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Nutritive Evaluation and Dry Matter Degradability of Broiler Litter-based Diets in West African Dwarf Sheep

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Target audience: Animal Nutritionists, Feed Millers

Abstract

Broiler litter (BL), an animal waste has great potential to reduce the cost of feeding and consequently the cost of production in ruminants. This study was designed to determine the nutritive value and dry matter (DM) degradability of BL based diets using rumen cannulated West African Dwarf (WAD) sheep. The chemical composition of the BL showed that it contain 84.1% dry matter (DM); 23.5% crude protein (CP); 2.8% ether extract (FE); 20.8% acid detergent fibre (ADF); 39.0% neutral detergent fibre (NDF) and 2 1.5% ash. The BL was used to formulate concentrate rations at graded levels of 0% (control), 25%, 50% and 75% inclusion as diets A, B, C and D, respectively. Rumen degradation characteristics of the BL-based diets showed significant ($P<0.05$) differences in all the values obtained. The highest soluble fraction (a) value was recorded for diet B (35.6%) followed by diet C (34.7%). The potential degradable (a+b) fraction was highest in diet D (82.6%) and least in diet A (control), but there were no significant differences in the 'a+b' values of diets B and C. It is concluded that inclusion of BL in the diet of ruminants up to 50% level would give optimum performance in sheep.

Keywords: West African Dwarf sheep; Broiler litter (BL) degradability; Rumen-cannulated sheep

Description of Problem

Over the years, meat consumption, has been linked with a position of social and economic status of a country or an individual (1). As a nation industrializes and improves its economic position, its meat consumption, which is the chief source of animal protein increases. Moreover, as the people experience improvement in their socio-economic status, they tend to demand an increase in the quantity and quality of meat and meat products they consume. It has long been demonstrated that low protein intake is the most important contribution to the incidence of retarded growth in children (2).

FAO (3) recommended an intake of 68g per head per day as the dietary protein allowance for man, from both plant and animal origins. Africans consume just one third of the value, which is below 35g recommended as dietary protein allowance from animal origin (4).

Meat is an excellent source of high quality protein and it contains large amount of minerals and essential B-vitamins. Haan *et al.* (5) observed that by 2020, the global population is projected to consume about 120 million tonnes of meat and 220 million tonnes of milk above current consumption. In 2020, the global meat demand is expected to grow from 209 million tonnes in 1997 to 327 million tones, which is about 56% increase. It is speculated that most of the growth in demand will be in developing world, because, for the lower income classes, meat and milk have high income elasticity. In a bid to meet up with the speculated livestock revolution, the limited supply of raw materials for the livestock feed industry has resulted in a continuous increase in the cost of production of livestock products. Thus, these products have become too expensive for the majority of the

population. Carew *et al.* (6) reported that feed component constitutes between 55 and 80% of the cost of production. With increasing cost of feed, replacing feed as wastes of little or no economic value inevitably leads to a significant reduction in the cost of meat, milk and other animal products.

Animal excreta is regarded as constituting a nuisance because of its foul smell, a pollutant and a source of human and animal health hazard on all farms. Its disposal is labour intensive, time consuming and usually expensive. Oftentimes, it contains drug residues, broken and dead epithelial linings, unabsorbed digestive juices and enzymes. The use of livestock wastes as feed ingredients has been considered and they have been found to contain relatively high protein contents when properly treated, dried and deodorized.

Sequel to Ososanya and Sekoni (7), this study was designed to evaluate the nutritive value and dry matter degradability of broiler litter as a feed supplement in diets of West African Dwarf (WAD) sheep.

Materials and Methods

Sample Collection

BL was collected from the Broiler Section of the Teaching and Research Farm, University of Ibadan, Ibadan. The house was partitioned into two pens with each pen containing fifty (50) birds. Each pen has a surface area of 10 square metres. Wood shavings were used as the bedding materials at an average depth of 5cm. The samples collected were bulked together and formulated into diets A, B, C, and D with 0, 25, 50 and 75% levels of inclusion of BL, respectively. About 30g was taken out of the lot and milled in a micro miller with I mm diameter screen and 2.5mm sieve for chemical analysis according to A.O.A.C. procedures (8). Parameters analysed were crude protein (CP), ether extract (EE), ash and moisture. Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined using the procedures described by Nahm (9).

Degradability Experiment

The rumen degradability study was carried out at International Livestock Research Institute (ILRI), Ibadan. Three mature WAD sheep with stable ruminal cannulae were used. The sheep were housed in individual pens with wood shavings as bedding. The animals were fed a combination of Guinea grass and *Leucena Leucephala* forage *ad libitum* supplemented with wheat bran having access to fresh clean water, salt lick and exercise. The area around the canulla was cleaned after the withdrawal of samples from the rumen with detergent soap and disinfectant. The animals were sprayed weekly and dewormed once every two weeks. In order to evaluate DM disappearance, the diets formulated from BL were incubated in the rumen of the canulated sheep using the nylon bag technique (10). Three grammes of the milled samples were weighed into nylon bags measuring 9xI 8cm with pore size of 41 microns (p). The bags were incubated in the rumen of the sheep in duplicates for 12, 48, 60, 72 and 96 hours. The evacuated bags from the rumen were rinsed immediately under a running tap to terminate fermentation. The residues in the bag were oven-dried at 65°C for 48 hours and the DM was determined. The results of DM disappearance were fitted to the expoimental exponential equation:

$P = a + b (1 - c^{et})$

as reported by (10), where

P = the degradation at time "t"

a + b potential release of degradation

t = the time of degradation

a = water soluble fraction

b = insoluble but degradable fraction

c = rate of degradation

Statistical Analysis

Data obtained were subjected to analysis of variance using the general linear model procedure of SAS (11) and significant treatment means were separated using Duncan (12) multiple range test of the same package.

Results and Discussion

Table I shows the chemical composition of the BL. The values obtained were 84.1% DM; 23.5% CP. 2.8% fat; 21.5% ash; 20.8% ADF and 39.3% NDF.

The value for CP showed BL to be adequate in its CP content as it exceeds the minimum of 6-8% required for optimum animal production (13).

BL is rich in uric acid. Therefore, it is capable of increasing the ammonia pool in the rumen of the animal, thereby making more proteins available for digestion and utilization (14). Both the ADF and NDF fractions of the diet are good indicators of the extent to which the food will be digested . A lower value implies better digestibility and shorter reflection nutrition period in the rumen, hence improved voluntary intake (14).

The high ash value obtained showed BL to be rich in minerals, thereby influencing the nutrition of the animals positively.

Table 1: Chemical composition of BL

Nutrient	% Composition
DM	84.1
CP	23.5
Fat	2.8
Ash	21.5
ADF	20.8
NDF	39.3

The gross compositions of the experimental diets are shown in Table 2. The calculated CP revealed that all the diets were adequate in their protein content with the values ranging from 16. 1 to 20.9%

The rumen degradation characteristics of the BL-based diets were presented in Table 3. The values obtained for the readily soluble fraction (a) in all the diets were significantly different (P<0.05) with the least (24.3%) in Diet A (control) and the highest (35.6%) in Diet B. Degradable fraction (b) was highest

Table 2: Gross composition of the experimental diets

Ingredient	Diet A	B	C	D
Broiler litter	-	25	50	75
Palm Kernel Cake	52	27	02	
Wheat Bran	30	30	30	7
Corn bran	15	15	15	15
Salt	2	2	2	2
Palmoil	I	1	1	1
Calc. CP (%)	16.1	17.5	18.8	20.9

Table 3 Rumen Degradation Characteristics of broiler litter based diets

Diet	a(%)	b(%)	a+b(%)	c(%h')	lt(h)
A	$24.3 + 0.0^{d}$	$49.5 + 0.5^{d}$	$73.7 + 0.5^{d}$	0.0 + 0.00	$7.0 + 0.5^{a}$
B	35.6+0.00	43.5±0.0c	$79.1 + 0.0^{b}$	0.1 ± 0.0	2.9+0,5c
C	34.7 ± 0.0^{b}	44.7 ± 0.1^{c}	794+06b	0,1 ± 0.0	1.3 ± 0.1^{d}
D	$31.1 + 0.0^{c}$	$51.5 + 0.1^{a}$	$82.6 + 0.1^{a}$	0.1 +0.0	$4.1 + 00^{b}$

a, b, c, d: means in the same column with similar superscripts are not significantly different (P> 0.05).

($P<0.05$) in Diet D *(51.5%)* followed by Diet A (49.5%), while the values obtained for Diets B and C were not significantly ($P>0.05$) different from each other. The highest potentially degradable (a + b) fraction was obtained for Diet D (82.6%) and least (73.7%) in Diet A, but the difference between Diets B and C was not significant ($P>0.05$).

The lag time of the diets is a measure of time taken for any feed sample to get fermented sufficiently before leaving the rumen for the true stomach where it gets digested and absorbed. Diet A (control) recorded the highest ($P<0.05$) lag time value of 7.0 hours obviously because of the more fibrous nature of the diet than others. The least value of 1.3 hours obtained for Diet D could only suggest the possibility of the nutrients in the diet being rapidly fermented and hence more microbial proteins will be synthesized (14).

Conclusion

From the results obtained, BL can be included in the concentrate ration of ruminants up to 75% level. However, when all the degradation characteristics were considered, including BL in ruminant diet up to 50% gave the optimal animal performance. The aversion being campaigned against the use of BL in ruminant feeding could be adequately taken care of if the BL is well processed, either by drying, ensiling, chemical treatment as any of these treatment procedures will reduce the microbial count, eliminate pathogens, increase palatability and acceptability of the ration. Furthermore, a huge amount of money will be reduced through the use of broiler litter thereby reducing the cost of production.

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