Methionine level. DL-methionine supplementation helps in improving the lymphoid organ weights (Table 4).

Table 4. Lymphoid organ weights in mg/100g BW of broiler chicks at 28th and 50th days of age after supplementation with DL-Methionine.

Group	Time of administration	Route of administration	Time of examination	Organs		
				Bursa	Thymus	Spleen
A	1st - 7th	Drinking water	28th day	218±8[a]	416±5[a]	137±4[a]
B	1st - 7th	Feed additive	28th day	217±9[a]	416±6[a]	136±7[a]
C	Control		28th	212±9[b]	411±12[b]	132±11[b]
			50th	231±4	530±10	152±9
D	29th - 36th	Drinking water	50th day	232±3	531±4	153±5
E	29th - 36th	Feed additive	50th day	231±2	532±4	152±7

Figures are mean values (±SEM) for 3 birds in each group with different treatment.
[a, b] Means in vertical row with different superscripts were statistically differed at P<0.05.

Adequate Zinc, Manganese and Copper level. Immune response is greatly enhanced in broilers through varying levels of Zinc supplementation as revealed from (Table 5)

TABLE 5. Average anti-SRBC antibody response (primary and secondary) of broilers fed different levels of zinc[1]

Treatment	Primary			Secondary		
	Total Antibody[2]	IgM[2]	IgG[2]	Total Antibody[2]	IgM[2]	IgG[2]
Diet[3]						
LZ	3.76[c]	2.45[b]	1.31[b]	4.64[b]	1.44[b]	3.20[b]
AZ	4.77[b]	2.92[b]	1.85[a]	6.50[a]	1.70[a]	4.80[a]
HZ	5.80[a]	3.72[a]	2.08[a]	6.61[a]	1.86[a]	4.75[a]
Pooled SEM	0.16	0.17	0.13	0.24	0.12	0.21

[a-c] Means within columns with different superscripts differ significantly (P<0.05).
[1]Values are least square treatment means. Data are from 18 birds per treatment.
[2]Data represent means of $\log_2$ of the reciprocal of the last dilution exhibiting agglutination.
[3]Low zinc (LZ ; 34 mg/kg zinc) and adequate zinc (AZ ; 68 mg/kg zinc) had no supplemental zinc, and high zinc (HZ ; 181 mg/kg zinc) was supplemented with zinc.

Apart from this various natural and synthetic additives are available to improve the immunity.

4. Inappropriate Market Conditions

Feed represents approximately seventy percent of the total costs of poultry production. Overall profitability of poultry producers depends on the consistent supply of more digestible and high value raw materials such as corn and soybean meal. However fluctuating prices for commodities and also the lower return for the finished product (egg / meat), troubles the poultry producer quite often. There is always a pressure on the feed cost continuously. We need to look various ways and means to optimize the poultry production under these unfavorable conditions.

Diet cost would be significantly reduced, if locally sourced by-products were able to be used to a greater extent in poultry diets. The performance of these raw materials can further be enhanced by addition of enzymes such as xylanase, phytase etc.

Further poultry producers have to employ feed formulations based on the anticipated market prices to delay or advance the growth of the broilers. It is always wise to stick to formulations that gives high returns / to produce broilers at lowest cost possible, but sometimes due to marketing reasons producers have to delay or advance the growth. In such cases, we need to stick to standard formulations for pre-starter & starter and early feeds and depending on the need either the finisher rations can be made into high density during favorable conditions or can be diluted during unfavorable conditions to delay the growth.

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