COMPARATIVE UTILIZATION OF SEWAGE SLUDGE, POULTRY DROPPINGS AND GROUNDNUT CAKE RATIONS BY WEST AFRICAN DWARF GOATS

*OKAGBARE G.O. AND AKINSOYINU A.O.

Department of Animal Science, University of Ibadan, Ibadan; Oyo State, Nigeria

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ABSTRACT

Eighteen young West African dwarf (WAD) goats were used to compare the utilization of sewage sludge, poultry droppings and groundnut cake rations by WAD goats.

Total dry matter intake of the animals fed diet A (groundnut cake based ration) and C (poultry droppings based ration) was significantly ($P < 0.05$) higher than dry matter intake of animals fed diet B (dry activated sewage sludge based ration). Total dry matter intake of animals fed diet A (664.6 g/day) appeared to be higher than those fed diet C (600.5g/day), although the differences observed were not significant. Values observed for apparent dry matter, ether extract and nitrogen-free extract digestibilities between animals fed the different diets were not significant ($P > 0.05$). Crude fibre and crude protein digestibility values however varied appreciably. Values recorded (12.03, 1.04 and 10.42 g/day; and 3.13, 0.28 and 2.72 g/day/ $W^{0.75}$ Kg for animals fed diets A, B, and C respectively) for nitrogen balance and weight gains (56.8, -2.7 and 36.8 g/day for animals fed diets A, B and C respectively) were higher for animals fed diet A, followed by animals fed diets C and B respectively.

Keywords: Protein utilization, groundnut cake, poultry droppings, sewage sludge, WAD goats.

INTRODUCTION

In the preparation of goat ration, the protein sources is one of the most expensive ingredient. The prices of fish meal and groundnut cake, the conventional sources of

protein in livestock ration, have risen exorbitantly in recent times, thus making the search for alternative sources of protein imperative.

The utilization of non-protein nitrogen by ruminants gives them a special advantage. Diets containing poultry waste have been fed to cattle (Harmon, Fontenot and Webb, 1975 and Smith, 1973, Balewu and Adeneye 1996); Sheep (Hamblin, 1980, Kanc and Paliev, 1981; Adeyemo, 1984; Adegbola, Smith and Okcudo, 1990; Taiwo, Adebawale, Akinsoyinu and Greenhalgh, 1995, Adebawale and Taiwo, 1996) and goats (Abasiokong, 1987; Adebawale and Taiwo, 1996). Activated Sewage sludge has also been used in compounding ration for cattle (Sridhar and Pillai, 1973; Bertrand, 1980) and sheep (Hackler, Heuman, Hatfield and Johnson, 1957).

Presently, poultry wastes and activated sewage sludge have not attracted any market value and information on their use in goat ration is limited. The inclusion of activated sewage sludge and poultry wastes in goat ration, will serve as a means of disposing the huge amount of these wastes, a reduction in environmental pollution, decrease feed cost and increase the supplies of available nitrogen and essential mineral sources. The study was therefore designed to investigate the possible utilisation of activated sewage sludge and poultry droppings in goat ration.

MATERIALS AND METHODS

Eighteen West African dwarf goats aged 5 - 6 months and weighing 5.3 - 6.4kg were used for the experiment. The eighteen animals were equally divided at random into three groups - A, B and C. The animals were dewormed with Thiobendazone at the beginning of the study.

*Present Address: Department of Animal Science, Delta State University, Asaba Campus, Asaba, Delta State.

TABLE 1: PERCENTAGE COMPOSITION OF EXPERIMENTAL DIETS

INGREDIENTS	DIETS		
	A	B	C
Cassava Flour	49.5	37.0	32.5
Dried Activated Sewage Sludge	-	37.5	-
Poultry Droppings	-	-	42.0
Groundnut Cake	25.0	-	-
Dried Brewers Grain	25.0	25.0	25.0
*Vitamin - Mineral Mixture	0.25	0.25	0.25
Common Salt	0.25	0.25	0.25
Calculated Crude Protein (%)	14	14	14
Total	100.0	100.0	100.0

* Contain Per kg: 7,500,000 iU Vitamin A, 1,500,000 iU Vitamin D₃, 1000 mg Vitamin B₁, 2750 mg B₂, 5 mg B₁₂, 5000 mg D - Calcium pantothenate, 2500 mg Vitamin E, 1500 mg Vitamin K, 12,000 mg niacin, 60,000 mg choline chloride, 5000 mg ethoxyquin, 16,130 mg KI, 286 mg Cobalt Sulphate, 12,500mg Zinc Oxide, 1283 mg Copper oxide, 20,323 mg Ferrie carbonate.

TABLE 2: PROXIMATE CHEMICAL COMPOSITIONS (g/100g DM) OF EXPERIMENTAL DIETS

Diets	Nutrient Composition					
	Dry Matter	Crude protein	Crude fibre	Ether extract	Nitrogen free extract	Ash
Diet A	94.0	14.4	9.5	2.0	68.1	6
Diet B	97.0	14.8	25.7	2.5	23.5	33.5
Diet C	98.3	14.2	18.8	3.5	55.0	8.5
Grass	62.1	6.8	51.9	1.5	34.9	5.0
Dried Activated Sewage Sludge (DASS)	94.0	27.7	6.9	4.0	15.2	40.0
Poultry Wastes (PW)	90.5	25.4	1.8	20.8	22.2	20.3

Diet A = Diet containing groundnut cake
 Diet B = Diet containing dried Activated Sewage Sludge
 Diet C = Diet containing Poultry Wastes

Three isonitrogenous rations (14% crude protein) were compounded in such a way that groundnut cake, sewage sludge or poultry wastes served as the source of nitrogen (Table 1). Diet A (containing groundnut cake) served as control diet. The dried activated sewage sludge was collected from the University College Hospital, Ibadan sewage treatment plant. While the poultry droppings were collected from the layer unit of the University of Ibadan Teaching and Research Farm and air dried. Each group comprising six animals was placed on each ration fed as supplement to grass (*Cynodon nlemfuensis*). The goats were kept in individual metabolic cage designed for the separate collection of faeces and urine. Each animal had access to fresh water daily.

The trial lasted 21 days, a 14 day adaptation

period being followed by a collection period of 7 days. Animals were weighed before and after the experimental period. Urine and faeces were collected each morning before morning feeding. Urine was collected from each animal in bottles wetted with 2 - 3 ml of 10% Mercuric chloride. The daily urine volume was measured and 10% of the total bulked for each animal and stored in a deep freezer at -5°C until required for chemical analysis. A 10% sample of the faeces voided per day was dried in a forced - draught oven at 70°C for 24 hours. These daily stored samples were then bulked, thoroughly mixed, ground and sub-sampled for chemical analysis.

Proximate analysis of feed and faeces samples were determined and urine samples were analysed for nitrogen (AOAC, 1984). Results were statistically evaluated by analysis

TABLE 3: LIVEWEIGHT CHANGES, FEED AND NUTRIENT UTILIZATION BY GOATS FED DRIED ACTIVATED SEWAGE SLUDGE, POULTRY WASTES AND GROUNDNUT CAKE BASED DIETS AS SUPPLEMENT TO GRASS.

Parameters	A	Experimental Diets		SEM
		B	C	
Initial Liveweight (Kg)	6.03 ^d	5.5 ^d	6.0 ^d	0.40
Final Liveweight (g/day)	7.22 ^d	5.44 ^b	6.77 ^c	0.76
Changes in liveweight (g/day)	56.8 ^d	-2.7 ^b	36.8 ^c	2.73
Dry matter intake from supplement (g/day)	597.9 ^d	218.3 ^b	530.0 ^c	6.86
Dry matter intake from grass (g/day)	66.6 ^d	103.4 ^b	70.5 ^a	5.5
Total dry matter intake (g/day)	664.6 ^d	321.7 ^b	600.5 ^a	7.36
Total -N intake (g/day)	14.49 ^d	6.30 ^b	12.80 ^a	1.73
Faecal -N (g/day)	1.40 ^d	2.75 ^b	1.34 ^a	0.63
Urinary -N (g/day)	1.06 ^d	2.5 ^b	1.04 ^a	0.36
N-balance (g/day)	12.03 ^d	1.04 ^b	10.42 ^a	1.20
N-balance (g/day/WKg ^{0.75})	3.13 ^d	0.28 ^b	2.72 ^a	0.43
Apparent Nutrient Digestibility (%)				
Dry matter	84.69 ^d	82.13 ^a	77.7 ^a	3.26
Crude protein	90.33 ^d	56.64 ^b	89.53 ^a	2.76
Ether extract	70.8 ^d	82.33 ^a	82.9 ^a	6.86
Crude fibre	72.13 ^d	86.0 ^b	69.32 ^a	3.76
Nitrogen-free extract	88.89 ^d	83.8 ^a	88.6 ^a	2.16

abc Means along the same row with different superscripts were significantly different ($P < 0.05$).

of variance (Steel and Torrie, 1980) and the Duncan Multiple Range test was used to detect differences among means.

RESULTS

Total dry matter intake of the animals is shown in Table 3. Total dry matter intake of animals fed diets A (groundnut cake based ration) and C (poultry droppings based ration) was significantly ($P < 0.05$) higher than dry matter intake of animals fed diet B. (dry activated sewage sludge based ration). Total dry matter intake of animals fed diet A appeared to be higher than those fed diet C, although, the differences observed were not significant ($P > 0.05$).

The variations observed (Table 3) for apparent dry matter, ether extract and nitrogen-free extract digestibilities between animals fed the different diets were not significant ($P > 0.05$). Crude fibre and crude protein digestibility values however varied appreciably. An appraisal of the results showed that the higher crude fibre digestibility values were recorded for goats fed diet B, followed by those fed diets A and C

respectively. Crude protein digestibility values recorded for animals fed diet B were significantly ($P < 0.05$) lower than those fed diets A and C.

Table 3 shows the summary of nitrogen utilization by the goats. Animals fed diets A and C had higher ($P < 0.05$) total nitrogen intake than those fed diet B. Nitrogen balance values, (g/day and g/day/WKg^{0.75}) were lower ($P < 0.05$) for animals fed diet B compared with those fed diets A and C. However, values recorded for weight gains, nitrogen balance (g/day and g/day/WKg^{0.75}) were higher for animals fed diet A than those fed diet C. Animals on diet B, were losing weight at the rate of 2.7 g/day.

DISCUSSION

The dry matter (62.1%) and crude protein (6.8%) contents recorded for the giant star grass (*Cynodon nlemfuensis*) in the present study were in agreement with values obtained in similar studies (Akinsoyinu, 1974) while the crude fibre content was higher. This is probably due to differences in the stage of maturity of the grass as at the time of harvest, because fibre content of forage tend to

increase as forage matures and lignification increases (Olubajo and Aken'Ova, 1985; Cleale and Bull, 1986).

Animals fed groundnut cake and poultry wastes based rations had higher dry matter intake than those fed the dried activated sewage sludge based ration. This suggests that the diet containing dried activated sewage sludge was not palatable, probably due to its high ash content. However, values observed for dry matter intake by the goats from concentrate supplements were higher than from grass. This suggests that the goats prefer the supplement diets to grass, since they had an unrestricted access to both grass and the concentrate supplements.

Animals fed ration containing dried activated sewage sludge appeared to have higher crude fibre digestibility values compared to those fed the other diets. This is probably due to the lower dry matter intake of animals fed dried activated sewage sludge based diets resulting in longer exposure time of feed to rumen fermentation.

Animals on groundnut cake based ration had higher values for weight gains (56.8g/day) than those fed ration containing poultry wastes (36.8 g/day). This tends to agree with the findings of Abasiokong (1987) and suggests that groundnut cake is a better source of nitrogen for young goats than poultry wastes. However, the values recorded for weight gains for goats fed diets containing poultry wastes in this study is higher than the value of 28.4g/day recorded by Adebawale and Taiwo (1996) for WAD goats fed diets containing 15 percent poultry litter. Four of the animals fed dried activated sewage sludge based ration had negative nitrogen balance values, resulting from high urinary nitrogen excretion. This suggests inadequate energy intake resulting in the mobilisation of tissue proteins to provide energy.

The result of this study suggests poor intake of ration containing dried activated sewage sludge by growing goats. However, the inclusion of poultry wastes up to 42% has no adverse effect on feed intake, nutrient utilization and health of growing goats, as no

health problem was observed during the experimental period. This agrees with the 40% maximum level of inclusion of poultry waste recommended by other workers (Taiwo *et al* 1995) in the ration of West African dwarf sheep.

REFERENCES

- ABASIEKONG, S.F. (1987). "Effect of supplementary urea, poultry waste and groundnut cake on growth, feed intake and nutrient digestibility of West African dwarf goat fed cereal residue based diets under practical tropical conditions". A paper presented at the 12th Annual Conference of the Nig. Soc. of Anim. Prod., University of Ibadan.
- ADEGBOLA, A.A., SMITH, O.B. and OKEUDO, N.J. (1990) "Response of WAD sheep fed cassava peels and poultry manure based diets". In: utilization of research results on forages and Agricultural by-product materials as animal feed resources in Africa. (Eds. Dzowela, B.H., Said A.A. Wondem - Agenehu, A. and Kategile, J.H.) ILCA Addis Ababa pp. 357 - 366.
- ADEBOWALE, E.A. and TAIWO, A.A. (1996) "Utilization of crop residues and agro-industrial by-products as complete diets for West African dwarf sheep and goats. *Nig. J. Anim. Prod.* 23(2) 153 - 160.
- ADEYEMO, A.I. (1984) "Effects of the replacement of groundnut cake with poultry droppings on feed intake, digestibility of nutrients and weight gain of sheep". *M.Sc. Thesis*: University of Ibadan.
- AKINSOYINU, A.O. (1974) "Studies on protein and energy utilization of West African dwarf goats". *Ph.D. Thesis*: University of Ibadan.
- A.O.A.C. (1984): *Official Methods of Analysis* 14th Ed. Washington D.C.
- BELEWU, M.A. and ADENEYE, J.A. (1996) The effects of broiler litter as protein source on the performance of Bunaji (White Fulani)

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- bull calves." *Nig. J. Anim. Prod.* 23(1) 66 - 71.
- BERTRAND, A. (1980). "Effect of dried digested sludge on corn grown on soil treated with liquid digested sludge on performance, Carcass quality and tissue residue in beef steers". *J. Anim. Sci.* 50: 1 - 36.
- CLEALE, R.M. and BULL, L.S. (1986). "Effect of forage maturity on ration digestibility and production by dairy cows". *J. Dairy Sci.* 69: 1587 - 1594.
- HACKLER, L.R., NEUMANN A.L., HATFIELD E.E. and JOHNSON B.C. (1957). "Dried Activated Sewage Sludge as nitrogen source for ruminants". *J. Anim. Sci.* 16 (4) 1090 (Abstr.)
- HAMBLIN, D.C. (1980). "Commercially processing and selling poultry waste as feed ingredients". *J. Anim. Sci.* 50 (2) 342 - 344.
- HARMON, B.W., FONTENOT, J.P. and WEBB K.E. (1975). "Ensiled broiler litter and corn forage 2. Digestibility, nitrogen utilization and palatability by sheep". *J. Anim. Sci.* 40: 156 - 161.
- KANE AND P, ALIEV, (1981): "Meals of dried Poultry litter and pigs faeces for fattening weaned lambs". *J. Anim. Sci.* 36: 22 - 28.
- OLUBAJO, F.O and AKENOVA M.E. (1985). "The voluntary intake and digestibility of sheep on *Pennisetum Purpureum* (SHUM) and of three interspecific F1 hybrid genotypes" *Nig. J. Anim. Prod.* 12:79.
- SMITH, L.W (1973) "Recycling animal wastes as protein sources". *Proc. Nat. Acad. Sci.* Washington D.C. 146 - 173.
- SRIDHAR, M.K.C. and PILLAI S.C. (1973). "Protein activity in sewage sludge and effluent". *Water and Waste Treatment U.K.* 16: 35 - 42.
- STEEL, R.G.D. and TORRIE J.H. (1980). *Principles and Procedure of Statistics.* McGraw-Hill Book Co., New York.
- TAIWO, A.A., ADEBOWALE E.A., AKINSOYINU A.O. and GREENHALGH J.F.D. (1995). "Comparative study on the use of four protein supplements by WAD sheep, *Nig. J. Anim. Prod.* 21: 68 - 75.