feed for ruminants. The objective of this study was to establish the effect of processing and storage on chemical composition of the waste, the acceptability by goat, haematological, serum chemistry and organ weights of goats fed abattoir waste-based ration.

MATERIALS AND METHODS

Abattoir waste was collected at Bodija abattoir in Ibadan, where between 250 to 300 cattle, 30-50 sheep and goats were slaughtered every day. Collection and processing was done on daily basis. Part of the waste was oven dried at 65°C for 48 h while the remaining part was sun-cured on a clean cemented platform until crisp. 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[1], while the remaining were used to compound concentrate rations for goats. Concentrate rations were formulation such that 0 (A), 35 (B), 70 (c) and 100% (D) of soybean meal; a conventional but expensive foodstuff, were replaced with sun-cared 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±1.5 kg were purchased from nearby villages, they were dewormed (with Banmith F ®), treated against manage (with ivomec) and dipped to destroy external parasites (with Asuntol), before allotting them to individual pens which were properly wash, disinfected and wood shavings were 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 h by jugular veni puncture. Blood for hematological parameters was collected into sterilized bottles containing Ethylene Diamme-Tetra-Acetic acid (EDTA) at 1.5 mg mL^{-1} 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[2]. 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[3].

RESULTS AND DISCUSSION

Effect of processing and storage on chemical constituents of abattoir waste: The result in Fig. 1and 2 show that the Crude Protein (CP) content of both sun-cured and oven dried samples increases with storage time while the values of Ether-Extract (EE) decreases 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[4] which sate that total volatile nitrogen content of fishmeal increases with storage time. However Hussein and Jordan[5] 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.

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 Reddy and Reddy[6] 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

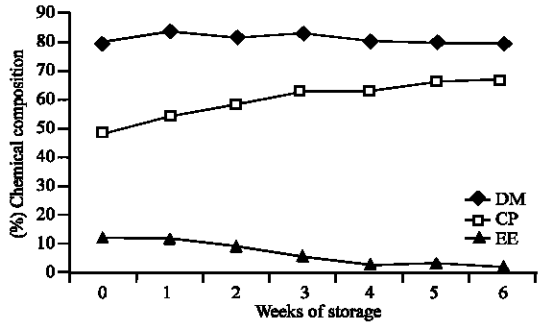

Fig. 1: Effect of storage period on chemical composition of sun-cured abattoir wastas

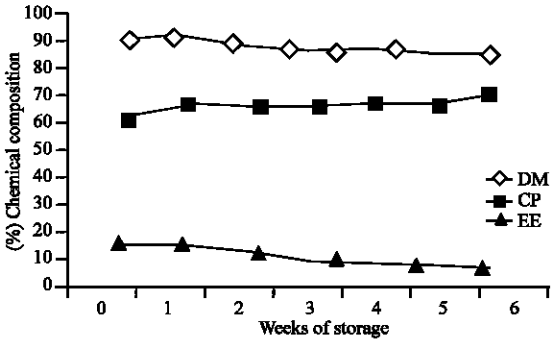

Fig. 2: Effect of storage period on chemical composition of oven-dried abattoir wastas

Table 1: Voluntary feed intake of goats fed AW-based diets

	DM intake C(gDM/day/kg 0.75)				
ITEM	A	B	C	D	SE
Grass	5.92ab	5.06b	6.18a	6.21a	2.90
Concentrate	64.9800	59.870	64.910	66.970	2.90
Total	70.9000	64.930	71.090	73.180	10.17
Conc./Total(%)	91.6500	92.210	91.310	91.430	0.41
Total as %BW	4.0000	3..30	4.000	4.100	0.39

Means in the same column with different subscripts are significantly different $p<0.05$

Table 2: Nutrient composition of AW-based rations (%)

Items	SBM	Sumcured AW	A	B	C	D
DM	84.80	89.450	85.550	85.190	84.940	85.530
CP	51.00	62.490	16.130	16.950	17.820	17.720
CF	6.48	1.570	-	-	-	-
ADF	-	-	20.730	19.840	21.850	21.230
NDF	-	-	37.380	36.980	38.070	38.300
EE	6.19	4.980	2.240	5.250	8.160	7.630
ASH	4.75	3.540	5.000	7.500	11.000	13.000
GE(Mcal/kg)	4.329	3.500	3.604	3.642	3.390	3.594

Table 3: Haematological profiles of goats fed AW-based diets

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

Means in the same column with different subscripts are significantly different $p<0.05$

as% body weight ranged from 3.3 to 4.1%. This is within normal range as animals are expected to consume between haematological indices due to dietary treatments were significant. Goats on ration B had the highest value of PVC, Hb and RBC (30.67%, 11.60 g/100 mL and 15.50 10^6 3 to 5% of their body weight as dry matter for proper performance[7].

Haematological profile of goats: Hematological values of goats are shown in Table 2. Variations observed in µL, respectively except for total WBC (8800.00 10^3 µL). 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[2]. 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[8].

Serum metabolites of goats: The mean values of serum metabolites of goats were shown in Table 3. Total protein in the blood of animals on ration B (6.60 g/100 mL) 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[9]. The different ration 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[10]. 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[11] 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 4: (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[12]. Ration C had the

Table 4: Serum metabolites of goats fed AW-based diets

Items	A	B	C	D	SE
DMI (g/day)	366.70c	355.70d	374.70b	403.30a	4.56
Urea (mg/ 100 mL)	37.70b	35.00b	42.30a	37.00b	0.96
Creatinine (mg/100 mL)	0.530	0.500	0.800	0.870	0.05
Cholesterol (mg/100 mL)	113.300	120.000	95.000	115.000	3.16
Total protein (g/100 mL)	6.40b	6.60a	6.30b	6.30b	0.04
Albumin (g/100 mL)	3.000	3.100	3.000	3.100	0.02
Globulin (g/100 mL)	3.300	3.300	3.200	3.200	0.02

Means in the same column with different subscripts are significantly different $p<0.05$

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

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

Means in the same column with different subscripts are significantly different $p<0.05$

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[13] that amino acid imbalance raises blood urea levels. Adejinmi and Akinboade[14] 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 (120 mg/100 mL) while those on ration C had the lowest mean value (95.0 mg/100 mL). Although, serum cholesterol values of goats used in his study agreed with those in standard goats; 80-130 mg/100 mL Stahr[15]. They were substantially higher than those reported for WAD goats and pygmy goats by Kamalu[10] which was 53.35 to 62.45 mg/100 mL. 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 (22.2 g), while ration C had the least value (20.0 g). 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[16].

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 hematological 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.chemical compositions of oven-dried abattoir waste is higher than sun-cured sample. DM was not stable during storage. However diets containing sun-cured AW were equally accepted by the animals as no significant difference was observed in their intake. Neither health nor behavioral 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 convectional but highly expensive feedstuff, in the diet of ruminant livestock.

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