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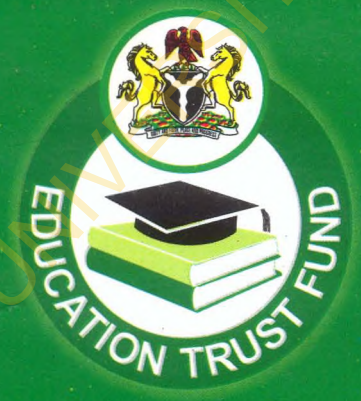

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Effect of Varying Levels of Broiler Litter on Growth Performance and Nutrient Digestibility of West African Dwarf Lambs

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Target audience: Ruminant Nutritionists, Sheep Producers, Feed Millers

Abstract

This study investigated the effect of varying levels of broiler litter wastes on growth performance and nutrient digestibility of WAD lambs. Sixteen rams were allotted into 4 groups while 4 experimental diets were formulated using 0, 25, 50 and 75% levels of broiler litter in their diets respectively. The parameters studied included dry matter (DM) intake and nutrient digestibility of the lambs. Results obtained showed that DM intake increased with increasing values of BL in the diet. Similarly, metabolic DMI values obtained were inconsistent with the increasing levels of BL in the diet. All ram lambs gained weight but the rate of gain across the treatments were significantly different (P<0.05) between diets 1 to 3 and 4. Furthermore, it was observed that with the increasing levels of BL in the diet, mean live weight of the animals decreased. Consequently, from the performance of the experimental animals, it can be concluded that broiler litter can be applied in any ruminant production venture as a supplement without any adverse effect at 50% inclusion level.

Keywords: Broiler litter, Intake, Nutrient Digestibility and Live weight.

Description of Problem

Ruminants possess a unique digestive system that allows them to use diets containing agricultural wastes and by-products as sources of dietary nutrients [1]. The low productivity of sheep in Nigeria results primarily from inadequate nutrition in terms of availability of feeds in the right quality and quantity.

Animal wastes such as broiler litter represent a vast reservoir of cheap nutrients, particularly for ruminants. Feeding of animal wastes results in reduced feed cost, lowered price of animal products and contributes to self sufficiency in protein supply [2]. Broiler litter has been used as feed for over 35 years in the United States of America without record of residual effects on humans, who have consumed the products from the animals [3]. The use of broiler litter as a feed for ruminants offers three primary advantages: It is an environmentally responsible use of a problem by- product, it provides an incentive for proper management of this by-product by poultry and ruminant producers alike and it reduces the cost of ruminant production.

Utilization of broiler litter as a feed in ruminant diets is still limited in this part

of the world, particularly due to limited awareness by some livestock producers as regards the potentials of broiler litter in the feeding of ruminants. Also, it creates a useful way of disposing broiler litter, which would have otherwise been a nuisance to the farmer in terms of its disposal, its potential to cause disease outbreaks and its capacity to pollute the environment [4].

The objective of this study therefore was to determine the feed intake, digestibility and weight changes of West African Dwarf sheep fed broiler litter based diets.

Materials and Methods

Management of Animals

Sixteen (16) primiparous WAD lambs aged five months were dewormed using Ivomectin (1ml/20kg live weight), dipped against ticks and fleas using Gamatox and treated with antibiotics were used in this study. Four complete experimental diets were formulated using 0, 25, 50 and 75% levels of broiler litter waste (BL) in addition to other ingredients as shown in Table 1. Prior to the commencement of the feeding trial, the animals were balanced for weight and fed *ad libitum* for six months. Fresh water was constantly available while salt lick was offered free choice. The growth rates were monitored weekly from 21-40 weeks of age.

Digestibility and Nitrogen Utilization

Digestibility of the feed was carried out by the faecal and urine collection methods. Animals were weighed and each ram was penned in an individual metabolic cage for twenty one days. During the last seven days, total feed refused (ort), faeces and urine were collected. Urine samples were frozen while feed and faecal samples were dried at 65°C to constant weight, milled and stored in air tight polythene bags.

Chemical and Statistical Analyses

Dried milled samples of feeds and faeces were analysed for their proximate compositions [5]. Nitrogen content was determined by the Micro-Kjeldahl Technique using the Markam's distillation apparatus.

Data were subjected to analysis of variance using ANOVA procedure [6]. Significant treatment means were compared using the Duncan's Multiple Range Test provided by the same package.

Results and Discussion

Dry Matter Intake and Digestibility of WAD lambs fed Broiler litter-based Diets

Tables 1 and 2 show the nutrient composition of feed and nutrient utilization of broiler litter waste fed to WAD lambs, respectively. The dry matter (DM) in the feed ranged from 91.0 to 92.1% for Diets 1, 2, 3 and 4, respectively. Diets 1 and 2 were significantly higher ($P<0.05$) in dry matter than Diets 3 and 4. DM intake increased with increasing levels of BLW in the diet. The values ranged from 355.5g/day in Diet 4 to 502.3 g/day in Diet 3. DM intake increased not significantly with increasing levels of BLW in the diet from Diets 1 to 3, but decreased significantly for Diet 4.

Dry matter (DM) intake is an important factor in the utilization of feed by ruminant livestock and is a critical determinant of energy intake and performance in small ruminant [7]. Several reports indicate that supplementation with grass as basal diets will improve feed intake and live weight gains [8 and 9]. With most forages, the efficiency of feed utilization is the major determinant of the production level achieved [10]. Best performance and efficiency of production were achieved in goats when supplement was added to their feed. It is therefore necessary to optimize efficiency of utilization of the nutrients that arise from fermentative and intestinal digestion by supplementing with nutrients that escape or bypass rumen fermentation [11].

Table 1: Gross composition (%) of diets fed to West African Dwarf sheep

Ingredient	Diet			
	1	2	3	4
Broiler litter	0	25	50	75
Palm kernel cake	52	27	2	-
Wheat bran	30	30	30	15
Corn bran	15	15	15	7
Salt	2	2	2	2
Palm oil	1	1	1	1
Calc. CP	16.1	17.5	18.8	20.9

Table 2: Dry matter intake, faecal and urinary output of rams fed broiler litter-based diets

Parameter	Diet			
	1	2	3	4
Dry matter in feed (%)	92.1±0.0^{a}	92.1± 0.0^{a}	91.0±0.0^{b}	90.5±0.0^{c}
DMI (g/day)	442.5±17.7^{a}	451.5± 20.7^{a}	502.3±16.7^{a}	355.5±15.3^{b}
DMI (g/day $^{0.75}$)	210.8±17.2	205.5± 8.8	248.0±18.6	188.8±7.9
Faecal output(g/day)	252.3±20.6^{b}	291.3±6.9^{b}	416.3±26.0^{a}	93.8±1.0^{c}
Faecal output (g/day/$^{0.75}$)	121.3±1.9^{b}	135.0±6.5^{b}	180.3±19.4^{a}	50.5±0.3^{c}
DM faeces (%)	51.5±0.5^{a}	42.6±1.0^{b}	35.3±1.1^{b}	41.8±1.1^{c}
Faecal DMO (g/day)	131.8±10.7^{a}	123.3±3.6^{a}	62.7±5.2^{a}	23.3±2.4^{b}
Urine (ml/day)	380.0±8.2^{b}	262.5±25.0^{c}	441.3±15.1^{a}	300.7±10.8^{c}
Urine (ml/day/$^{0.75}$)	178.5±4.3^{c}	121.9±7.8^{c}	192.0±10.2^{a}	163.8±5.5^{b}

$^{a, b, c:}$ Means in the same row with different superscripts are significantly different ($P < 0.05$).

Metabolic DMI values were inconsistent with the increasing levels of BL in the diet. The values obtained were 210.8, 205.5, 248.0 and 188.8g/day for Diets 1, 2, 3 and 4, respectively. The general lack of interaction with the intake level indicates that the effect of ruminal degradation rate on this factor was

independent of feed intake level.

DM digestibility increased significantly with increasing levels of BL in the diet with 69.9% for Diet 1 to 89.6% for Diet 4 (Table 3). The DM digestibility coefficients were comparable to 78-79 and 78-80% DM digestibility observed by [12] for sheep and goats fed hay supplements with concentrates, respectively as well as those reported by [13], who fed concentrates at restricted intakes to lambs in complete diets. In the same trend, crude protein (CP) digestibility ranged from 70.1% for Diets 1 and 2 to 88.3% for Diet 4. CP digestibility for Diet 3 was significantly higher than the rest of the diets; this led to the highest degree of DM intake of Diet 3. This observation is consistent with the speculation of [14, 15 and 16], that digestibility of nutrients varies with nutrient composition.

Table 3: Nutrient digestibility coefficients of lambs fed broiler litter-based diets

Parameter	1	2	3	4
Dry Matter (%)	69.9 ± 0.6^{d}	72.9 ± 0.8^{c}	81.2 ± 0.3^{b}	89.6 ± 0.2^{a}
Crude Protein (%)	70.1 ± 0.8^{c}	70.1 ± 1.0^{c}	77.4 ± 0.4^{a}	88.3 ± 0.2^{b}
Neutral Detergent Fibre	63.1 ± 0.5^{b}	66.2 ± 0.4^{a}	65.5 ± 1.1^{ab}	66.4 ± 1.1^{a}
Acid Detergent Fibre	47.8 ± 0.6^{a}	42.4 ± 1.2^{b}	41.7 ± 0.6^{b}	45.9 ± 0.5^{a}
Ether Extract	78.2 ± 0.8^{d}	81.5 ± 0.9^{c}	86.0 ± 0.4^{b}	89.3 ± 1.3^{a}
Ash	39.5 ± 5.9^{b}	42.4 ± 3.0^{b}	48.1 ± 4.8^{b}	68.6 ± 4.2^{a}
Nitrogen-free Extract	76.5 ± 0.6^{c}	77.6 ± 0.7^{c}	86.6 ± 0.9^{b}	92.6 ± 0.3^{a}

[a, b, c:] Means in the same row with different superscript are significantly different ($P < 0.05$).

NDF digestibility ranged from 63.1% for Diet 1 to 66.4% for Diet 4. Significant differences ($P<0.05$) were observed between Diets 2, 4, 3 and 1. The higher NDF digestibility observed in sheep on diets 2 and 4 might have a longer retention in the digestive system and hence the higher digestibility obtained. This may be related to changes in the rate of passage of digesta from the rumen [17]. Although the constant rate of disappearance of slowly digestible NDF fraction in the rumen was low, slow rate of degradation might have exerted a beneficial effect on fibrolytic activity in the rumen. The reduction of time spent by concentrate in the rumen due to protein source would reduce protein degradation in the rumen [18]. Also, ADF digestibility varied significantly between the diets ($P<0.05$). However, the values obtained in this study did not agree with the range of 63.3-78.4% obtained by [19], who fed maize offal and sorghum brewers grain as supplement to WAD goats.

The ether extract digestibility was significantly ($P<0.05$) different with increasing levels of BL in the diet. However, for ash digestibility, Diet 4 was significantly ($P<0.05$) different from the other diets. The NFE digestibility increased with the increasing levels of BL in the diet; significant ($P<0.05$)

differences were observed between Diets 4, 3, 1 and 2.

Weight Changes of WAD Rams fed Broiler litter-based Diets

Live weight changes of rams fed broiler litter based diets are presented in Table 4. All ram lambs gained weight and the rates of gain across the treatments were significantly ($P<0.05$) different from Diets 1 to 3 and 3 to 4. Similarly, mean live weight changes of the animals ranged from 10.2 kg in Diet 4 to 13.4kg in Diet 1. Furthermore, it was observed that with the increasing levels of BL in the diet, mean live weight of the animals decreased. However, there were no significant ($P>0.05$) differences observed from animals on Diets 1 to 3, but, significantly different from Diet 4. Also, average daily weight gain indicated a consistent decrease from 556.2, 535.6 and 528.9g for Diets 1 to 3, respectively. There were significant $P<0.05$) differences observed between Diets 1 to 3 with Diet 4.

Table 4: Live weight changes in WAD lambs fed broiler litter-based diets

Parameter	Diet			
	1	2	3	4
Initial live weight (kg)	13.4±1.3	13.7±1.6	13.4±1.4	13.2±1.1
Final live weight (kg)	26.7±1.5	26.5±1.5	26.1±1.6	23.4±0.7
Mean live weight gain (kg)	13.4±0.3^{a}	12.9±0.1^{a}	12.7±0.2^{a}	10.2±0.5^{b}
Average daily weight gain (g)	556.2±11.2^{a}	535.6±6.0^{a}	528.8±9.3^{a}	422.9±21.5^{b}
Metabolic live weight gain ($g^{0.75}$)	417.1±8.4^{a}	401.7±4.5^{a}	396.6±7.0^{a}	317.2±16.1^{b}

$^{a, b, c:}$ Means in the same row with different superscripts are significantly different ($P < 0.05$).

Conclusion and Application

a) Broiler litter, an animal waste with a great potential to improve productivity of ruminants was fed to WAD lambs.
b) The performance of the experimental animals suggests that the test diets can be applied in any ruminant production venture as a supplement, without any adverse effect at 50% inclusion level.
c) Also, it was observed that at 50% inclusion level, the animals utilized the feed more, thereby, gain weight faster than the animals in other diets.

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