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Apparent and True Metabolizable Energy in Artemia Meal

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Abstract: For determination of metabolizable energy of artemia meal and comparison with fish meal, samples gathered from 3 regions include : Urmia Lake Artemia, Earth Ponds Artemia (beside urmia lake) and Ghom Salt Lake Artemia. Then samples dried, milled and used in a biological experiment with fish meal. 20 Rhode Island Red cockerels with approximately same live weight used in Sibbald assay with completely randomized design with 5 treatments and 4 repetitions for determination of AME, AMEn, TME and TMEn. Results showed there were significant differences between treatments from standpoints of metabolizable energy ($P<0.05$). ULAM and FM had highest ME and EPAM and GLAM had lowest ME. The highest TME belong to FM and the lowest TME pertained to EPAM. Except to EPAM that had the lowest TMEn, other treatments didn't have any differences between them.

Key words: Metabolizable energy, artemia meal, fish meal

Introduction

The nutritional value of an ingredient depends on some it's nutrients like energy content. Apparent Metabolizable Energy corrected for nitrogen (AMEn) is accepted for poultry, although True Metabolizable Energy corrected for nitrogen (TMEn) is better than it but for some limitations, AMEn is common now (Cole and Haresign, 1989; Mc Nab, 2000; National Research Council, 1994; Sibbald, 1982; Sibbald, 1987; Wolynetz and Sibbald; 1984).

Fiber has negative effect on metabolizable energy content. Feed ingredients with high fibers cause diet become bulky and decrease its energy concentration. In feed ingredients with animal origin, chitin, ash, skin, fur and feather have negative effect on metabolizable energy (Klasing, 1998; Leeson and Summers, 2001; Longe and Ogedegbe, 1989).

Pesti *et al.* (1986) showed correlation between MEn, ash, Ca and gross energy of diet. Results from those experiment showed there is high negative correlation between MEn and ash content (-0.89) and between MEn and Ca (-0.85) and high positive correlation between MEn and gross energy (0.78) (Pesti *et al.*, 1986).

Part of poultry diets has consisted animal protein resources. These proteins not only provide necessary amino acids for birds but also supply to some extent energy for them. We can use artemia meal in poultry diet as an animal protein ingredient.

Zarei *et al.* (2006) replaced different levels of two kind of artemia meal protein instead of different levels of fish meal protein in broiler diet. Results showed there were no differences between treatments from view point of mean of daily weight gain and feed conversion ratio.

In this research apparent and true metabolizable energy from three kind of Artemia meal with one sample of fish meal determined and compared with them.

Materials and Methods

Twenty Rhode Island Red cockerels with nearly same weights used for determination of metabolizable energy by Sibbald procedure (Sibbald, 1976a; Sibbald, 1976b). Birds were located in a standard single cages wire. Three samples of artemia meal include: Urmia Lake Artemia Meal (ULAM), Earth Ponds Artemia Meal(EPAM) and Ghom Lake Artemia Meal (GLAM) and one sample of Fish Meal (FM) prepared, milled and weighted in 30 gram packages. For each treatment 4 packages (repetition) prepared.

Birds prohibited on feed for 24 hours but water was *ad-lib*. Then cockerels weighted and each of them forced feeding with 30gram of samples, except four of them that continued their starvation for determination of indigenous faecal nitrogen. For next 48 hours water was available for their drinking. After this time excreta collected on tray under cages. Collected excreta send to laboratory. In there samples dried, weighted and milled. Then dry matter, nitrogen and gross energy determined according to standard procedures. Finally data used for calculation of AME, AMEn, TME and TMEn with equations as follow:

1. $AME = [(F_i \times GE_f) - (E \times GE_e)] / F_i$
2. $AME_n = [(F_i \times GE_f) - (E \times GE_e) - (NR \times K)] / F_i$
3. $TME = [(Fi \times GE_f) - (E \times GE_e)] + (FE_m + UE_e) / F_i$
4. $TME_n = [(F_i \times GE_f) - (E \times GE_e) - (NR \times K)] + [(FE_m + UE_e) + (NR_0K)] / F_i$

AME: Apparent Metabolizable Energy (kcal/gm)
AME_n: Apparent Metabolizable Energy corrected for nitrogen (kcal/gm)
TME: True Metabolizable Energy (kcal/gm)
TME_n: True Metabolizable Energy corrected for nitrogen (kcal/gm)
F_i: Feed intake (gm)
E: Excreta (gm)
GE_f: Gross Energy of feed sample (kcal/gm)
GE_e: Gross Energy of excreta (kcal/gm)
FE_m: Metabolic Faecal Energy (kcal/gm)
UE_e: Indigenous Urinary Energy (kcal/gm)
NR: $NR = (F_i: \times N_f) - (E \times N_e)$ Nitrogen Retention (gm)

N_f: Feed Nitrogen (%)
N_e: Faecal Nitrogen (%)
NR_0: Nitrogen Retention at zero level for control group (gm)
K: Nitrogen Retention corrected coefficient (8.73kcal/gm for each gm N)

Results

Data analysis showed significant differences between treatments from stand point of Metabolizable Energy ($P<0.05$) (Table 1).

Table 1: Compare means of metabolizable energy in artemia meals and fish meal (kcal/kg)

Treatments	AME	AMEn	TME	TMEn
EPAM	2131.2^{b}	2298.5^{b}	2808.3^{c}	2554.7^{b}
ULAM	2858.5^{a}	2803.7^{a}	3500.7^{b}	3066.5^{a}
GLAM	2205.3^{b}	2372.8^{b}	3236.5^{bc}	3060.9^{a}
FM	2753.1^{a}	2852.4^{a}	4129.2^{a}	3369.5^{a}

Means within the same column with different alphabets differ significantly at ($P<0.05$)

There wasn't any significant difference between ULAM and FM for AME, AMEn and TMEn. These two ingredients had high level of metabolizable energy among treatments. There was no significant difference between EPAM and GLAM from view point of AME, AMEn and TME and these two treatments had lowest ME in comparison other treatments. TMEn of EPAM was the lowest and had significant difference with another treatments ($P<0.05$).

Discussion

Differences between treatments were due to differences in amount of their crude fat, crude fiber and ash content. Ash content of ULAM was %5 lesser than EPAM and GLAM and this caused ME increased in this kind of artemia.

Ash and crude fiber in FM were lesser than other treatments and for this reason level of ME in FM and EPAM were higher than other treatments.

Results from this research were agree with Klasing (1998); Longe and Ogedegbe (1989) and Pesti *et al.* (1986). They declared that ash and crude fiber are the most effective on AME content.

Pesti *et al.* (1986) showed there is high negative correlation (-0.89) between MEn and ash content in poultry by-products meal.

In our experiment the highest energy was belong to FM. This differences probably were due to nature of ingredients that effected on indigenous energy losses. Farrell *et al.* (1991) also pointed to this subject and they concluded in their study that indigenous losses is under effect of nature of diet (Farrell *et al.*, 1991).

In this experiment the most indigenous nitrogen losses belong to FM treatment. Difference between passage rate of feed ingredients through gastrointestinal tract can effect on this subject.

Sibbald (1982) showed there are differentiation in disappearance of feed residues in gastrointestinal tract. In this study maybe artemia meal needed to more time for passage through GI.

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