EVALUATION OF ABATTOIR WASTE IN GOAT RATION: PROCESSING, STORAGE, UTILIZATION.

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ABSTRACT

An experiment was conducted to determine the nutrient composition of processed and stored abattoir waste (AW); a scrapping from the papillae layer of rumen of slaughtered cattle in Nigeria, and to evaluate the utilization of abattoir waste-based diet by West African dwarf (WAD) goats.

Concentrate diets were formulated such that 0% (A), 35 % (B), 70% (C) and 100 % (D) of soybean meal (SBM); a conventional but expensive feedstuff, was replaced with sun-cured AW. All diets were approximately isonitrogenous (161-171g CP kg ^{1}DM). These diets were fed along with grass *ad libitum* to 16 growing WAD bucks with mean body weights of 6±1.5 kg in a completely randomized design for 28 days to determine treatment effect on acceptability of feed, haematological and serological profiles and internal organs weights of experimental animals.

The oven dried sample contained higher crude protein (CP), dry matter (DM) and gross energy (GE) than sun-cured sample. (67.70%, 91.52% and 3.95 Mcal/kg vs 60.49%, 83 45% and3.54 Mcal/kg). DM contents of oven-dried and sun-cured AW samples were not stable during storage for 6 weeks in a silo. An increase was observed in CP contents of both samples while EE contents decreased during storage. The goats preferred concentrate diets to grass as revealed by concentrate intake ranging from 91.31 to 92.21 % of total intake although no significant difference was observed in total intake. The mean serum metabolites' indices showed the value of total protein levels of goats on diets A, C and D as 6.40, 6.30 and 6.33 g/100ml, respectively. Dietary effect on serum cholesterol and albumin: globulin ratios were significant ($P<0.05$). Variations in haematological indices due to dietary treatments were also significant. Spleen weights were similar ($P>0.05$) for goats on diets B, C, and D, but lower in animals on diet A. Animals on diets C and D had significantly higher heart weights.

However, diets containing sun-cured AW were equally accepted by the animals as no significant difference was observed in their intake. Neither health nor behavioural traits were affected by the experimental diets as the values obtained were within normal range. This implies that the abattoir waste, which constitutes a disposal problem in Nigerian abattoirs, may be used to replace soybean meal, a conventional but highly expensive feedstuff, in the diets of ruminant livestock.

KEYWORDS: Abattoir waste, Waste Recycling, Goats, Concentrate.

INTRODUCTION

Inadequate or poor quality feed is responsible for the low livestock productivity in the tropics. A critical study of the situation shows that there are some unused resources, which are not consumed by man and could be used for animal feeding purposes (FAO, 1982). Originally, recycling mainly concerned the urban environmentalist, but livestock scientist discovered that animal wastes and slaughter house by-products could in fact constitute a sustainable resource; the primary purpose of this aspect of recycling is to prevent animal husbandry from competing with humans for the same food resources; cereals and pulses in particular. Voluntary intake is an important factor, which helps to decide how much of the ration containing the waste could be used. Properly processed abattoir wastes are wholesome in appearance, taste and smell and they do not have their original characteristics. They are normally rich in protein and mineral matter, though usually low in digestible energy. Presently, the waste is primarily used as fertilizers in some part of the country but in view of

its nutrient potential and feeding value, attention is now focused on recycling it as a source of nutrient for livestock. Information is scarce on the nutritive value of abattoir waste as feed for ruminants. The objective of this study therefore is to establish the effect of processing and storage on chemical composition of the waste, and also to assess the utilization of abattoir waste based diets by goat.

MATERIALS AND METHOD

Abattoir waste (AW) was collected at Bodija abattoir in Ibadan, Oyo State, Nigeria where 250 to 300 cattle, 30-50 sheep and goats were slaughtered daily. Collection and processing were done on daily basis. Part of the waste was oven dried at 65°C for 48 hours while the remaining part was sun- cured on a clean concrete platform until crispy. Samples were kept in jute bags and put in the silo to monitor storage effect for 6 weeks, other samples were taken and kept in air tight sample bottles for the determination of nutrient composition (AOAC 2000),.Sun cured sample was used to compound concentrate rations for goats because of the high cost involved in oven drying. Concentrate rations were formulated such that 0% (A), 35% (B), 70% (c) and 100% (D) of soybean meal; a conventional but expensive foodstuff, were replaced with sun-cured AW. All diets were approximately isonitogenous (161 - 171 g CP Kg^{-1} DM) and Isocaloric (3.39 - 3.64 Mcal GE Kg^{-1} DM). 16 WAD bucks of 5-7 months old weighing 6.5 $\pm$ 1.5 kg were purchased from nearby villages. They were dewormed (with Banmith F ®), treated against mange (with Ivomec) and dipped to destroy external parasites (with Asuntol), before allotting to individual pens, which were properly wash, disinfected and wood shavings placed on the floor for bedding. The animals were randomly assigned to the diets with 4 replicates per diet in a completely randomized design (CRD). The experimental diets, wilted grass (*Panicum maximum*) and clean water were offered at 9:00 every morning. Any left over was weighed and discarded the following morning. Voluntary intake was estimated as the difference between feed offered and feed refused. Wood shavings were replaced once a week. The experiment lasted for 28 days. Blood was collected at the end of the 4 weeks at 8:00 hr by jugular venipuncture. Blood for haematological parameters was collected into sterilized bottles containing ethylene diamine tetra-acetic acid (EDTA) at 1.5 mg/ml of blood as anti coagulant while those for serum metabolites were allowed to clot. Serum samples were recovered by centrifugation. All samples were taken immediately to the laboratory for analysis according to Schalm (1965). Finally the animals were slaughter at the end of the 28 days period by severing both the jugular veins and carotid artery at the atlanto occipital articulation and properly bled. Internal organs were separated and individually weighed, using a sensitive kitchen scale. All data collected were analyzed using the general linear model (GLM) procedure of SAS (1990).

RESULTS AND DISCUSSION

Effect of processing and storage on chemical constituents of Abattoir Waste

The result in Figures 1and 2 show that the crude protein (CP) content of both sun-cured and oven dried samples increased with storage time while the values of ether extract (EE) decreased with storage time. Dry matter content was unstable during the period. This instability of DM might probably be due to changes in atmospheric temperature and relative humidity of the storage environment. The trend observed in the values of CP and EE is similar to the work of Kjeldsen *et al* (1983) which showed that total volatile nitrogen content of fishmeal increases with storage time. However, Hussein and Jordan (1991) were of a contrary view that during storage, fish spoilage due to autolysis, lipolysis and microbial actions results in soft degraded flesh with low crude protein and high fat contents. The changes observed in CP and EE contents of sun-cured AW were more pronounced than that of the oven-dried sample. This might probably be because some of the bacteria and enzymes causing these changes might have been destroyed during oven drying process and the oven-dried samples had little or no support for bacterial and enzymatic actions.

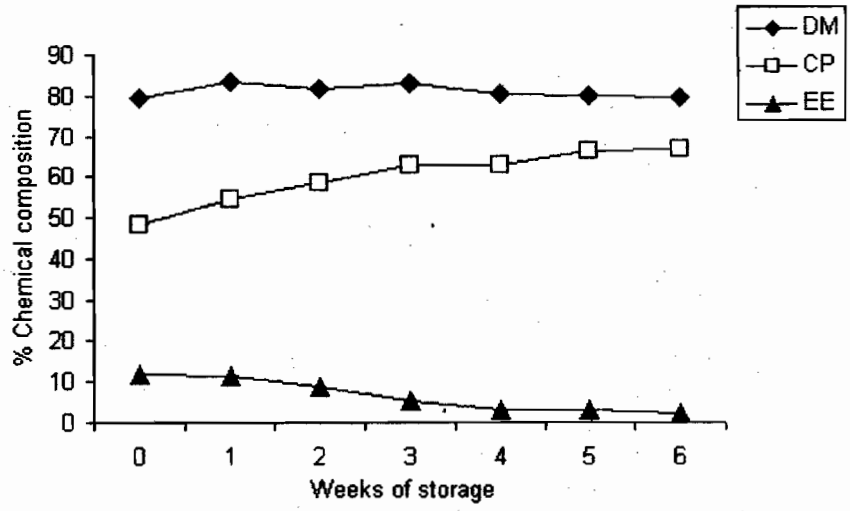

Figure 1: Effect of storage period on Chemical composition of sun-cured abattoir wastes

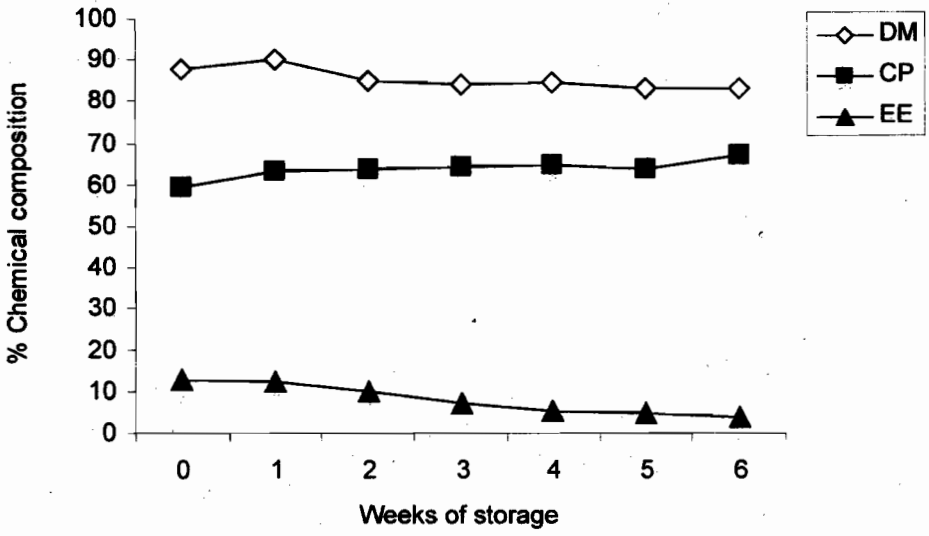

Figure 2: Effect of storage period on chemical composition of oven-dried abattoir waste

TABLE 1: Nutrient composition of Abattoir Waste-based rations (%)

PARAMETER	SBM	SUNCURED AW	A	B	C	D
DM	84.80	89.45	85.55	85.19	84.94	85.53
CP	51.00	62.49	16.13	16.95	17.82	17.72
CF	6.48	1.57	-	-	-	-
ADF	-	-	20.73	19.84	21.85	21.23
NDF	-	-	37.38	36.98	38.07	38.30
EE	6.19	4.98	2.24	5.25	8.16	7.63
ASH	4.75	3.54	5.00	7.50	11.00	13.00
GE(Mcal/kg)	4.329	3.500	3.604	3.642	3.390	3.594

SBM: Soybean meal

Acceptability of feed by goats

Table 1 summarizes the voluntary feed intake of animals on DM basis. Grass voluntary consumption of goats on rations C and D were similar but higher than goats on ration A. Those on ration B voluntarily consumed the least amount. The voluntary concentrate intake of the animals on the various rations showed no significant difference (P>0. 05). These observations suggest that the various rations were palatable to the goats. The % of concentrate per total intake ranged from 91.31% to 92.21%. This further support the fact that the various concentrations were well accepted by the goats, since they had unrestricted access to both grass and concentrate. This acceptance could be due to the processing of AW before incorporation into diet. According to FAO (1982) and Reddy & Reddy (1992) processed animal wastes are wholesome in appearance taste and smell, and they do not have their original characteristics. Acceptance could also be due to the contribution of other ingredients used to compound the rations. Total intake as % body weight ranged from 3.3 to 4.1%. This is within normal range as animals are expected to consume between 3 to 5% of their body weight as dry matter for proper performance. (Steele, 1996)

Table 2: Voluntary feed intake of goats fed Abattoir Waste based diets

PARAMETER	A	B	C	D	SE
	DM intake (g DM/day/kg $^{0.75}$)				
Grass	5.92^{ab}	5.06^{b}	6.18^{a}	6.21^{a}	2.90
Concentrate	64.98	59.87	64.91	66.97	2.90
Total	70.90	64.93	71.09	73.18	10.17
Conc./Total(%)	91.65	92.21	91.31	91.43	0.41
Total as %BW	4.00	3..30	4.00	4.10	0.39

^{a,b} Means in the same column with different superscripts are significantly different P<0.05

Haematological profile of Goats

Haematological values of goats are shown in Table iii. Variations observed in haematological indices due to dietary treatments were significant. Goats on ration B had the highest value of PVC, Hb and RBC (30.67%, 11.60g/100ml and 15.50 10^{6} l respectively except for total WBC (8800.00 10^{3} l). The mean WBC values increased with increasing levels of AW inclusion in the diet. This might suggest a reaction in the animals, making them to produce antibodies, or WBC to fight against any infection that might occur as a result of feeding AW. In this study, however neither health nor behavioural traits were affected by the experimental rations as the values obtained were within normal ranges (Schalm, 1965). The mean higher Hb value recorded for animals on ration B are indicative of higher oxygen carrying capacity The result obtained in this study is comparable to the report of other researchers (Binta *et al*, 1996,)

Table 3: Haematological profiles of goats fed Abattoir Waste-based diets

PARAMETER	A	B	C	D	SE
DMI	366.70^{c}	355.67^{d}	374.67^{b}	403.33^{a}	4.56
PVC	26.33^{c}	30.37^{a}	27.67^{b}	30.00^{a}	0.58
Hb	9.97^{d}	11.60^{a}	10.40^{c}	11.00^{b}	0.21
RBC	13.43^{c}	15.50^{a}	13.20^{c}	14.90^{b}	0.32
Total WBC	8966.67^{c}	8800.00^{d}	10966.67^{b}	11266.67^{a}	324.3

^{a,b,c,d}Means in the same column with different superscripts are significantly different P<0.05

Serum metabolites of Goats

The mean values of serum metabolites of goats were shown in Table 4. Total protein in the blood of animals on ration B (6.60g/100ml) was significantly higher (P<0.05) than those on rations A, C and D (6.40, 6.30, 6.33 g/100 ml respectively). Though animals on dietary treatment B had the highest total protein in the blood, yet DM intake was lowest. This might suggest that the protein consumed by the animals is well digested and assimilated into the blood. This observation is supported by the report of Tewe and Maner (1980). The different ratios had no significant effect on serum globulin levels. This further substantiates the safety and nutritional adequacy of feeding the abattoir waste and this indicates that massive infection did not occur when it was fed. Lower values were obtained in the study of Kamalu et al., (1988). Urea levels were significant while creatinine levels were not. Animals on ration B had lowest urea level while highest level was observed in ration C. Aletor and Ogunyemi (1998) reported an increase in blood Urea values with increasing levels of fishmeal replaced with SBM. The high urea and creatinine values observed in this study for animals on diet C could be attributed to (1) Energy deficiency as revealed by the gross energy content of the various rations table ii: (3.604, 3.642 3.390 and 3.594 Mcal/Kg DM for rations A, B, C and D respectively, as against the value of 4.2 to 4.4 Mcal / kgDM reported by Lu et al, (1989). Ration C had the lowest energy content resulting in the mobilization of tissue protein to provide energy (2) Amino acid imbalance as suggested by the findings of Kumta and Harper (1982) that amino acid imbalance raises blood urea levels. Adejinmi and Akinboade (1999) reported lower blood urea levels for normal WAD goats and higher creatinine levels than that obtained in this study. The mean serum cholesterol value for goats on ration B was highest (120mg/100ml) while those on ration C had the lowest mean value (95.0 mg/100ml). Although, serum cholesterol values of goats used in this study agreed with those in standard goats; 80 - 130mg/100ml. (Stahr, 1977), they were substantially higher than those reported for WAD goats and pygmy goats by Kamalu *et al.* (1988) which was 53.35 to 62.45 mg/100ml.

Table 4: Serum metabolites of Goats fed Abattoir Waste-Based diets

PARAMETER	A	B	C	D	SE
DMI (g/day)	366.70^{c}	355.70^{d}	374.70^{b}	403.30^{a}	4.56
Urea (mg/100ml)	37.70^{b}	35.00^{b}	42.30^{a}	37.00^{b}	0.96
Creatinine (mg/100ml)	0.53	0.50	0.80	0.87	0.05
Cholesterol (mg/100ml)	113.30	120.00	95.00	115.00	3.16
Total Protein (g/100ml)	6.40^{b}	6.60^{a}	6.30^{b}	6.30^{b}	0.04
Albumin (g/100ml)	3.00	3.10	3.00	3.10	0.02
Globulin (g/100ml)	3.30	3.30	3.20	3.20	0.02

^{a,b,c,d}Means in the same column with different superscripts are significantly different P<0.05

Internal organ weights of Goats

Table 5. Shows the mean weights (g) of internal organ of animals on the different experimental ration. Spleen weight was highest (P<0.05) for animal on ration B (22.2g), while ration C had the least value (20.0g). Goats on ration D had highest (P<0.05) mean weight of heart. Organs performing digestive function such as pancreas, bile and liver are heaviest in animals on ration A. this might be indicative of the high level of fat in the

diet, which these organism had to work upon during lipogenesis. Treatment effect on the weight of omental fat was highest in animals on ration A and least in those on ration D. This result is highly correlated with the quantity of AW in the diet. i.e. the quantity of AW in the ration is inversely related to the weight of omental fat. The goats on ration A with sole SBM were able to lay up more fat as omentum than those on other rations. This value however, is lower than that obtained by Okello (1994).

Table 5: Internal organ weights of goats fed Abattoir Waste-based diets (g)

	Diets				
PARAMETER	A	B	C	D	SE
Heart	61.80^{b}	59.80^{c}	59.60^{c}	$67.5.0^{a}$	0.97
Kidney	45.10^{a}	40.50^{d}	41.60^{c}	43.70^{b}	0.55
Spleen	21.00^{c}	22.20^{a}	20.00^{d}	21.60^{b}	0.27
Pancreas	104.70^{a}	97.70^{b}	95.70^{c}	91.20^{d}	1.47
Bile	18.30^{a}	16.80^{ab}	16.60^{b}	16.80^{ab}	0.30
Liver	300.00^{a}	208.70^{c}	208.80^{c}	230.20^{b}	11.31
Omental fat	250.30^{a}	90.80^{b}	75.20^{c}	63.00^{d}	22.90

^{a,b,c,d}Means in the same column with different superscripts are significantly different $P<0.05$

CONCLUSION

In conclusion, although the chemical composition of oven dried abattoir waste tends to be more stable during storage in the silo than sun-cured samples, most local farmers might not be able to afford the adoption of the method, therefore, the sun curing processing method was used in the Animal studies. The voluntary intakes of the experimental animals were quite encouraging. The results of both the haematological and serological studies indicated that animals on ration B had the best blood profile, which was better than the control treatment (ration A), while animals on ration C had the poorest profile. From these observations, it could be deduced that replacement of SBM with RW above 35% might not support good performance and production in goat nutrition.

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