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ASSESSING THE TRUE METABOLIZABLE ENERGY VALUE AND DIGESTIBILITY OF MOLASSES IN BROILER DIETS

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Target Audience: Feed Industry and Poultry Farmers.

ABSTRACT

Ten mature broiler chickens paired on equal weight basis were starved for 24 hrs to avoid completely previous feed residues. Five of the birds were force-fed 30g dry matter (DM) of molasses as slurry and was also sampled for proximate analysis. The other five birds (control) were starved for the estimation of the metabolic faecal and endogenous urinary losses. Excreta were quantitatively collected at 24, 48 and 60 hr post-prandium and part of each sample was taken for proximate analysis for calculation of their percent digestibility of nutrients while the other part was bombed along with the molasses for gross energy determination. Results showed that 48 hr represented the period when faecal residues were totally voided since there was no difference between 48 and 60 hr collection periods. The true metabolisable energy (TME) values were greater ($P < 0.51$) than the apparent metabolisable energy (AME) values at each collection period. The apparent dry matter digestibility (ADMD) of molasses ranged from 58.53 to 76.99%. The true dry matter digestibility (TDMD) ranged from 80.65 to 86.39%. The TDMD was significantly ($P < 0.05$) greater than ADMD at the collection periods.

Key words: TME and Digestibility of Molasses.

DESCRIPTION OF PROBLEM

True and apparent metabolisable energy (TME and AME) are the bioassays used in determining the bioavailable energy (GE) of feed minus the GE of the excreta of feed origin. In contrast, AME is defined as the consumed feed energy minus that of the total excretion (1). Molasses is a by-product of cane sugar industry which exists in some Northern States of Nigeria. Molasses has been used to feed livestock and poultry owing to its unique qualities as a binder in the manufacture of pellets. It reduces dustiness in rations, increases palatability of rations for livestock, and it is a source of energy (2).

Nutrient availability as measured by digestive and absorptive efficiency, together with utilisation *in vivo*, are needed forms for assessment of nutritive

values of dietary raw materials (3). Incorporation, therefore, of digestibility assay in determining the bioavailability of energy contained in molasses is another approach towards ensuring its adequate nutritive use by animals. Considering that the bioavailable energy content of feed ingredients determines intake of other nutients that make up a diet, and that an animal eats to satisfy its energy requirement when fed *ad libitum* (4), it becomes necessary to determine the quality of molasses produced in Nigeria. The objecives of this study, therefore, were to determine the proximate analyses, TME and digestibility of nutrients in Nigerian molasses using mature broiler chickens.

MATERIALS AND METHODS

Ten 19-week old commercial broiler chicken were selected on equal weight basis to determine the bio-available energy and nutrient digestibility of molasses. The birds were removed from the rearing units in deep litter to the metabolic cages where they were placed in an open-sided house. They were kept for one week before the balance trial commenced to enable them adapt. The experimental layout was the completely randomized design, each bird representing an experimental unit. Five birds served as the control group and were starved throughout the experimental period while the other five were fed.

Molasses was obtained from Bacita in Kwara State, Nigeria. Some sample was taken for proximate anlalysis (5). Correction was made for moisture content of molasses such that 30g dry matter (DM) of molasses weighed out into five places were fed the five test birds. An assay devoid of feeding the birds through crop intubation (6) was adopted. By this token, each of the five birds was force-fed once only 30g DM molasses in slurry at a time by careful introduction.

Before feeding the test group, all the birds were starved without water for 24 hr to completely clear undigested materials in their digestive tracts. While the five test birds were force-fed, thereafter, the other five birds (control) were starved throughout the experimental period. The control group furnished data which were used to estimate the metabolic faecal and endogenous urinary energy. Water was added to the troughs attached to the metabolic cages when the birds were fed.

Faecal materials were quantitatively collected at 24, 48 and 60 hr post-prandium. Polythene sheets were spread on top of the faecal receptacles located beneath the metabolic cages, where the faeces were completely scooped with a spoon into empty cans. A simulated oven made of metabolic cage and electric bulbs was used to dry the faeces on the farm before they were transferred to the force-draft oven in the laboratory for final drying. This was done to avoid attraction of house flies to the collected faeces.

The dried faeces were weighed, bagged in small plastic bags and stored in desiccators. Part of each sample was taken for proximate analysis for calculation of the percent nutrient digestibility of molasses, while the other part was used to obtain the gross energy (G.E.) value.

Using the parr's adiabatic oxygen bomb calorimeter fitted with a digital thermometer, the GE of both the molasses and the faeces were determined. Bioavailable energy values were calculated using the methods of (7) and (8). The percent nutrient digestibility of molasses were calculated using various methods of (9, 10, 11).

All data were subjected to analysis of variance and differences between treatment means were seperated using Turkey pairwise comparisons (12).

RESULTS AND DISCUSSION

The proximate analyses of molasses and its calculated contents were 14.03, 2.46, 1.00, 9.42, 0.41 and 0.09% for moisture, protein, ether extract, ash, calcium, and phosphorus, respectively. The energy values (AME and TME) of molasses at different faecal collection periods are shown in Table 1. Apparent metabolisable energy (AME) of molasses decreased significantly ($P < 0.05$) at the succeeding collection periods, but there were no differences ($P < 0.05$) between the 48 and 60 hr collection periods. The true metabolisable energy values were greater ($P < 0.05$) than the AME estimates at each collection period.

Table 1: Different energy values of molasses at different faecal collection periods.

Collection Period (hr)	AME	Time
	(Kcal/gm)	
24	$3.04^{c} = \pm 0.01$	$3.32^{b} = \pm 0.02$
48	$2.58^{b} = \pm 0.01$	$3.11^{a} = \pm 0.02$
60	$2.45^{b} = \pm 0.02$	$3.09^{a} = \pm 0.02$

* Means are ± standard error of the means

a, b, c, d Means within the row not bearingthe same superscripts are significantly different ($P < 0.05$).

AME: Apparent Metabolisable Enegery,

TME: True Metabolisable Energy.

Apparent dry matter digestibility (ADMD) of molasses ranged from 58.53 to 76.99% (Table 2) The digestibility estimates were significantly different ($P < 0.05$) at the succeeding collection periods. The true dry matter digestibility (TDMD) ranged from 80.65 to 85.3%). The 24 hr value was significantly ($P < 0.05$) greater than ADMD at the different collection periods. Protein digestibility was not computed because of the low protein content of molasses.

Table 2: Digestibility values of dry matter contained in molasses at different faecal collection period[2] (%).

Collection Period (hr)	ADMD (%)	TDMD
24	$76.99^{b} = \pm 0.48$	$86.39^{a} = \pm 0.53$
48	$62.74^{a} = \pm 0.34$	$81.10^{b} = \pm 0.42b$
60	$58.53^{c} = \pm 0.35$	$80.65^{b} = \pm 0.39b$

[1]Values are ± standard error of the means
a, b, c, d, Means within the rows not bearing the same superscripts are significant ($P < 0.05$).
ADMD: Apparent Dry Matter Digestibility
TDMD: True Dry Matter Digestibility

The sample of molasses used in this study was highly viscous, and therefore, the moisture content (14.03%) was much lower than values of other workers. It has been reported that moisture range of 27.8 to 29.60% characterizes a less viscous molasses (13). The difference in moisture contents could be due to different processing methods. However, the viscousity of the molasses did not increase the protein and ether extract contentS compared to other results (13, 2, 14). The observed ash, calcium and phosphorus contentS closely agree with other analyses (13 and 2).

True metabolizable energy estimate of molasses stabilized at 48 hr whilst the AME continued to decrease significantly with time. Consequently, the 48 hr energy estimates were used to represent the actual energy content of molasses (4). Apparent metabolizable energies (AME) of 3.04, 2.58 and 2.45 Kcal/gm - obtained at the three collection periods were much higher than 1.96 and 1.87 Kcal/gm reported by others (6, 15, 16). The difference could be as result of different methods of processing the sugar-cane. Sucrose is expected to be higher in local molasses than those processed in advanced and more industrialized countries because of ineffective extraction of sucrose from the canes in Nigeria.

Data obtained in this study showed that TME was generally higher than AME estimate. This was due to the correction made for metabolic faecal and endogenous urinary energy lost during the period. This correction ensured that faecal materials used in this energy calculation were those of feed origin hence the TME values were consistently higher than AME. Usually, correction made for nitrogen-balance improved the TME and AME systems as true estimates of energy of feedstuffs. The nitrogen-balance correction using 8.73kcal/gm (7), improved the AME and TME, stabilizing and making them less variable.

The observed significant time effect of ADMD of molasses was similarly observed in the computation of AME. These indicated that the ADMD and AME decreased ($P < 0.05$) with time of collection. On the other hand, TDMD at 24 hr collection differed ($P < 0.05$) from that at 48 and 60 hr indicating that digestibility was optimum at 48 hr collection period. Generally, the ADMD was lower ($P < 0.05$) than the TDMD estimates because of the correcton of

metabolic and endogenous loses taken care of in calculating the true digestibility values. The same effect was earlier observed while correcting the AME to TME of molasses. Apparent digestibility was affected more by period of faecal collection than the corrected form. The results, therefore demonstrated that corrections made for apparent digestibility and bioavailable energy values were necessary to enhance greater precision of data obtained.

CONCLUSIONS AND APPLICATIONS

1. Faecal residues were totally voided at 48hr
2. The TME values were greater than the AME values.
3. The ADMD of molasses ranged from 58.53 to 76.99%
4. The TDMD value ranged from 80.65 to 86.39%
5. At all collection periods TDMD was significantly greater than ADMD
6. Corrections made on apparent digestibility and bioavailable energy values were necessary to enhance greater precision of data obtained.

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