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Formulation of diets with meat and bone meal based on total and digestible amino acids and its effect on the productive performance of broilers

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Abstract

An experiment was conducted to study the effect of feeding Meat and Bone Meal (MBM) on total amino acid (TA) and digestible amino acid (DA) basis on the performance of 150 straight run "Vencobb" broiler chicks. Maize, soybean and fishmeal based control diet, T1 (without MBM) and other four diets, T2 (5% MBM on TA), T3 (5% MBM on DA), T4 (10% MBM on TA) and T5 (10% MBM on DA) were formulated and supplied to 5 groups of birds. The body weight of broiler at 42 days were 1663.33, 1563.33, 1705, 1499 and 1730 g for T1, T2, T3, T4 and T5 respectively. The body weight was significantly improved at 5th & 6th week of age in T3 and T5 compared to other treatments. During 2-6 weeks feed conversion ratios were 1.95, 2.09, 1.86, 2.20 and 1.83; protein efficiencies were 2.51, 2.33, 2.58, 2.20 and 2.60; energy efficiencies were 16.70, 15.53, 17.43, 14.80 and 18.07 for the treatments T1, T2, T3, T4 and T5 respectively. Feed conversion ratio was significantly improved in T3 compared to T2 and in T5 compared to T4.Dressing Yield was also better in T3 and T5 and higher in male than female. Feed cost was higher in control diet while, feed cost/kg live weight was lower in T3 and T5 and profit was also higher in diets formulated on digestible amino acid basis. It may be concluded that up to 10% MBM can be included in broiler diets on DA basis for better performance and maximum profit.

Keyword: Meat & bone meal, Digestible amino acid, Total amino acid, Broiler

Introduction

Feed is one of the major cost accounting for about 65-70 percent of the total cost of production (Bhuiyan et al.1998). Protein cost accounts for 15% of feed cost (Singh, 1990 and Banerjee, 1992). People are putting every effort to reduce feed cost. Now a day, most of the poultry farmers have been using different protein concentrates in poultry diet instead of fishmeal. Meat and bone meal (MBM) is a good source of protein and amino acids at lower cost. Mateos and Lazaro (2000) reported that MBM could be included in diets of poultry at level up to 10% when the nutrient variability is minimized. Wang et.el. (1995) reported that the availability of amino acid varies greatly among meat and bone meals due to processing. NRC (1994) suggested that digestible amino acid values are more indicative of relative nutritional value of feedstuff than total amino acid. Bryden et al. (2000) reported that poultry diets formulated on a digestible amino acid basis was superior to formulation on total amino acid basis.

Recently, poultry nutritionists are becoming interested in formulating diets on the basis of digestible amino acids (Rhone-Poulene, 1989; Wang and Parsons, 1998) for better performance. As it is more logical that digestible part of feed nutrient are better indicative of nutritional value than that of total nutrient. Moreover, it improves the precision of diet formulation and ensures more predictable bird performance. In studies with cottonseed meal (Ravindran and Bryden, 1999c) and meat & bone meal (Ravindran and Bryden, 1999d), found beneficial effects of using digestble amino acids in broiler diet formulations. The persent study was therefore, undertaken to evaluate the diets formulated with MBM on digestible and total amino acids and its effect on broiler performance.

Materials and Methods

Management and Records: The experiment was conducted with 7-day old one hundred fifty straight run "Vencobb" commercial broilers. The chicks were equally and randomly distributed in five dietary treatments having three replications. The birds were reared on rice husk litter floor with 1080 sq. cm floor space per bird. They were exposed to a continuous lighting of 23.30 hrs in 24 hrs. All dry mash feed was supplied *ad libitum* throughout the experimental period and water was available all the times. The birds were vaccinated against Gumboro, New castle disease and Infectious Bronchitis. Weekly body weight and feed consumption were recorded. Mortality if any was recorded daily. Feed conversion ratio, protein efficiency, energy efficiency were calculated. The production cost was calculated on the basis of market price of the ingredients. Dressing, giblet and abdominal fat percent of both male and females were recorded in different dietary treatments.

Experimental diets: Maize, soybean and fishmeal based control diet (T_1) were prepared. Four other diets were prepared with 5% and 10% MBM by replacing fish meal and some soybean meal from control diet on total and digestible amino acid basis (Table).

Statistical analysis: Collected and calculated data were analyzed for analysis of variance using MSTAT program by following the principles of Completely Randomized Design. Least Significant Difference (LSD) was done to compare variations between treatments when ANOVA showed significant differences.

Results and Discussion

The body weight of broilers fed different levels of meat and bone meal on total and digestible amino acid basis is shown in Table 2. It is evident that the body weight of broilers differs significantly ($p<0.01$) among diets during 5^{th} and 6^{th} week of age. The broilers on diets T_3 and T_5 gave better body weight compared to other dietary treatments. This indicated that feeding meat and bone meal at a level of 5 and 10% in the diets by replacing fish meal on digestible amino acid basis improved body weight than similar level of meat and bone meal on total amino acid basis. The results agreed with Green (1986) and Wang and Parsons (1998), who stated that formulation of diet based on a digestible amino acid basis is superior to total amino acid basis, when diet contain MBM. Ravindran & Bryden (1999c,d) also reported that increasing level of dietary MBM (50 and 100g/kg) on total amino acid basis significantly ($p<0.01$) lower weight gains, while weight gain was unaffected when MBM was included on digestible amino acid basis.

Feed consumption was not affected by dietary treatments as it revealed from non-significant differences among the treatments during the experimental period (Table 3). It is evident that feeding MBM significantly improved feed efficiency in dietary treatment T_3 than T_2 and in T_5 than T_4. This indicated that formulating diet with MBM on the basis of digestible amino acid ensured better utilization of dietary nutrients than diet formulated on total amino acid basis. The results are consistent with Green (1986), and Wang and Parsons (1998). In this study, it was observed that feeding MBM at a level of 5 and 10 percent in the diet on total amino acid basis reduced feed efficiency even than that of control diet. When MBM was included in the diet on digestible amino acid basis improved feed efficiency up to 10 percent level.

Table 1. Composition of experimental diet (g/kg) formulated on total and digestible amino acid basis

Ingredients	Treatment				
	T_1 (control)	T_2 (5% MBM on TA)	T_3 (5% MBM on DA)	T_4 (10% MBM on TA)	T_5 (10% MBM on DA)
Maize	497.5	502.5	500.5	487.5	497
Rice Polish	130	130	130	120	120
Soybean meal	230	220	220	240	230
Fish meal	100	50	50	-	-
Meat and Bone meal	-	50	50	100	100
DCP	10	10	10	10	8
Soybean oil	25	30	30	35	35
Common salt	5	5	5	5	5
L-Lysine	-	-	1.1	-	1.4
DL- Methionine	-	-	0.9	-	1.1
Vitamin-mineral premix	2.5	2.5	2.5	2.5	2.5
Cost per kg diet (Tk)	13.02	12.55	12.80	12.06	12.61
Nutrient composition					
ME K cal/kg	3121	3132	3125	3114	3124
CP %	21.19	20.9	20.9	21.4	21.1
DCP %	19.6	19.2	19.2	19.5	19.2
Ca %	1.05	1.05	1.05	1.05	1.00
Av. P %	0.41	0.48	0.48	0.55	0.53
Lysine %	1.24	1.14	1.24	1.13	1.23
Dig. Lysine %	1.09	1.00	1.09	0.99	1.09
Methione %	0.45	0.40	0.48	0.37	0.46
Dig. Methionine %	0.40	0.36	0.44	0.33	0.42
Methionine+Cystine %	0.75	0.67	0.75	0.67	0.72
Dig.Methionine+Dig.Cystine%	0.67	0.58	0.66	0.52	0.62
Tryptophan %	0.25	0.22	0.22	0.21	0.21
Dig. Tryptophan %	0.17	0.16	0.16	0.15	0.15

Table 2. Body weight (g/bird) of broilers at different ages in diets formulated on total and digestible amino acid basis

Age in week	Treatment					LSD value &level of significance
	T_1	T_2	T_3	T_4	T_5	
Initial weight (1st week)	121.67	121.67	121.67	120.83	120.00	1.90^{NS}
2nd week	220	236.67	235.00	230.00	238.00	6.43^{NS}
3rd week	414.67	436.00	435.00	430.00	436.00	6.82^{NS}
4th week	830.00	828.33	843.33	811.67	866.67	19.09^{NS}
5th week	1226.67b	1200.00b	1290.00a	1146.67c	1320.00a	73.139**
6th week	1663.33b	1563.33c	1705.00a	1499.00d	1730.00a	45.225**

The figures in a row having similar alphabet do not differ significantly. NS: Non significant, **p<0.01

Protein efficiencies significantly improved in dietary treatment T_3 than T_2 and T_5 than T_4 during 4-6 weeks and 2-6 weeks of age (Table 3). The results are consistent with the earlier observations of Rostagno and Pupa (1995). This might be due to better balance of amino acids and utilization of the dietary nutrients when diet was formulated on digestible amino acid basis.

Table 3. Feed consumption, FCR, protein efficiency and energy efficiency of broilers in diets formulated on total and digestible amino acid basis

Treatment	Feed consumption			FCR			Protein efficiency			Energy efficiency		
	2-3 week	4-6 week	2-6 week	2-3 week	4-6 week	2-6 week	2-3 week	4-6 week	2-6 week	2-3 week	4-6 week	2-6 week
T_1	645	2358	3003	2.18	1.88b	1.95b	2.23	2.57a	2.51b	14.91	17.19b	16.70c
T_2	640	2379	3019	2.03	2.08c	2.09c	2.39	2.30b	2.33c	15.99	15.40c	15.53c
T_3	650	2313	2963	2.07	1.82ab	1.86a	2.33	2.65b	2.58b	15.73	17.89a	17.43b
T_4	650	2383	3033	2.10	2.22d	2.20d	2.30	2.17c	2.20d	15.49	14.60d	14.80e
T_5	640	2314	2954	2.02	1.78a	1.83a	2.36	2.68a	2.60a	16.15	18.27a	18.07a
LSD value & level of significance	26.45^{NS}	30.97^{NS}	35.72^{NS}	0.10^{NS}	0.120^{**}	0.083^{**}	0.10^{NS}	0.120^{**}	0.083^{**}	0.728^{NS}	0.791^{**}	0.899^{**}

The figures in a row having similar alphabet do not differ significantly. NS: Non significant, **p<0.01

Energy efficiency significantly improved in dietary treatments T_3 and T_5 than other treatments during 4-6 weeks and 2-6 weeks of age. While, significantly reduced in dietary treatment T_2 and T_4 than control diet (Table 3).

Only one bird died in treatment (T_1) during the experimental period. This indicated that including MBM up to 10 percent level has no any deleterious effect on survivability of broilers. The results are consistent with the observation of Mateos and Lazaro (2000). The feed cost reduced with the inclusion of meat and bone meal in diets (Table 1). When 5 and10 % MBM was included in the diets on DA basis (T3 and T5) feed cost significantly ($p<0.01$) reduced than control diet but not on total amino acid basis (T2 and T4). This might be due to better utilization of dietary nutrients in diets formulated on digestible amino acid basis (Table 5). The results are consistent with Kim et al. (1993) and Rostagno & Pupa (1995) who reported that use of MBM in poultry diet on DA basis reduced feed cost. Total cost per kg broiler was also lower in T3 and T5 while, the profit per kg broiler was ($p<0.01$) higher in T3 and T_5 than other treatments.

It is evident that dressing percentages differed significantly among treatments and sexes (Table 4). The highest dressing yield was in the dietary treatment T_5 (72.93%) which was almost similar to T_3 (72.39%). The lowest dressing yield was in T_4 (69.05%). This might due to lowest live weight in T_4. The dressing yield was significantly higher in males than females. The results are consistent with Moran and Orr (1969) and Broadbent et al. (1981). The giblet yields were not affected by dietary treatments and sexes. Abdominal fat was significantly affected by dietary treatments but not by sexes. The highest abdominal fat was obtained in dietary treatment T_4 (1.34%) and the lowest in T_5 (0.87%). However, female had higher tendency of abdominal fat than male. The results are consistent with Plavnik and Hurwitz (1983). Treatment and sex interaction on dressing yield, giblet & abdominal fat was non significant.

Table 4. Meat Yield traits of male and female broilers in diets formulated on total and digestible amino acid basis

Variable	Sex (S)	Treatment(T)						LSD value and level of significance		
		T_1	T_2	T_3	T_4	T_5	Mean	T	S	TxS
Dressing %	M	72.33	72.95	74.36	69.60	73.84	72.62a	3.861**	2.398**	0.895^{NS}
	F	70.98	68.48	70.72	68.48	72.02	70.08b			
	Mixed sex	71.66a	70.72ab	72.39a	69.05b	72.93a				
Giblet %	M	5.70	5.54	5.87	5.39	5.95	5.70	0.282^{NS}	0.178^{NS}	0.025^{NS}
	F	5.91	5.87	6.12	5.65	6.22	5.96			
	Mixed sex	5.81	5.71	6.00	5.52	6.09				
Abdominal fat %	M	0.94	0.96	0.80	1.23	0.84	0.95	0.365**	0.086^{NS}	0.044^{NS}
	F	1.00	1.06	0.99	1.45	0.91	1.09			
	Mixed sex	0.97b	1.01b	0.89b	1.34a	0.87b				

The figures in a row having similar alphabet do not differ significantly, **P<0.01

Table 5. Livability, feed Cost and profit margin in diets formulated on total and digestible amino acid basis

Variable	Treatment					LSD value & Level of significance
	T_1	T_2	T_3	T_4	T_5	
Livability %	96.67	100	100	100	100	-
Feed cost (Tk./kg broiler)	25.35b	26.27a	23.94c	26.53a	23.12d	0.855**
Total cost (Tk./kg broiler)	50.70b	51.62a	49.29c	51.88a	48.47d	0.845**
Sale (Tk./broiler)	92.46b	86.46c	95.00a	82.68d	96.60a	2.640**
Profit(Tk./kg broiler)	9.30c	8.38d	10.71b	8.12d	11.53a	0.852**

The figures in a row having similar alphabet do not differ significantly, **P<0.01

It may be concluded that formulating diet with MBM based on digestible amino acid is more logistic and justified for better broiler performances, lower feed cost and more profit than on total amino acid basis.

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