APPARENT NITROGEN CORRECTED AND TRUE METABOLISABLE ENERGY OF PROCESSED THEVETIA OIL FOR BROILER FINISHER BIRDS

*O.A. ADEYEMI¹, J.O ATTEH¹ and S.A. IBIYEMI²

¹Department of Animal Production,

²Department of Chemistry, University of Ilorin,

P.M.B. 1515 Ilorin, Nigeria

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ABSTRACT

Sixty, finishing broilers aged 35 days were used to determine the Apparent, Nitrogen corrected and True metabolisable energy value of thevetia oil. The oil was subjected to heat treatment of 110°C for 25 minutes. Four experimental diets consisting of a basal diet and three other diets in which thevetia oil was substituted for 2.5, 5.0 and 10.0% of the basal diet. The experiment lasted for 10 days, made up of a 7-day adjustment period and a 3-day total collection period. Protein and fibre retention were significantly ($P < 0.05$) influenced by dietary thevetia oil level. Three regression equations were derived for estimating the metabolisable energy value of thevetia oil viz: $y = 2990 + 61.9x$ (AME), $y = 3076 + 59.8x$ (FME) and $y = 2848 + 57.2x$ (AME_N). The Apparent metabolisable energy (AME) of thevetia oil was determined to be 9180kcal/kg and 9056kcal/kg respectively.

Keywords: Thevetia oil, metabolisable energy, broiler finisher.

INTRODUCTION

Fats are being increasingly utilized in monogastric rations as energy booster (Adeyemi, 1998). Utilization of fat in diets of monogastric animals is associated with the fact

that they are a more energetically convertible ingredient with a lower heat increment (Freeman, 1983). Fats and oils improve the general appearance of feed (Dale and Fuller, 1978). They are also sources of essential fatty acids and are important in the metabolism of fat-soluble vitamin.

Vegetable oils are the main type of fat that are used in poultry diets. Atteh *et al.* (1990) observed that recent competition between man and livestock for vegetable oils has resulted in little conventional oil being available for livestock feeding, hence the need for cheaper and readily available alternative oil. Thevetia oil – a product of Yellow Oleander (*Thevetia peruviana*) which is a common ornamental plant that flowers and fruits all year round is one such novel vegetable oil.

The work of Atteh *et al.* (1990), had shown that based on its fatty acid profile, thevetia oil has a considerable appeal as a feed ingredient. The oil however contains some inherent deleterious factors especially thevetia, a cardiac glycoside (Datta and Gopa, 1981).

Precise and accurate information on the nutritive value of novel feed ingredient needs to be available before such material can be effectively included in compounded diets. The metabolisable energy value is the most practical and useful indicator of dietary energy available to non-ruminant animals from feed ingredients. Adeyemi *et al.* (2001) evaluated the Apparent and True metabolisable energy of solvent extracted thevetia oil to be 7846 and 8016 Kcal/kg.

*Current Address:

Department of Animal Production,
Ogun State University,
P.M.B. 2002,
Ago-Iwoye.

These values, though in the range of values reported for animal fats by NRC (1984), were lower than the values for most vegetable oils. These low values were thought to be associated with poor utilization of the oil. Further investigation by Adeyemi (1998), however showed that finishing broilers on diet containing heat treated thevetia oil tended to exhibit a better performance probably because some of the toxic compounds in the oil are thermolabile. This study was therefore embarked upon to determine the metabolisable energy value of thevetia oil processed by mild heat treatment.

MATERIALS AND METHODS

Oil Extraction

The procedures for oil extraction and processing by mild heat treatment have been previously described (Adeyemi, 1998).

Experimental birds and diets

60, five weeks old Cobb broilers which had been reared on conventional starter mash were used for the study. The birds were individually weighed and randomly divided into four groups of 15 birds each and these were further divided into 3 replicates of 5 birds each. Replicate groups were similar in weight and each replicate was housed in battery cages. The experimental diets consisted of a basal diet (control) and thevetia oil-based diets in

which 0, 2.5, 5.0 and 10.0% respectively of the control diet was replaced by the heat-treated thevetia oil. (Table 1) The experiment lasted for 10 days, made up of 7-day adjustment and a 3-day collection period. Prior to the collection period, a total of 6 birds were selected at random from those on basal diet to a separate cage. Starved for 24 hours after which their excretion for the next 24 hours were collected, dried and ground for the determination of metabolic faecal wastes. The remaining 54 birds were given weighed quantity of feed.

The faecal droppings collected over a 72 hour period using the total collection procedure (Cullison, 1982) were oven dried at 60°C, cooled, weighed and ground before chemical analysis.

Chemical analysis

All test diets and excreta were subjected to proximate analysis in accordance with AOAC (1990). The gross energy of the diet and excreta samples was determined using a Gallenkamp ballistic bomb calorimeter.

The apparent metabolisable energy (AME) and the nitrogen corrected metabolisable energy (AME) value was determined by the method of Hill *et al.* (1960) while the true metabolisable energy (TME) was calculated using the equation of Sibbald (1976).

TABLE 1: COMPOSITION OF EXPERIMENTAL DIETS (%)

	Dietary Treatment			
	1	2	3	4
Basal Diet	100.00	97.50	95.00	90.00
Thevetia oil	0.00	2.50	5.00	10.00
<i>Determined nutrient composition (%):</i>				
Dry Matter	91.56	91.21	98.19	89.89
Crude Protein	20.25	20.51	19.96	20.14
Crude Fat	5.51	7.84	9.96	13.11
Crude Fibre	5.25	5.16	4.88	4.60

Maize 54.0%, Maize offal 6.0%, Soybean meal 31.68%, BDG 5.0%, Bonemeal 1.84%, Oyster shell 0.88%, Salt 0.25%, Vit-Min Premix 0.25%, DL Methionine 0.010%.

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Data Analysis

Data collected for the experiment were subjected to analysis of variance using a complete randomized design according to the procedure of Mead and Curnow (1987). Means that were significant were separated using the least significant difference.

RESULTS AND DISCUSSION

The influence of dietary inclusion level of thevetia oil on the metabolisable energy value of each dietary treatment is presented in Table 2. There was an increase ($P < 0.05$) in dietary AME, TME and AME_n with increase in dietary concentration of thevetia oil. Three regression equations were derived from the experiment for the determination of apparent, true and nitrogen-corrected metabolisable energy values respectively. These are:

$$AME \quad y = 2990 + 61.9x$$

$$TME \quad y = 3076 + 59.8x$$

$$AME_n \quad y = 2848 + 57.2x$$

By extrapolation to 100% inclusion level of the heated oil the AME, AME_n and TME was found to be 9180, 8568 and 9056 kcal/kg respectively.

The investigation of Adeyemi (1998) had shown that heat treatment of thevetia oil at 110°C for 25 minutes appear to overcome a substantial portion of the problems encountered with both mechanically extracted oil (Atteh *et al.*, 1990) and solvent extracted

oil (Adeyemi *et al.*, 2001), thus indicating that some of the residual poisonous properties in thevetia oil are heat labile as exhibited in terms of nitrogen and fat retention (Table 2).

The effect of heating upon the nutritional value of fats and oils appears to be two-fold. When fats are heated at a high temperature, polymerization occurs during which the characteristic odour and taste of the unsaturated triglycerides may be removed (Deuel, 1955). Extensive heat treatment of oil leads to a change in the degree of unsaturation as evident by a marked decrease in iodine number (Deuel, 1955). He observed that the primary cause of the reduction in nutritive value of diets which contained thermally polymerized linseed oil was the presence of one or more dimeric fatty acid radicals. In the present study however, the oil was subjected to only 110°C which is substantially below the temperature of 200°C cited by Roy (1994) for polymerization to take place.

The linear increase in ME value of diets with increasing concentration of thevetia oil agrees with the findings of Bayley *et al.* (1974) who evaluated ME of rapeseed meal with young chicks at six level of inclusion (from 0 to 500g/kg in 100g increments). Agunbiade *et al.* (1991) were of the opinion that such responses generally are to be expected when substituting a compound with a comparatively high dietary energy value into a basal diet with a relatively

TABLE 2: EFFECT OF INCREASING DIETARY LEVEL OF HEATED THEVETIA OIL NUTRIENT RETENTION (%) AND ME VALUE OF DIETS (kcal/kg)

Dietary level of Thevetia oil	Nutrient Retention			Apparent ME	ME values	
	Crude Protein	Crude fat	Crude fibre		AME_n	TME
0	59.87 ^{ab}	63.49 ^a	64.80 ^a	2980 ^a	2856 ^a	3081 ^a
2.5	53.94 ^a	70.47 ^{ab}	59.49 ^b	3170 ^b	2989 ^b	3230
5.0	53.79 ^a	75.26 ^b	63.98 ^a	3298 ^c	3124 ^c	3360 ^c
10.0	61.72 ^b	76.18 ^b	62.26 ^{ab}	3609 ^d	3427 ^d	3681 ^d
SE (n=3)	6.80	8.64	8.26	0.00087	0.00087	0.00087

Values on the same column (except SE) with different superscripts are significantly different ($P < 0.05$).

lower one. Similar results were reported by Muztar *et al.* (1981) with rapeseed soap stock given to adult cockerel and with rapeseed oil given to broilers (Wiseman and Lessire, 1987).

The AME value of 9180 kcal/kg obtained in the current study is higher than the value of 7846kcal/kg for raw thevetia oil determined by Adeyemi *et al.* (2001) using 2-weeks old broilers. Basilo *et al.* (1980), reported ME value of 8530 ± 330 kcal/kg and 8780 ± 250 kcal/kg for crude and semi refined palm oil thus implicating mode of processing/treatment as influencing ME value. Heat treatment of the oil appeared to be responsible for the difference in value between the current study and earlier work of Adeyemi *et al.* (1990). Age is however known to affect ability of chickens to utilize fat. Polin and Hussein (1982) observed that chicks at one week of age retained 25% less lipid than 3 weeks of age. Earlier report by Carew *et al.* (1972) showed that the young chick does not have full physiological capacity for fat absorption. There is evidence to suggest that the quantity of bile being produced increases with age hence more bile acids for the emulsification of fat by older birds. Gomex and Polin (1976) suggested that the maturation of the mechanism involved in absorption of fat in chicken appeared to involve the availability of bile acids. Atteh and Leeson (unpublished) explained that increased bile acid production in adult birds makes for more efficient micellarization of fats and less contact between fatty acids and cation so yielding better fat absorption compared with young birds.

Although the age at which chicken reach their full digestive and absorptive capacity for fats has not been stated in literature, it is expected that broiler chicks at 5 weeks of age would have reached a stage at which they have full ability to utilize the fat source.

CONCLUSION

The conclusion reached from the result of the current investigation is that processed thevetia oil having an AME value of 9180Kcal/kg appeared to have a considerable potential as a dietary energy source for poultry feeding.

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