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RECYCLING BROILER LITTER AND CAPRINE RUMEN CONTENT AS LOW COST BY PRODUCT FEEDING STUFFS FOR GOAT PRODUCTION

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ABSTRACT

Experiments were conducted to evaluate the potentials of broiler litter (BL) and caprine rumen content (CRC) as low cost by product feeding stuffs for goats. Twenty (20) West African Dwarf goats (WAD) with average weight of 10kg were randomly assigned to five dietary treatments of 0%CRC/30%BL, 10%CRC/20%BL, 20%CRC/10%BL, 30%CRC/0BL% and 0BL%/0%CRC (control) for diets A to E, respectively. Results indicated that dry matter (DM) intake of goats decreased ($p>0.05$) with increasing level of CRC in the diets. Goats on diet A had the best performance in terms of daily gain (g/day) and feed: gain ratio with goats on diet D having the least ($p<0.05$) performance. The DM and CP digestibilities followed the same trend across the dietary treatments with goats fed diet D having significantly ($p<0.05$) lower digestibility compared to the other treatments. Blood parameters monitored fell within the range required for goats and varied ($p<0.05$) across the treatments with exception of total protein and blood glucose. The carcass characteristics of WAD goats as a result of feeding BL with CRC were not influenced ($p>0.05$) by the dietary treatments, while the meat composition varied ($p<0.05$) in the CP and fat contents. It is concluded that supplementing BL in CRC diets at 20 and 30%BL, respectively, has the potential of improving feed intake, weight gain, digestibility and carcass quality in WAD goats for profitable performance.

Keywords: Goats, broiler litter, caprine rumen content, performance.

INTRODUCTION

Small ruminants can utilize a wide range of feed resources. The bulk of their feed however, comes from forages as they are primarily considered to be forage consumers (Mason *et al.*, 1991). Moreover, there have been production slumps in ruminant animal husbandry, because of the persistent shortage of forages and fluctuation in nutrients, more especially during the dry months of the year (Anigbogu and Okocha, 2003). These adversely affect the ruminant animal industry in Nigeria, thereby giving rise to the need of investigating additional alternative feed resources in order to improve the ruminant animal production system within the country.

Animal wastes represent a vast reservoir of cheap nutrients, particularly for ruminants. Feeding of animal wastes and slaughterhouse by-products result in reducing feed cost and a lower price of animal products; it contributes to self-sufficiency in protein, phosphorus and other expensive nutrients in ruminant rations (Bagley and Richards, 1998;

Babayemi and Isah, 2005). In addition, the system makes possible a vertical, mutually complemented integration of animal production among individual species, which can, in return, solve some problems of waste disposal and thus some problems of pollution.

Broiler litter is the most valuable animal waste because of its relatively high energy and protein contents, of which about 45 to 67% is present as true protein, 18 to 30% as uric acid and 12 to 17% as ammonia (Belewu and Adeneye, 1996; Goestch and Aiken, 2000). Caprine rumen content on the other hand has been successfully fed to growing, pregnant and lactating goats without any deleterious effects as it forms a good source of dietary protein and minerals in ruminant nutrition. (Isah and Babayemi, 2005; Bawala and Akinsoyinu, 2006).

This study aimed at determining the effect of utilizing recycled broiler litter and caprine rumen content in goat's diet with the view of assessing the intake, digestibility, haematological profile and carcass characteristics as well as the cost benefits of using these feedstuffs.

MATERIALS AND METHODS

Experimental site and animal management

The experiment was carried out in the Small Ruminant Unit of the Teaching and Research Farm, College of Animal Science and Livestock Production, University of Agriculture, Abeokuta. Twenty (20) West African Dwarf goats with average weight of 10kg were purchased from villages around Abeokuta, Ogun State. They were quarantined for 21 days during which the animals were treated against internal and external parasites and were also vaccinated with tissue culture rinderpest vaccine against *Peste des Petite Ruminante* before the commencement of the experiment that lasted for 105 days.

Experimental diets

Broiler litter (BL) was obtained from the broiler unit of the Teaching and Research Farms of the University of Agriculture, Abeokuta, Nigeria, while the caprine rumen content (CRC) was collected from the abattoir situated at Gbonagun area, Abeokuta. The BL and CRC were sun dried to a moisture content of about 12% before incorporating into the diets. Cassava peels were obtained from the cassava processing unit of the University and sun dried while *Pennisetum purpureum* was harvested from the University environs and fed fresh to the animals. The goats were randomly assigned to five dietary treatments of 0%CRC/30%BL,10% CRC%/20BL, 20%CRC/10%BL, 30% CRC/0BL and 0BL%/0%CRC (control) for diets A to E, respectively (Table 1). The diets were offered daily to the goats at 4% of body weight (Oyenuga, 1968) in feeding troughs twice a day at 8.00 am and 1.00 pm, respectively while water and mineral/salt lick was given *ad libitum*.

Data collection

Weights of individual animals were measured at the onset of the experiment and subsequently on a weekly basis. Feeds offered and feed refusals were measured daily to estimate feed intake for each animal. For the digestibility trails, samples of faeces were collected from goats in metabolic crates at the last 7 days of the experiment, oven dried to constant weight and bulked until required for analysis.

For the haematological analyses, about 5mls of blood was collected from each of the experimental animals at the beginning and end

Table 1: Gross Composition of the Experimental Diets (%DM) fed to West African Dwarf goats

Ingredients	Diets				
	A	B	C	D	E
Caprine rumen content	0	10	20	30	-
Broiler litter	30	20	10	0	-
Cassava peels	20	20	20	20	20
Palm kernel cake	25	25	25	25	25
*Pennisetum purpureum**	24	24	24	24	24
Corn offals	-	-	-	-	30
Salt	1	1	1	1	1
Total	100	100	100	100	100

*Offered fresh

of the experiment by jugular vein puncture as described by Frandson (1986) with sterilized 19-guage needle and syringe and deposited in lithium-herparinized bottles and taken immediately to the laboratory to determine its chemical constituents.

At the end of the digestibility study, three bucks from each treatment were selected on weight basis, starved for 24hours and slaughtered to evaluate the carcass characteristics. The hair was removed through the application of hot water on the skin. The animals were eviscerated and the gastric intestinal tract with organs were carefully excised and weighed. The slaughter weight, empty body weight, carcass weight, hot carcass weight and the dressing percentage were determined and each part was weighed as described by Adu and Brinckman (1981).

Chemical Analyses

The dry matter, crude protein, crude fibre, ash and ether extract contents of diets, faeces and meat samples were analysed according to the method of AOAC (1990), while the blood samples were analysed for packed cell volume, red blood cells, white blood cells, glucose, blood urea nitrogen and total protein as described by Hyduke (1975).

Statistical analysis

Data collected were subjected to analysis of variance in completely randomized design according to SAS (1999). Separation of means was done using the Duncan multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of broiler litter (BL), caprine rumen content (CRC) and the experimental diets are shown in Table 2. The crude protein (CP) content for BL and CRC as determined in this study was 22.75 and 39.66%, respectively. The CP content of BL is similar to that reported by Blair (1975) and the range reported by Bagley and Richards (1998). It is, however, lower than 31.30% reported by Bhattacharya and Taylor (1975) with higher CP content, and higher than

18.40% reported by Belewu and Adeneye (1996). The difference across the experiments might be due to level of nutrition and feed wastage, nature of bedding materials and length of the rearing period of broilers. On the other hand, the CP content of CRC as shown in this study was higher than BL which might be as a result of microbial protein in the rumen. However, the CP content of CRC is lower compared to that reported by Isah and Babayemi (2005) and Bawala and Akinsoyinu (2006). This might be due to specie of the animal from which the rumen content was collected from and the method of processing.

The chemical composition of the experimental diets fed to WAD goats as shown in Table 2 revealed that diet A containing 30%BL had the least CP content which increased with an increase in the level of CRC across the dietary treatments. On the other hand, diet A had the least crude fibre (CF) content which increased with a decrease in the level of CRC in the diets.

Table 2: Proximate composition of the experimental diets (%DM) fed to WAD goats

Parameters	Diets						
	A	B	C	D	E	BL	CRC
Dry matter	90.15	90.08	90.17	90.21	85.79	89.65	87.28
Crude protein	15.46	16.38	17.49	19.57	16.72	22.75	39.66
Crude fibre	21.67	23.56	23.66	23.71	18.81	14.06	21.85
Ether extract	3.14	3.06	3.17	3.21	12.68	1.89	3.49
Ash	7.24	7.08	7.69	7.12	9.53	11.89	15.38
Nitrogen free extract	52.49	49.92	40.99	46.39	42.26	49.61	19.62

BL Broiler litter
CRC Caprine rumen content

The performance of WAD goats fed the experimental diets are summarized in Table 3. The goats on diet A with 30% BL performed best ($p<0.05$) having an average daily gain of 40.10 g/day which was statistically similar ($p>0.05$) with goats on diets B and the control treatment, while goats on 30% CRC recorded the least ($p<0.05$) gain (g/day). This supports the findings of Burdine *et al*. (1993) and Bagley *et al.* (1994) that showed that cattle performance was the same with BL diets mixed with different agro industrial by products. Also, Cross and Jerney (1976) found similar gains of feedlot steers fed diets containing corn silage with 10, 20 or 30% inclusion of BL. The range reported for gain (g/day) in this study was higher than that reported by Odeyinka (2001) when WAD goats were fed *Gliricidia sepium* and *Leucaena leucocephala* leaves but lower to the reports of Fasae *et al.* (2007) when the same breed of goat was fed with cassava peels and palm kernel cake.

Table 3: Summary of the performance of WAD goats fed the experimental diets

Parameters	Diets					SEM
	A	B	C	D	E	
Initial weight (kg)	7.89	8.15	8.02	7.84	8.23	0.75
Final weight (kg)	12.08	12.31	11.91	11.09	12.47	1.21
Weight gain (g/day)	40.10[a]	39.62[a]	37.05[a]	30.95[b]	40.38[a]	2.94
DM intake (g/day)	317.38[a]	314.59[a]	297.74[ab]	284.63[b]	321. 41[a]	10.01
CP intake (g/day)	54.35[a]	50.11[ab]	47.35b	42.17[b]	53.26[a]	3.33
Feed/gain	7.91[b]	7.93[b]	8.90[b]	9.62[a]	7.96[b]	0.07
DM digestibility (%)	66.70[a]	63.53[a]	63.10[a]	59.21[b]	67.04[a]	6.72
CP digestibility (%)	62.87[a]	63.53[a]	61.86[a]	58.86[b]	64.79[a]	5.11
Feed cost (N/kg)	7.10[c]	7.31[b]	7.63[b]	7.74[b]	12.87[a]	0.78
Feed cost/weight gain (N/kg)	56.16[c]	57.97[c]	67.91[b]	74.46[b]	102.45[a]	5.02

[abc] Means in the same row with the same superscripts are not significantly different ($p>0.05$)

The DM intake of the experimental diets by goats increased ($p<0.05$) with a decrease in the dietary inclusion of BL. The maximum intake observed in goats fed 30% BL with 15% dietary CP concentration agrees with the reports of Adu and Osinowo (1985) who observed maximum intake at 15% dietary CP concentration on the performance of weaned lambs, suggesting that dietary CP concentration higher than 15% may not be beneficial to ruminants.

The DM and CP digestibility followed the same trend across the dietary treatments and were significantly ($p<0.05$) the same with exception of the digestibility of goats on 30% CRC. This suggests that inclusion of BL in the diets of WAD goats encouraged optimal rumen environment for maximum degradation of the feed constituents resulting in better digestibility. On the other hand, the poor digestion of diet D with 30% CRC could be attributed to the unfavorable rumen environment for the microbes due to higher CP dietary concentration. The values obtained for the DM and CP digestibility are lower compared with the reports by Okagbare and Akinsoyinu (1998) when WAD goats were fed poultry droppings and groundnut cake rations. The difference may be attributed to the variation in the composition of the diets fed to the animals.

The cost analysis indicated that it is remarkably economically cheaper ($p<0.05$) to use BL and CRC in the diets of goats being more beneficial in gain with reduction in the production cost compared to the control treatment. Besides, as at the present situation in Nigeria, BL and CRC could be gotten free of charge from poultry houses and abattoirs.

Table 4 shows the results of some of the blood parameters of WAD goats fed the experimental diets. The packed cell volume

(PCV) observed across the dietary treatments fell within the range 19 to 38% reported by Orheruata *et al.* (2004) for WAD goats. Although, there was a significant ($p<0.05$) decrease in the level of packed cell volume (PCV) and haemoglobin concentration as the level of CRC increased in the diets which shows a direct relationship between PCV and haemoglobin. Wilson and Brigstocke (1981) reported that PCV is an indication of blood dilution which confirms the results of this study.

Table 4: Blood profile of WAD goats fed the experimental diets

Parameters		Diets					SEM
	RPE	A	B	C	D	E	
Packed cell volume (%)	25.01-37.12	33.50^{a}	31.01^{a}	28.31^{ab}	26.85^{b}	29.93^{ab}	2.75
Haemoglobin (g/dl)	5.98 - 9.01	9.01^{a}	8.31^{a}	7.90^{ab}	6.09^{b}	8.47^{a}	1.21
Red blood cells (µ/L)	7.20 -12.89	11.12**a**	10.55^{a}	8.99^{ab}	7.91^{b}	10.01^{a}	1.94
White blood cells(µ/L)	15.94- 20.15	16.38^{b}	17.59^{ab}	16.90^{b}	19.70^{a}	18.41^{a}	2.01
Total protein (mmg/L)	5.66 - 8.00	6.22	6.41	6.35	6.12	6.51	1.01
Blood glucose (mmol)	2.10 - 4.14	2.99	3.31	3.64	3.15	3.45	0.88

a b means in the same row with the same superscripts are not significantly different ($p>0.05$) RPE – Range prior to experiment

Table 5: Carcass characteristics (kg) of WAD goats fed the experimental diets

Parameters	Diets					SEM
	A	B	C	D	E	
Live-weight	11.39	11.50	11.30	10.82	12.04	0.85
Empty carcass weight	10.31	10.74	10.51	8.95	10.31	0.61
Hot carcass weight	7.22	7.23	6.94	6.42	7.45	0.73
Carcass weight	5.10	5.06	4.86	4.51	5.13	0.34
Dressing percentage	44.77	44.00	43.01	41.68	44.30	2.11

The chemical composition of the meat from WAD goats used for the experiment is shown in Table 6. Goats fed 30% CRC significantly ($p<0.05$) had the least CP and fat contents relative to the other dietary treatments.

CONCLUSION

The result of the study suggest poor intake of diet containing 30% CRC by WAD goats. However, supplementing BL in CRC diets at 20 and 30%BL respectively, has the potential of improving feed intake, weight gain, digestibility and carcass quality in WAD goats for profitable performance, which is a good indication of the potential of these animal wastes as low cost by product feeding stuffs for goat production.

Table 6: Chemical composition (%) of meat from loin of WAD goats fed the experimental diets

Parameters	Diets					SEM
	A	B	C	D	E	
Dry matter	91.11	91.56	91.35	91.88	92.14	1.75
Crude protein	35.33[a]	33.25[a]	33.05[a]	31.54[b]	34.56[a]	0.93
Fat	9.22[a]	8.97[a]	8.82[a]	7.67[b]	9.01a	0.36
Ash	14.22	14.59	14.63	14.01	13.99	0.64

a b means in the same row with the same superscripts are not significantly different (p>0.05)

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