THE TRUE METABOLIZABLE ENERGY VALUES OF SOME SELECTED FEEDSTUFFS OF BANGLADESH

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Summary

An experiment was conducted to measure the true metabolizable energy (TME) values of seven major poultry feed ingredients, two feed concentrates and one randomly collected layer mixed feed prepared from the available feed ingredients. The results of this study were the most thorough evaluation of the TME content of some selected common feed ingredients of Bangladesh. The observed TME values of some feed ingredients were very close to the values of different origins of feed ingredients. But the TME values measured in mixed layer feed were very low which could not support the standard requirement of laying birds. These values will be of assistance in describing the energy content of the most common available feed ingredients of Bangladesh.
(**Key Words** : True Metabolizable Energy, Feed Ingredient, Poultry)

Introduction

Commercial poultry farming based on imported hybrid strains has been expanding in Bangladesh over the last few years. Feed is one of the main constraints for the development of poultry industry. Feed cost alone accounts 70 percent of the total cost of poultry production. Profit in poultry farming is highly dependent on the cost of the different ingredients used for mixed feed and the nutrients available from the feeds. In Bangladesh, wheat, wheat bran, rice polish, sesame oil cake and local fish meal are the major feed ingredients for mixed feeds. Maize and soybean meal have recently been introduced as feed ingredients in poultry ration. Presently, available information of energy feeds in Bangladesh is mainly based on National Research Council (NRC) or Agricultural Research Council (ARC) data which are developed for their regions. Accurate data on the energy values of different feed ingredients are a basic need for quantitating production, as it is required to reduce the feed cost as well as to increase the domestic feed resources utilization. A limited number of directly determined metabolizable energy (ME) values of some feedstuffs are available (Huque and Stem, 1993). The TME assay system was developed to estimate the bio-available energy value in various feedstuffs (Sibbald, 1976a) and validated with studies on duration of feed deprivation prior to feeding (Sibbald, 1976b). Sibbald (1975a) reported that some of the variation in apparent metabolizable energy (AME) values is associated with species, strain and age. TME varies less and have wider practical application than AME (Dale and Fuller, 1980). Sibbald (1975b) discussed reasons why conventional methods for measuring ME are unsuitable for present day. The main advantages of TME method are using less feed and simplicity. To develop accurate data in energy values of some of the most common feed ingredients in Bangladesh, the present experiment was conducted to determine true metabolizable energy (TME) values of the selected feed ingredients.

Materials and Methods

The TME values were determined for ten feed ingredients: wheat, corn, soybean meal (dehulled), sesame oil cake, fish meal, rice polish, mustard oil cake, concentrate for layer, concentrate for broiler and layer formula feed using eighteen 56 weeks old single comb White Leghorn roosters of the Shaver strain. All the ingredients were brought to Japan from Bangladesh and stored in a freezer. Wheat was collected from the local market of Bangladesh and was produced locally in the country. Two samples of wheat from two different sources

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were analyzed. The ingredients were ground using 1.0 cm sieve for TME determination. Ground samples of each ingredient were assayed for gross energy content using a ballastic automatic bomb calorimeter. Each ingredient was also assayed for moisture, crude protein, crude fiber, ash and ether extract (Anon, 1983). The TME assay was conducted according to the method of Sibbald (1976a) with minor modifications (Yamazaki, 1987). The roosters were trained and housed previously in individual wire cages in a windowless temperature controlled house where they received 16 hours of light each day. Each cage was fitted with an individual feeders and water supply. Four individual roosters were employed to each ingredient and reused the birds for covering all individual feed ingredients. After a 36 hours fast, all roosters were individually weighed and force-fed 30 g of wheat, corn, and mixed layer feed and 25 g of dehulled soybean meal, sesame oil cake, rice polish, concentrate for layer feed and concentrate for broiler feed and 20 g of mustard oil cake and fish meal, respectively. Force feeding was accomplished by inserting a stainless funnel into the crop via the esophagus. After feeding, the birds were returned to their cages. A stainless tray with a plastic sheet on the top was used for each cage to collect excreta. Excreta of each bird was collected twice at 24 and 48 hours, cleaned free from feathers and scales and mixed together and was frozen, freeze dried and allowed to reach equilibrium with atmospheric moisture. Excreta samples were then weighed. After weighing, excreta of each bird was ground by pestle and mortar. The ground samples were passed through a 1.0 cm screen and evaluated for gross energy and nitrogen content. A trial was conducted with all eighteen roosters following the same procedure for collection of individual bird's endogenous excretion to calculate TME. The fasted birds were allowed 9 days standard feeding for recovery from fasting stress before starting the next trial.

Results and Discussion

The proximate composition of the ten feed ingredients are presented in table 1. The TME of the eight feed ingredients are listed in table 2.

Wheat :

In proximate composition of wheat, an extreme variation was noted in crude protein content between wheat 1 and wheat 2 ranging from 10.58 and 14.42 percent respectively. Fiber and fat contents were reasonably close. The average TME values was 3.28 kcal/g measured from the wheat 1 which was 17.14% higher than the metabolizable energy (ME) value of NRC (1984). This value is approximately 95% that of corn. Wheat is the major energy source for poultry ration in Bangladesh.

Corn :

Yellow corn was collected locally from the Dhaka city feed market as a poultry feed. Corn is not a so popular feed ingredient in Bangladesh. The average crude protein content of corn was 8.74 percent (table 1). The average TME values was found 3.44 kcal/g which was 2.68% higher than the ME value of NRC (1984). Recently it has been started to use as poultry feed ingredient in a limited amount.

Rice polish :

Rice polish, fine particle of rice bran without husk, is an excellent source of energy in poultry rations. Rice polish is produced mostly in automatic rice mills in Bangladesh with an extraction rate of 6% of total rice milling. Samples of rice polish obtained from different sources with four sample for each number were analyzed and the crude protein content were ranging from 13.06 to 14.54 percent (table 1). An extreme variation was observed in fat, fiber and ash contents between these two samples. The average TME value from rice polish 1 was found 3.42 kcal/g which seems to be very good as energy source. This value was 9.64% higher than the ME value of NRC (1984). It is noted that this rice polish was not defatted.

Sesame oil cake :

Sesame oil cake is a by-products from sesame with an average extraction rate 56 percent. It is mostly used as a source of protein in poultry ration. Samples of sesame oil cake obtained from different sources with four samples for each number were analyzed and their crude protein content were ranging from 26.49 to 28.83 percent (table 1). The average TME values from sesame oil cake 1 was found 1.85 kcal/g which was 16.28% lower than the ME value of NRC (1984).

Soybean meal :

Soybean meal is not a popular feed ingredient in Bangladesh though it is an excellent source of protein. Most of the soybean meal available in the local market are imported from India without any quality control. The present sample was collected from the local market of Bangladesh but imported from India. Its crude protein content was found 46.81 percent (table 1). TME values was found 2.33 kcal/g which was slightly lower than the ME values of NRC (1984). This lower value was possibly due to the variation of sources of soybean meal.

Mustard oil cake :

Mustard is the most widely cultivated oil seed in Bangladesh. Its oil cake is a main by-product from the seed with an extraction rate ranging from 59 to 70 percent. It is not a commonly used feed ingredient in poultry diet but some of the farmers use it at less than 6%. Its crude protein content was 33.07 percent. The TME value measured was 2.30 kcal/g which was very close to that of soybean meal.

Fish meal :

The fish meals produced in Bangladesh are from fishes, which are not used for human consumption. Moreover, fish meals available in Bangladesh are mostly adulterated with low quality fish as well as the heads and tails of different fishes. Three grades of fish meal are

TABLE 1. PROXIMATE COMPOSITION OF THE TESTED INGREDIENTS (%)

Feed ingreadients	Proximate composition (Dry matter basis)					
	DM (%)	CP (%)	EE (%)	NFE (%)	CF (%)	C. ash (%)
Wheat 1	86.52 ± 0.38 (4)	10.58 ± 0.20	1.87 ± 0.21	70.72 ± 0.21	1.89 ± 0.15	1.46 ± 0.25
Wheat 2	87.09 ± 0.19 (4)	14.42 ± 0.65	1.76 ± 0.12	66.93 ± 0.59	1.92 ± 0.58	2.06 ± 0.65
Corn	86.66 ± 0.48 (4)	8.74 ± 0.66	3.88 ± 0.55	70.69 ± 0.67	1.83 ± 0.59	1.52 ± 0.36
Rice polish 1	88.34 ± 0.31 (4)	13.06 ± 0.57	15.86 ± 0.86	46.60 ± 1.29	4.94 ± 0.66	7.88 ± 0.96
Rice polish 2	89.44 ± 0.63 (4)	14.54 ± 0.66	24.84 ± 0.73	30.72 ± 1.12	9.58 ± 0.86	9.76 ± 0.77
Sesame cake 1	89.24 ± 0.58 (4)	28.83 ± 0.33	7.39 ± 0.50	19.54 ± 0.57	21.09 ± 0.73	10.39 ± 1.11
Sesame cake 2	88.74 ± 0.74 (4)	26.49 ± 0.54	5.19 ± 0.70	18.31 ± 2.27	20.80 ± 1.50	17.95 ± 1.00
Soybean meal	87.81 ± 0.82 (4)	46.81 ± 0.68	1.55 ± 0.18	27.18 ± 1.06	5.36 ± 0.42	6.91 ± 0.64
Mustard cake	88.93 ± 0.55 (4)	33.07 ± 0.80	8.14 ± 0.77	30.44 ± 2.54	10.62 ± 1.32	6.65 ± 1.03
Fishmeal (not defatted)	86.33 ± 0.67 (4)	50.62 ± 1.34	12.83 ± 0.88	3.54 ± 1.59	2.02 ± 0.73	17.32 ± 0.72
Fishmeal (defatted)	84.24 ± 1.64 (4)	57.26 ± 1.16	1.44 ± 0.39	6.42 ± 1.86	1.65 ± 0.46	17.47 ± 0.56
Fishmeal (Grade A)	85.13 ± 0.70 (4)	51.23 ± 1.51	2.81 ± 0.28	1.75 ± 1.35	3.95 ± 0.50	25.39 ± 0.81
Fishmeal (Grade B)	81.51 ± 0.77 (4)	42.19 ± 1.76	5.13 ± 0.56	3.19 ± 1.37	2.07 ± 0.43	28.99 ± 0.63
Fishmeal (high quality)	86.00 ± 0.85 (4)	63.79 ± 0.72	3.77 ± 0.76	–	–	18.84 ± 0.71
Concentrate for layer	89.51 ± 0.67 (4)	41.35 ± 0.76	7.66 ± 0.77	10.20 ± 1.22	2.56 ± 0.46	27.74 ± 0.37
Concentrate for broiler	88.62 ± 0.73 (4)	49.19 ± 0.80	9.25 ± 0.46	7.41 ± 0.99	1.95 ± 0.25	20.82 ± 0.70
Layer formula feed	87.77 ± 0.87 (4)	16.81 ± 0.72	11.89 ± 0.47	49.36 ± 1.65	4.18 ± 0.33	15.53 ± 0.70

TABLE 2. TRUE METABOLIZABLE ENERGY, METABOLIZABLE ENERGY AND GROSS ENERGY VALUES OF THE TESTED FEED INGREDIENTS

Name of the test feed ingredient	T.M.E. (kcal / g)	M.E.[1] (kcal / g)	M.E.[2] (kcal / g)	G.E. (kcal / g)
Wheat	3.28 ± 1.66 (8)	2.80	3.32	3.83
Com	3.44 ± 2.24 (4)	3.35	3.70	3.93
Rice polish	3.42 ± 1.22 (8)	3.09	3.20	4.34
Sesame cake	1.85 ± 1.87 (8)	2.21	2.12	4.33
Soybean meal (Dehulled)	2.33 ± 1.89 (4)	2.44	2.69	4.15
Mustard cake	2.30 ± 2.29 (4)	0.00	2.20	4.48
Fish meal (Not deffated)	2.64 ± 2.28 (4)	0.00	0.00	4.32
Concentrate for layer	1.98 ± 1.48 (4)	0.00	0.00	3.59
Concentrate for broiler	2.61 ± 0.83 (4)	0.00	0.00	4.05
Mixed layer feed	2.30 ± 2.38 (4)	0.00	0.00	3.35

[1] NRC, 1984.
[2] Huque and Stem, 1993., 0.00 = not available. Figures in parentheses indicate number of sample.

produced e.g. Al, A2, and A3 which are determined by their crude protein contents approximately 60, 50, and 45 percent, respectively. However, poor quality control of the protein content results in a great deal of variation within and between the various grades. Since the oil is not extracted away from these fish meals their protein values and shell quality are not competitive to oil extracted fish meal. Also, the level of silica in fish meal is relatively high because the fish is dried on the sand before being ground to meal. Fish meal is the major source of protein for poultry diet in Bangladesh. The five samples of fish meal were collected from different sources and analyzed. The proximate compositions were varied from sample to sample which clearly demonstrated the variation of the fish meal. TME values was 2.64 kcal/g in the fish meal with the content of protein 50.62 percent.

Concentrate for layer feed :

Concentrate for layer was collected from the local market. It was a mixture of soybean meal, blood meal and liver meal imported from India. The quality of this product varied in a large extent from lot to lot. The protein content of this concentrate mixture was 41.35 percent. TME value was 1.98 kcal/g in this concentrate.

Concentrate for broiler feed :

Concentrate for broiler was collected from the same market. It was a mixture of similar ingredients like concentrate for layer but the compositions were different. It was also imported from India and the quality varied from lot to lot. The protein content was 49.19 percent. TME value was 2.61 kcal/g in this concentrate.

Layer formula feed :

This was a feed prepared with the locally available feed ingredients mixed by hands. The formula feed was collected randomly from the feed market of Dhaka city, where the small scale poultry formers usually buy the formula feed. The protein content was 16.81 percent which may normally meet the protein requirement for the birds. But the TME was 2.30 kcal/g which was much lower than that the birds normally required.

The results demonstrated that the TME values of wheat, corn and rice polish were slightly higher than ME values of NRC (1984) which was in the line of NRC (1984). The TME values of sesame cake and soybean meal were lower than that of NRC values. The causes might be due to the variation of sources or quality of the ingredients.

The metabolizable energy values of five ingredients (Huque and Stem, 1993) shown in the table 2 are also in the line of NRC (1984) except wheat which might also be due to the variation of sources and the quality of the wheat used.

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