Bulletin of Animal Science, Supplement Edition, 1998 *ISSN 0126-4400*

TOTAL AND DIGESTIBLE AMINO ACIDS FORMULATION OF BROILER FEED USING DIFFERENT SOYBEAN MEAL

Budi Tangendjaja[1]

ABSTRACT

A feeding experiment has been conducted to evaluate different soybean meal from USA, India and Latin America in ration formulated using total and digestible amino acids from broiler. One thousand five hundred chicks (Arbor Acre male) were divided into 6 treatments in a factorial design (3 different sources of soybean meal and 2 methods of formulation) and 5 replicates containing 50 birds/ replicate pen. Dietary treatments were formulated using corn and soybean meal as major ingredients. At 21 days, body weight was significantly affected by different soybean meal; USA soybean meal gave the highest body weight (559 g) followed by India soybean meal (540 g) and Latin America soybean meal (515 g). Daily feed consumption was not affected but feed/gain were 1.655, 1.669 and 1.766 for USA, India and Latin America, respectively. However, at 42 days only body weight gain were affected but not feed/gain or feed consumption. Formulation using digestible amino acid was significantly better than total amino acid on body weight and feed/gain but not on feed consumption. Body weight was 27-29 gram higher and feed/gain was improved about 7 point at 21 days of age.

Key words: Amino acid, Soybean, Formulation, Broiler

INTRODUCTION

In order to maximize growth of broiler, the ration has to be designed to meet the requirement of the nutrient for broiler. Beside energy, amino acids play an important role for broiler production. Several factors affect the amino acid requirements for broiler. These include dietary factors such as metabolizable energy or crude protein, bird age, genetic and sex differences.

Amino acids can be supplied from the protein obtained in the feed ingredients, however, the balance of amino acids within feed ingredients may vary greatly even through the protein level is similar. Therefore, amino acids analysis is needed to determine protein quality in the feedstuff. The development of amino acid analysis techniques increases the ease and rapidity by which nutritionist can obtain information on the amino acid composition of feed ingredients (Parson, 1995).

The knowledge of the amino acid composition of feed ingredients is important for ration formulation to meet the amino acid requirements. However, such chemical analysis result does not take into account the utilization of amino acids by animal during digestion and absorption. Normally, the amount actually available to animal may be much lower than the quantity analyzed from the ingredient. Several factors affecting the amino acid availability to animal, these include: naturally bound enzyme resistant protein such as bound protein associated with acid detergent fibre, tannin, the development of indigestible compounds form during processing such as maillard reaction and digestive enzyme inhibitors include anti trypsin etc (RPAN, 1989). Several amino acids are proned to heat processing and may reduce the availability to animal. Parson (1995) reported that lysine and cysteine are the most susceptible amino acid during cooking.

In order to measure the available amino acids, two methods have been developed are growth assay and digestibility assay. Growth assay is laborious, expensive and often imprecise. Therefore, several researchers have recommended digestibility assay. Digestibility measures the differences

[1]Research Institute for Animal Production, P.O. Box 221 Bogor 16002, Indonesia

between the quantity of amino acids consumed and that voided in the feces and urine in the case of poultry.

Digestibility value for several ingredients have been collected by several reports include Green 1988, Green *et al* 1987a,b. In the last few years, several institutions have also published the true digestibility figure for ingredients such as NRC (1994), ADM (1995), RAPN (1989), DeGussa (1995) and Ajinomoto (1992).

It is generally accepted that digestible amino acid values are more indicative of relative nutritional value among feedstuffs than are total amino acid concentration values. There is little or no published research on the digestible amino acid requirements of poultry species. NRC (1994) is still using the total amino acid concentration in their recommendation. However, Rhone Poulenc Animal Nutrition (1993) has given some recommendation of the digestible amino acid requirement for some of amino acids (lysine, methionine, methionine + cystine and threonine).

Most studies on amino acid requirement were based on corn-soybean meal diet. Previous studies at Research Institute for Animal Production Bogor Indonesia (unpublished) and Creswell (1992) reported that there are some differences on the composition or quality of soybean meal from different countries. It is possible that different soybean meal may confound the value in formulating the diet.

In this experiment, the differences of soybean meal from USA, India and Latin America were evaluated for broiler feed, which was formulated using total amino acid suggested by NRC (1994) and digestible

Table 1. Dietary composition of broiler starter formulated using different soybean meal and amino acids (total and digestible)

INGREDIENT (%)	SBM USA		SBM INDIA		SBM LATIN AMERICA	
	Total	Digest	Total	Digest	Total	Digest
Corn	64.49	61.25	62.23	58.79	63.36	58.76
SBM USA	24.49	27.44				
India			25.51	28.30		
Latin America					24.60	28.31
Rice bran	5.00	5.00	5.00	5.00	5.00	5.00
Palm oil	1.53	2.02	2.66	3.00	2.48	3.00
Corn Gluten meal				0.86		0.85
Dical Phosphate	2.05	2.04	2.07	2.05	2.07	2.05
Limestone	1.25	1.23	1.27	1.01	1.27	1.01
Salt	0.39	0.39	0.39	0.39	0.39	0.39
Methionine	0.33	0.26	0.33	0.24	0.32	0.24
Lysine	0.27	0.16	0.25	0.15	0.30	0.18
Vit-mineral, antibiotic, premix	0.21	0.21	0.21	0.21	0.21	0.21
Cost (Rp/Kg)	690.8	687.5	690.9	689.4	690.8	691.1
Calculated nutrient						
Metabolizable energy (Kcal/Kg)	3000	3000	3000	3000	3000	3000
Crude protein (%)	18.0	19.0	17.8	19.2	17.0	18.7
Lysine (%)	1.10		1.10		1.10	
Methionine (%)	0.60		0.60		0.59	
Meth + cystein (%)	0.90		0.90		0.90	
Digestible lysine (%)		0.97		0.97		0.97
Digestible methionine (%)		0.51		0.51		0.50
Digestible meth + lys (%)		0.77		0.77		0.77

Table 2. Dietary composition of broiler finisher formulated using different soybean meal and amino acids (total and digestible)

INGREDIENT (%)	SBM USA		SBM INDIA		SBM LATIN AMERICA	
	Total	Digest	Total	Digest	Total	Digest
Corn	62.54	60.95	60.74	58.99	61.60	58.95
SBM USA	20.40	21.84				
India			21.24	22.86		
Latin America					24.49	22.86
Rice bran	10.00	10.00	10.00	10.00	10.00	10.00
Palm oil	2.79	3.01	3.73	4.00	3.59	4.00
Dical phosphate	1.80	1.79	1.81	1.81	1.81	1.81
Limestone	1.41	1.40	1.42	1.36	1.42	1.36
Salt	0.42	0.42	0.42	0.42	0.42	0.42
D.L. Methionine	0.18	0.23	0.18	0.23	0.18	0.22
L. lysine HCl	0.26	0.16	0.24	0.14	0.29	0.17
Vit. Min + antibiotic Premix	0.21	0.21	0.21	0.21	0.21	0.21
Cost (Rp/Kg)	653.6	655.5	651.6	654.0	653.6	657.7
Calculated nutrient						
Metabolizable energy (Kcal/Kg)	3050	3050	3050	3050	3050	3050
Crude protein (%)	16.4	16.9	16.2	16.7	15.6	16.3
Lysine (%)	1.00		1.00		1.00	
Methionine (%)	0.44		0.44		0.43	
Meth + Cyst (%)	0.72		0.72		0.72	
Digestible lysine (%)		0.85		0.85		0.85
Digestible methionine (%)		0.46		0.46		0.46
Digestible Meth + cys (%)		0.69		0.69		0.69

amino acid suggested by RPAN (1993).

MATERIALS AND METHODS

Feeding experiment was carried out at Research Institute for Animal Production, Ciawi-Bogor Indonesia from August-September 1996. The place was located at altitude 300 mt above sea level with average daily temperature 28EC-30EC. Feeding was done in an open sided house and concrete floor system. Rice hull (6 cm thickness) was used as litter which normally done at commercial level. 32 wire pens at size of 3 x 3 mt divided the house.

One thousand five hundred broiler chicks (all male of Arbor Acre strain) were divided into 30 pens and each pen contains 50 birds as replicate.

The treatments were combination between soybean meal and technique of formulation. A factorial design was used in which factor 1 was 3 different soybean meals from USA, India, and Latin America while factor 2 is different formulation of diet using total amino acid suggested by NRC (1994) and digestible amino acid suggested by RPAN (1993). The ration formulae and calculated composition is presented in Table 1 and 2.

Starter feed were given from 0-21 days and grower feed from 22-41 days. Heating was provided using infra red lamp for 2 weeks. Feeding was provided in hanging-

type feeder and water was provided in a bell type of drinker. The feed contained salinomycine at recommended level and vaccination was done for New Castle Disease and Infection Bursal Disease.

Measurements were done on body weight, feed consumption and feed conversion ratio. All data were subjected to statistical analysis using MSUSTAT program with factorial design.

RESULTS AND DISCUSSION

Performance of broiler fed different origin of soybean meal and formulated using total and digestible amino acids are presented in Table 3. Statistical analysis of data indicated that different soybean meal from Latin America, India and USA resulted in different on body weight both at 21 and 41 days. The highest body weight was obtained from feeding of USA soybean meal while the lowest body weight was from Latin America soybean meal. At older age, the feeding of USA and India soybean meal did not give statistical difference. Similar to body weight, feed/gain also gave a significant difference for younger bird but not for older bird. At all age, feed consumption was not affected by different origin of soybean meal.

Formulation techniques resulted on the significantly difference to body weight and also to feed/gain at starter period. Formulation using digestible amino acids gave a better body weight compared to that using total amino acids. Again formulation techniques did not affect the feed intake of broiler. The data as ingredient specification for formulation was based on Creswell (1992) for total amino acid of USA, India and Latin America soybean meal while digestible amino acids was obtained from Rhone Poulenc Animal Nutrition (1993) taking into account of crude protein content which is 48% for USA soybean meal, 46% for India soybean meal and 44% for Latin America soybean meal. Metabolisable energy value of USA soybean meal (Hipro) was assumed to be 2525 kcal/kg while other soybean meal were 2350 kcal/kg

Table 3. Performance broiler fed different soybean meal (SBM) and formulated using digestible and total amino acid

Formulation/origin of SBM	Body weight (g)		Average Daily Feed Consumption (g)		Feed/gain	
	21 days	41days	21 days	41days	21 days	41 days
Total amino acid (NRC,1994)						
Latin America	512.2	1603	43.0	81.5	1.762	2.091
India	529.7	1695	43.6	79.1	1.727	1.915
USA	534.8	1692	43.4	78.3	1.706	1.902
Digestible amino acid (RAPN, 1993)						
Latin America	517.3	1621	44.3	79.2	1.778	2.110
India	558.3	1715	42.8	79.6	1.611	1.847
USA	582.6	1742	44.5	80.4	1.604	1.893
Effect of formulation	***	*	NS	NS	*	NS
Effect of origin of SBM	***	***	NS	NS	**	NS

*** = Significant at P<.001
** = Significant at P<.01
* = Significant at P<.05
NS = Non significant

as recommended by American Soybean Meal Association.

This result was clearly shown that formulation based on digestible amino acids is more beneficial to maximize broiler performance which probably more precise as suggested by Parson (1995). NRC (1994) did not give the requirements of digestible amino acid due to the limited published results, however, they recommended a minimum crude protein requirement which is 23% for starter and 19% for finisher. In this experiment, crude protein content in the diet was not limited and after calculated, crude protein content in the diet fallen below NRC (1994) recommendation. Table 1 indicated that formulation based on digestible amino acids had a slightly higher (1-1.5%) crude protein content compared than formulation based on total amino acids. However, the better performance on broiler fed digestible amino acids is unlikely due to the higher protein content. Separate trial indicated that increasing crude protein level from 17 to 23% did not give a better performance (Tangendjaja, unpublished).

The cost of ration for broiler starter and finisher seem to be comparable among the treatments. Formulation using digestible amino acids had a lower cost at about Rp 1-3/Kg but higher cost about Rp 2-4%/Kg for broiler finisher. It is interesting to note that formulation using USA soybean meal with digestible amino acid had a lowest cost for broiler starter, despite higher price of USA soybean meal, which is Rp, 800 compare to Rp 760 for Indian soybean meal and Rp 780 for Latin American soybean meal. These probably related to higher digestible amino acid and higher metabolizable energy value.

The consistent performance of broiler fed USA soybean meal was also found in the previous experiment. However, the choice of using soybean meal is depending on the cost of feed and also the performance obtained from broiler production. Since the price of soybean meal fluctuate significantly during 1996, the decision has to be made carefully on the time rations are formulated.

REFERENCES

Ajinomoto. 1992. *True Digestibilitiy of Essensial Amino Acid for Poultry.* Ajinomoto Tokyo.

Creswell,D. 1992. *Comparison of Soybean Meal from the US, China and India.* ASA Tech. Bull, P.O. 21992 ASA Singapore.

Da Libard, P. and E. Paillard. 1993. Amino Acids Formulation Based Tech-nique. *Proc. Feed Tech. Workshop* Balitnak Bogor Indonesia.

De Gussa. 1995. *Amino Acid Recommendation for Poultry.* De Gussa AG. Frankfurt.

Green,S. 1988. Effect of dietary fibre and caecectomy on the excretion of indegenous amino acids from adult cockerels. *British Poult. Sci.*, 29:419-429.

Green,S. S.C. Bertland, M.J.C. Duron and R. Maillard. 1987a. Digestibilities of amino acids in mavie, wheat and barley meal, determined with intact red caecectomized cockerels. *British Poult. Sci.*, 28:631-641.

Green,S. S.C. Bertland, M.J.C. Duron and R. Maillard. 1987b. Digestibilities of amino acids in soybean, sunflower and groundnut meals, determined with intake and caecectomized cockerels. *British Poult. Sci.*, 28:643-652.

NRC. 1994. *Nutrient Requirements of Poultry.* 9th ed. National Academy Press., Washington DC.

Parson,C. 1995. *Lysine.* ADM Bioproduct Decatur IL

RPAN. 1989. *Nutrition Guide. Feed Formulation with digestible amino acids.* Rhone Poulenc Animal Nutrition. Antony Cedex , France.