Avitech
Knowledge | Nutrition | Innovation

Technical Bulletin

November 2006

Broiler Nutrition: The Road Ahead

The genetic potential of modern broilers is continuously improving through genetic selection, which is directed towards increasing profitability by improving a large number of production and support characteristics such as growth rate, feed conversion, livability, eviscerated yield, meat yield, carcass fat, leg and skeletal strength and breast conformation resulting in increasingly successful broiler production. This trend is expected to continue in the same direction and a remarkable progress can be achieved within a short time. Table 1 below is indicative of this progress.

Table 1: **Improvement in genetic potential expected in the next 5 years**

Trait/parameter	Improvement
Weight	+ 270g
Days to market	- 5 days
Feed conversion	- 0.05
Eviscerated yield	+ 0.5% of live weight
Breast meat	+ 1.0% of live weight
Abdominal Fat	- 0.3% of live weight
Livability	+ 0.5%

Ref: Ross breeder's manual

Considering the increasing genetic potential, nutritionists are required to formulate feeds to exploit fully this genetic potential. Optimising the productivity and more importantly the profitability is an important criterion whilst formulating the feed. This is an on-going process and hence there is a need to focus not on the feed cost but to feed for more profit and to ensure that the increased genetic potential is realised as profit. In this case achieving the maximum performance may sometimes not necessarily be more profitable. Nutritional standards in future will no longer be derived from textbooks. The knowledge of nutritional response is going to be a key tool to design the most profitable nutritional strategy.

Focus Area for Broiler Nutrition

The following areas require more attention in designing a profitable nutritional strategy.

1. Nutritive Value of Feed Ingredients

Nutritionists need to shift their focus towards the purchase of feed ingredients and judging their nutritive value. Table 2 and Figure 1 indicate crude protein content of different samples of Soy meal. Nutritionists need to decide whether to consider the Mean (45.35) or Median (45.15) or Mode (44.7) values whilst formulating the feed. To have better control over the feed ingredients purchased, consideration of median values rather than mode / mean values will make sense and there should be continuous attempt to minimise the deviated values to desired values (desirable median value should match this) considering the increased / decreased price paid for the different lots of Soya.

Figure 1: **CP% of different Soya samples received at Nutrisys Centre for Animal Nutrition**

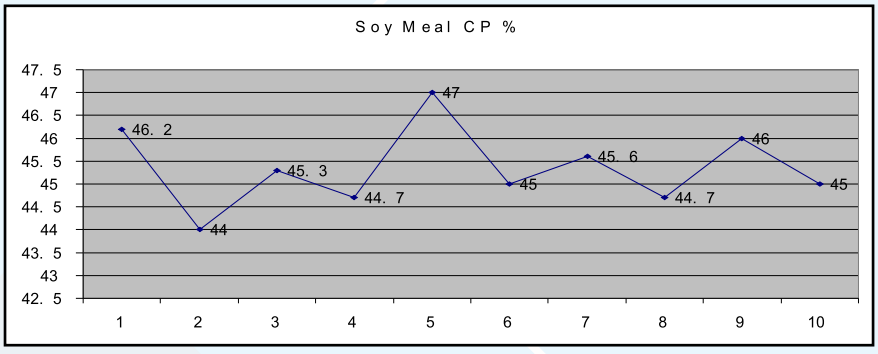


Table 2: **Crude Protein (CP)% of different Soya samples received at Nutrisys Centre for Animal Nutrition**

Sample No	Soy meal CP %
1	46.2
2	44.0
3	45.3
4	44.7
5	47.0
6	45.0
7	45.6
8	44.7
9	46.0
10	45.0

CV : 0.76
Standard Deviation: 0.872
Mean : 45.35
Median : 45.15
Mode : 44.7

In another example as depicted in Table 3 it has been shown that while accounting for the amino acid content of the feed ingredients with different crude protein (CP) levels, there needs to be shift from considering a constant level of amino acid to varying levels which needs to be adjusted as per the change in crude protein level.

A further shift is required to arrive at prediction equations based on the amino acid content of raw materials vis-à-vis CP levels. Prediction equations used by Nutritionists at Avitech to find out the Methionine and Lysine levels in Corn and Soy meal have been given below:

Prediction Equations:

Soy meal
Methionine : 0.13+(0.011xCP content)
Lysine : -0.25 + (0.066 x CP content)

Corn
Methionine:0.015+(0.019xCP content)
Lysine : 0.06 + (0.023 x CP content)

2. Feed Formulation

Nutritionists should, whilst formulating feed, ensure the purpose or objectives of feed formulation. For example feed formulation for total performance (improved live weight) shall differ from the feed formulation designed for improved Meat quality. Whilst arriving at the ideal formulation, nutritionists should consider the following critical areas:

- Ideal calorie density
- Energy protein / amino acid ratios
- Formulation based on digestible amino acids
- Ideal amino acid profile
- Calcium status of the feed
- Electrolyte balance of feed
- Immuno - modulation
- Cost saving in the formulation or requirements - pelleting / crumbling.
- Pelleting benefits-quantification, pathogen reduction.

3. Breeder Nutrition-Broiler Performance

The most profitable strategy for breeder nutrition is maximizing the breeder productivity because breeder feed costs are only 25% of the day old chick production cost and further it will also influence the offspring performance.

For eg. -

Consideration :

- A breeder hen consumes 60kg of feed in its productive lifetime (68 weeks)
- Breeder feed costs Rs.8500 per MT.
- The hatchability of breeder hen is usually 80% and each hen produces 140 chicks.

One broiler breeder hen consumes approximately 60 kg feed in its life (68 weeks) and hence a 1% incremental feed cost for breeders (i.e. From Rs.8500 to Rs.8585 / ton) means an incremental cost of Rs.5.10 per parent.

To pay back the extra invested amount,

- The breeder hen hatchability has to be improved by 0.42%

OR

- The live weight of 40-day broiler bird needs to improve by 2gm per bird.

OR

- The FCR of 40-day broiler needs to be better by 0.0018.

It may, therefore, be prudent to consider breeder feed cost as an investment and not an expense. Nutritionists needs to strongly resist cost cutting in breeder feed formulations in order to maximize profitability.

Table 3: **Various approaches towards change in amino acid levels based on crude protein content**

Protein %	Constant		Pro-rata Basis		Prediction Equations	
	Lysine	Methionine	Lysine	Methionine	Lysine	Methionine
Soy meal						
44	2.8	0.65	2.73	0.63	2.67	0.62
45	2.8	0.65	2.79	0.65	2.74	0.63
46	2.8	0.65	2.85	0.66	2.81	0.64
Corn						
8	0.25	0.18	0.236	0.169	0.234	0.169
8.5	0.25	0.18	0.247	0.178	0.249	0.179
9	0.25	0.18	0.259	0.188	0.264	0.190

4. Early Chick Nutrition

There is a saying, "WELL BEGUN IS HALF DONE". Early nutrition plays a critical and defining role in broilers because the 0 to 7 days period of the broiler life accounts for 20% of their total life today and with increasing production parameters and consequent reduction in marketing age the same period is likely to account for 25 to 30% of the broiler life cycle in the future.

Nutrition at this stage needs to be designed for

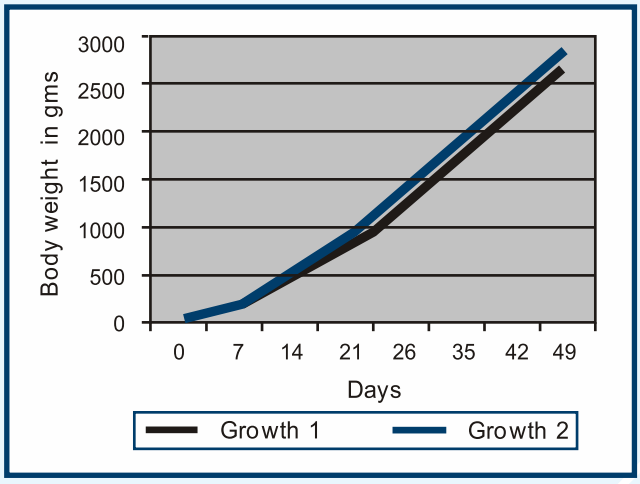
- Healthy & early growth of internal organs (GIT)
- Development of the immune system
- Minimizing the availability of nutrients for the growth of harmful bacteria
- Stimulating early feed intake
- Alleviating stress

Feeding for an excellent start

The time and feed required to produce a 2 kg broiler is continuously decreasing. The starter period is gaining a much higher proportion of the growing cycle, emphasizing the importance of a good starter diet. A good start will ensure higher body weight at 10th day. Higher amino acid levels increases the 10th day weight by 10g, body weight at slaughter by

30-50g and the breast meat yield by 0.2%. The starter diet represents only 6-7% of the total feed. The most profitable nutritional strategy for starting broilers is therefore, to try and maximise the early growth. Figure 2 and Table 4 represent the impact of increase in first week weight on final body weight.

Figure 2: **Relationship of first week weight on final body weight of broilers**



5. Nutrition for Gut Health

Gut environment management should be practical and cost effective to ensure favourable conditions in terms of pH, redox potential, ingest viscosity, passage time, and digestion efficiency.

Management of gut environment has become a crucial part of broiler production since members of the gut flora (pathogens and commensals) and certain feed ingredient molecules (undigested or partially digested) may cause gut diseases.

Table 4: **Relationship of first week weight on final body weight of broilers**

Days	Growth 1	Growth 2
0	42	42
7	159	169
14	467	497
21	803	854
28	1265	1345
35	1765	1876
42	2255	2397
49	2715	2886

Hence gut health management should attempt towards the following:

1) Inhibition of sub-clinical infections.
2) Reduction of growth-depressing microbial metabolites.
3) Reduction of nutrient uptake by microbes.
4) Enhanced availability of nutrients to the birds.

Measures to ensure gut health

- Nutrition for gut health should ideally start at the parent level to avoid vertical transmission.
- Early administration of probiotics is found to be beneficial.
- Usage of in-feed antimicrobials should take into account, rotation & shuttle programs, multi drug resistance related to quantity & method of antibiotic use etc.
- Acidification of feed and / water. Weak acids (preferably coated) should be incorporated, as they are more effective in the small intestine
- Decreasing nutrient speed of flow enhancing digestion enzyme addition, nutrient specification modification etc.
- Enhancing resilience

6. Nutrition in Relationship with Environment

Nutrient requirements of birds not only depends on the growth required but also depends upon

- **Management**
  - Stocking density
  - Human interaction
  - Lighting regime
  - Temperature
  - Litter quality
  - Humidity
  - Feed
  - Form
  - Altitude
  - Transportation
  - Noise
- **Disease Challenges**

The nutrient density, feed cost and production cost get decreased when the above factors are brought to an optimum level.

7. Nutrition for Meat Quality

Meat quality is a composite of those characters that:

- differentiate the product
- have significance in determining the degree of acceptability to the consumer. These characters

Table 5: **Ideal Amino acid levels for different grow out period of the broilers for meat quality and total growth**

Parameters	Meat Quality			Total Growth		
	Pre-starter	Starter	Finisher	Pre-starter	Starter	Finisher
Energy (Kcal / kg)	2950	3050	3170	2950	3050	3170
Lysine %	1.40	1.26	1.14	1.34	1.2	1.07
Dig. Lysine %	1.26	1.13	1.03	1.21	1.08	0.96
Dig. Methionine %	0.52	0.49	0.46	0.49	0.46	0.43
Dig. Meth. + Cys.%	0.93	0.88	0.84	0.89	0.84	0.79
Dig. Arginine %	1.32	1.21	1.12	1.27	1.16	1.05
Dig. Threonine %	0.83	0.77	0.72	0.8	0.73	0.67
Dig. Tryptophan %	0.20	0.19	0.16	0.19	0.18	0.15

include breast meat, abdominal fat, flavour, aroma, tenderness, juiciness and drip loss.

High nutrient density increases the breast meat accretion (high energy & protein) as well as abdominal fat. Narrowing the energy: protein ratio (energy: lysine ratio) reduces the fat.

There is a positive correlation between dietary lysine and breast meat accretion. The feed formulated for meat quality should provide ideal protein with proper balancing of amino acids. Weight for age, FCR and breast meat yield of broilers are improved when higher levels of digestible amino acids are used in the diet. Breast yield is more responsive to higher levels of digestible amino acids than weight for age and FCR. Accordingly the levels of amino acids in the diet need to be fixed. Table 5 indicates the difference in requirements of amino acids for particular energy levels for meat quality as well as the total growth for different grow out period of broilers.

1. Lipids are important components of meat and they enhance the flavour, aroma, tenderness and juiciness
2. Antioxidants - Ethoxyquin, BHT, Vitamins - Vitamin E, C, B2 , Niacin, Calcium-d-pantothenate etc. reduce lipid oxidation, reduce drip loss and improve meat quality
3. Higher levels of antioxidants and organic minerals like Zinc / Selenium also help to improve the meat quality.

8. Nutrition for Food Safety

Key Issues

1. Mycotoxins/presence of fungus & moulds destroys nutritive value of feed. Mycotoxins are carcinogenic, can be Hepato & Nephrotoxic, and can also cause reproductive problems, immuno - suppression in birds.
2. Oxidation that may lead to undesirable flavours / odours.
3. Pathogenic bacteria (Salmonella).
4. Pesticide residues. Residues in meat & soil could pose health hazards.
5. Antibiotic usage that may lead to development of drug resistance in bacteria and subsequent transmission to human beings, allergic reactions etc.
6. Antibiotic residues.
7. Dioxins.

Measures to be taken to ensure food safety

- Strict quality control on feed ingredients.
- Producing and feeding safe feed.
- Following a withdrawal period.
- Growing broilers without antibiotics.
- Usage of organic acids.
- Usage of toxin binders/ antioxidants.
- Total feed quality management.
- Following regulatory principles.

9. Margin of Safety : A Deadly Weapon

A higher margin of safety has to be employed by nutritionists at times of uncertainty about feed ingredients received, and also considering different climatic and stress conditions. As our understanding of the critical parameters of nutrition improves in times to come such as improved understanding nutrient profile of feed ingredients, climatic conditions, requirements of the birds, there will be a room for a reduction of safety margin levels that will reduce the cost of feed and ensure more profit.

Summary

- Broiler nutrition should be addressed towards optimising profitability. It is an on-going process for poultry producers and nutritionists to maximise the opportunity from the ever-increasing genetic potential.
- Knowledge of nutritional response to several nutrition input variables will assist in determining feed specification based on broiler requirements.
- The profitable approach for breeder nutrition continues to focus on maximising the breeder productivity.
- Early Chick Nutrition, Gut Health, Formulating for different environmental and stress conditions, Meat Quality and Food Safety are the key areas that will require focus in the coming years.

Avitech
Knowledge | Nutrition | Innovation

AVITECH NUTRITION PVT LTD
(An ISO 9001 Certified Company)
GP-51, Udyog Vihar, Sector-18, Gurgaon-122001 Haryana, India.
Tel: +91-124-4011147, 4278511/12 Fax: +91-124-4013620
Email: info@avitechnutrition.com Website: www.avitechnutrition.com