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COMPARATIVE EVALUATION OF GROWTH AND INGESTION BEHAVIOUR OF WEST AFRICAN DWARF SHEEP AND GOATS UNDER THREE FEEDING SYSTEMS

P.O. OGEBE[1], E.J. AKO[1] AND A.O.K. ADESEHINWA[2]
[1]Department of Animal production, Unversity of Agriculture, P.M.B. 2373, Markurdi, Benue State, Nigeria
[2] National Agriculture Extension and Research Liaison Services, Ahmadu Bello University, South West Zone, Ibadan, Nigeria.

Target Audience: Sheep and goat rearers, farmers, extensionists

ABSTRACT

A study was conducted with nine rams and nine bucks under three feed management systems namely: tethering, zero grazing and tethering with supplementation, to compare body and growth performances and ingestion parameters of West African Dwarf (WAD) sheep and goats. The sheep were aged between 7-8 months and weighed between 11.50- 12.50kg (mean, 11.83 +- 6.83kg), while the goats were aged 7-8 months and weighed between 7.00-7.50 kg (mean= 7.17± 0.01kg). Each feeding management regime was randomly allotted three sheep and three goats.

Sheep performed consistently better (P<0.05) in body weight gains,compared to goats at 0-4 weeks of study (or>12 months of age) under all feeding management. Zero grazing or tethering with supplementation resulted in better animal responses, also at 0-4 weeks of study. Body weight gains improved more (P<0.05) from 5 weeks of study. and above (or 12 months of animal age and above) under tethering feeding management in both sheep and goats, compared to zero grazing and tethering with supplementation. The pattern for thoracic girth was similar to that of body weight at 0-4 weeks of study across all feed management systems. Also, from 5-8 weeks, and from 9-12 weeks, the weekly changes in thoracic girth of 0.35cm (or 0.5mm/day). and 0.94cm (or 1.34mm/ day) obtained in the tethered sheep and in goats supplemented under tethering, respectively indicated that these feeding managements led to better (P<0.05) performances of experimental animals, compared to zero grazing. Weekly changes in withers height followed the pattern of body weight changes. Sheep performed (P<0.05) better in all the feeding management across the study period, compard to goats. From 5 weeks onward, tethering management, followed by tethering with supplementation led to greater (P<0.05) height improvement, compared to zero grazing.

Compartively,sheep receiving supplement under tethering performed significantly (P<0.05) better in daily dry matter intake (40.9g\kgW$^{.75}$), rumination rate (80 chews min^{-1}) and drinking duration (18 Sh^{-1}). Longer unitary eating time (min\gDM\ KgW^{15}) was spent in the goats under zero grazing (4.0) and in tethered goats receiving supplementation (5.0). Meal exploration was longest (1 sec) in both sheep and goats under tetheting and shortest (0.5 sec.) under tethered animals receiving supplementation. Both sheep and goats exhibited high forage selectivity across all feeding management. Refusal rate was highest (30%) among goats raised under

the zero grazing management system No differences existed in daily time spent ruminanting, on free water intake and drinking frequency.

Key words: Feed management system, sheep, goats

DESCRIPTION OF PROBLEM

The pressure militating against the practice of the traditional feeding system by small ruminant holders in Nigeria have been enumerated (1,2). Some modification strategies peculiar to the Nigeria situation of the traditional feeding management have been tested with the goats (3,4) but no dates is available on sheep, or a comparative study between these two species of ruminants, for reasons of biological assumed similarity (5). Evidence, however, is accumulating on the unique metabolic differences of sheep and goats.

This study aims at a comparative nutritional evaluation between sheep and goats under three modifications of the traditional feeding management, namely: tethering, zero- grazing and tethering with supplementation.

MATERIALS AND METHODS

A total of nine rams and nine bucks, of theWest African Dwarf breeds were studied under three feeding systems namely tethering, zero-grazing and tethering with supplementation, to evaluate body performances and behavioural parameters related to ingestion. Each feeding system consisted of a random distribution of three males each of sheep and goats. The sheep were aged between 7-8 months and weighed between 11.50-12.50kg (mean 11.83 ± 6.83kg), while the goats were aged 7-8 months and weighed between 7.00- 7.50kg (mean 7.17 ± 0.01kg). Animals were sourced using the methods described (6) and were adjusted for new environment (7).

Management of Animals

In the first treatment involving Zero grazing management, animals were housed individually and were provided with 20% each, of five naturally growing forages identified in the study (Table 1). The forages identified were itch grass *(Roattboella Cohinchinesnsis), Panicum spp* (Guinea grass), *Bracharia spp, Eleusine indica and Pennisetum spp.* Quantities of forages were out and served *ad libitum* daily at 0800 hr and feeds were tied by ropes held to pen walls to mimic position of forage under natural grazing and to reduce contamination from trampling and urine and faecal dropping.

For tethering study, animals were tied by the neck with about 40cm length rope and led out at 0800 hr and randomly tied to pickets at the grazing area among forage species which included *Roattboella cohinchinensis* (itch grass), *Panicum* (Guinea grass), *Bracharia* spp. *Eleusine indica* and *pennisetum spp.* Animals were returned to separate pens at 1800 hr daily.

The third investigation consisted of the procedure involving "tethering", but in addition, experimental animals received a daily 0.5kg each of the five (5) naturally growing forages (making a total of 2.5kg forage) per treatment as overnight supplement (or soilage) after the goats were driven into their pens in the evening.

Cool clean drinking water was provided to experimental animals throughout the experimental period and the study lasted for 70 days (between June 8, 9and August 16 of 1998) during the rainy season.

Records

Animal were observed twice daily at between 0800 hr and 0900 hr and 1700 hr and 1800 hr for feeding behaviour. For tethered animals, observation were carried out and recorded by merely standing at an average distance of 5.0-10.0 metres away from the animals depending on their grazing vigour. For the penned treatments, feeds (2.5kg forages) and refusals (where applicable) were collected daily by samples and weighed as described by (8,9) and dry matter intake determined. Forage composition was determined by proximate analysis (10). Body weight changes (weekly basis) and animal thoracic girth were measured (6).

The data were subjected to analyses of variance (ANOVA). Duncan's Multiple Range (P=0.05) test was used to compare treatment means (11)

RESULTS AND DISCUSSION

Chemical Composition of forage

Table 1 presents chemical composition of forages consumed by sheep and goats. The crude protein contents of forages ranged from 8.16% - 14.36% and the values were similar (P>0.5) for all forages except for the value for *Eleusine indica* (8.16%) which was significantly (P<0.05) lower compared to the other values. The values of crude fibre and ether extract followed a similar trend, while no significant (P>0.05) differences existed in the values of dry matter and ash. The value of NFE was highest (30.47%) in *Bracharia spp* and this was only significantly (P<0.05) higher than the value (24.23%) obtained in *Panicum spp.*

Table 1. Chemical Composition of forages consumed in the study Area(g 100g DM or %).

Forage Sample	Dry Matter	Crude protein	Ether Extract	Crude fibre	Ash	NFE
Roattboella	65.01	8.16^{b}	12.43^{2}	37.39^{2}	10.67	26.37^{b}
Cohinchinensis	70.60	14.36^{a}	8.98^{b}	39.75^{a}	8.35	24.13^{b}
Bracharia spp.	65.86	11.69^{a}	11.92^{a}	30.00^{b}	9.81	30.47^{a}
Eleusine indica	64.46	13.40^{a}	12.62^{a}	34.52^{ab}	8.43	26.34^{b}
Pennisetum spp.	59.26	10.15^{ab}	14.39^{a}	34.48^{ab}	10.56	24.42^{b}

$^{a,b:}$ Means within the same column having different superscripts differ (P< 0.05) significantly.

Body Weight Changes

Table 2 presents the mean weekly changes in body weight (gm) in sheep and goats. At 0-4 weeks of study (or 11-12 months of animal age) sheep performed consistently ($P<0.05$) better compared to the goats in each of the feed management systems. Considering management, zero grazing, followed by tethering with supplementation, resulted in better weight changes in both sheep and goats compared to tethering. The absence of sun heat (as in tethered animals receiving supplementation), may have improved the performance of the relatively younger animals. It has been reported (12,13) that during high ambient temperatures, grazing animals reduce their grazing habit and (where given the choice) seek for shade to ruminate or breathe heavily, a condition similar to panting. It has also been established (7) that as temperature increased, less time was spent consuming food by growing West African Dwarf goats, probably to minimise or curtail body heat production and to keep the body cool. However, from 5-8 weeks (or 9-12 months of animal age), the pattern indicated that sheep performed better under tethering while goats preferred tethering with supplementation for optimum weight gains. This indicates that the species of animal, age and management method affect the performance of grazing sheep and goats on rangeland.

Table 2. Comparison of mean weekly body weight gains (gm) in sheep and goats under three feed management systems

Feed Management System	Experimental Weeks		
	0-4	5-8	9-12
Zero Grazing			
Sheep	0.18 ± 0.07^{a}	0.16 ± 0.13^{cd}	0.21 ± 0.09^{cd}
Goats	0.11 ± 0.06^{b}	0.22 ± 0.03^{bc}	0.09 ± 0.04^{e}
Tethering			
Sheep	0.06 ± 0.16^{c}	0.33 ± 0.19^{a}	$.38\pm0.13^{a}$
Goats	$_0.08\pm0.04^{d}$	0.13 ± 0.02^{d}	0.25 ± 0.03^{c}
Tethering with supplementation			
Sheep	0.14 ± 0.08^{ab}	0.09 ± 0.11^{d}	0.17 ± 0.08^{de}
Goats	0.08 ± 0.08^{c}	0.27 ± 0.15^{ab}	0.27 ± 0.16^{bc}

a,b,c,d,e: Means within the same column having different superscripts differ ($P<0.05$) significantly.

Changes in thoracic girth

Mean weekly changes in thoracic girth (cm) are presented in Table 3. Results obtained followed the pattern of body weight gains, with sheep indicating better ($P<0.05$) performances in thoracic girth compared to goats and under tethering. Goats under zero grazing lost thoracic girth during the

first 4 weeks while those on tethering with supplementation system neither gained nor lost thoracic girth. Advancing age with experimental weeks generally improved animal performances under all the feeding systems, especially in tethering for sheep and tethering with supplementation system for goats.

Changes in Height at Withers

Mean weekly changes in withers height in sheep and goats are presented in Table 4. Sheep maintained its overall superiority ($P<0.05$) in height at withers compared to the goats, and the tethering proved most beneficial. The goats preferred supplementation under tethering for optimum performance, especially at the age below 1 year or 0-4 weeks of study.

Table 3. Comparison of mean weekly changes in thoracic girth (cm) in sheep and goats under three feed management systems.

Feed Management System	Experimental Weeks 0-4	5-8	9-12
Zero Grazing			
Sheep	-0.11±0.06^{d}	0.00±0.00^{d}	0.42±0.09^{b}
Goats	-0.24±0.02^{e}	0.05±0.04^{cd}	0.42±09^{b}
Tethering			
Sheep	0.21±0.2^{a}	0.35±08^{a}	0.11±0.10^{c}
Goats	0.06±0.06^{bc}	0.12±0.07^{c}	0.11±0.10^{c}
Tethering with supplementation			
Sheep	0.11±0.01^{b}	0.00±0.00^{d}	0.11±0.01^{c}
Goats	0.00±0.00^{c}	0.21±0.07^{b}	0.94±0.30^{a}

$^{a,b,c,d:}$ Means within the same column having different superscripts differ ($P<0.05$) significantly.

Table 4. Comparison of mean weekly changes in withers height (cm)±sem in sheep and goats under three feed management system

Feed Management System	Experimental Weeks 0-4	5-8	9-12
Zero Grazing			
Sheep	0.06±0.03^{bc}	0.21±0.02^{a}	0.00±0.00^{b}
Goats	0.05±0.05^{bc}	0.00±0.00^{c}	0.00±0.00^{b}
Tethering			
Sheep	0.22±0.02^{d}	0.21±0.02^{a}	0.11±0.01^{a}
Goats	0.10±0.06^{b}	0.11±0.00^{b}	0.00±0.00^{b}
Tethering with supplementation			
Sheep	0.11±0.01^{b}	0.21±0.02^{a}	0.00±0.00^{b}
Goats	0.00±0.00^{c}	0.00±0.00^{c}	0.07±0.04^{ab}

a,b,c,d: Means within the same column having different superscripts differ ($P<0.05$) significantly.

Table 5. Comparison of dietary activities in sheep and goats[a].

Parameters	Feed Management Systems: Zero grazing Sheep	Zero grazing Goat	Tethering Sheep	Tethering Goat	Tethering with Supplementation Sheep	Tethering with Supplementation Goat
Ingestion Behaviour						
Dry matter Intake (g\KgW.^{75}\day)	31.84^{c}	29.03^{c}	-	-	40.95^{b}	30.05^{c}
Unitary Eating time (min/gDM/KgW.^{75})	2.8^{c}	4.0^{b}	-	-	2.5^{c}	4.5^{b}
Meal exploration (sec)	1	1	>1	>1	0.5	0.5
Selectivity	very high		very high		very high	
Refusal Rate (%)	17^{cd}	30^{b}	-	-	10^{d}	21^{c}
Physiological parameters						
Daily time spent ruminating (hr/day)	7.17	6.17	8.48	7.50	9.63	7.87
Free water intake (g/Kg of liveweight day^{-1}	101	111	95	120	100	103
Rumination rate (chews min^{-1})	65^{c}	46^{d}	53^{cd}	60^{c}	80^{b}	65^{c}
Drinking duration (Sh^{-1})	4.01^{c}	10.53^{bc}	-	-	6.00^{c}	12.07^{b}
Drinking frequency (no.h^{-1})	1	1	-	-	1	2

a: Means are across all the study period

b,c,d: Means within the same row having different supercripts differ ($P<0.05$) significantly.

Dietary Activities

Mean daily dry matter intake (g\kgW$^{.75}$) was highest (P<0.05) in tethered sheep reveiving supplementation (Table 5). The values for unitary eating time (min\gDM\KgW$^{.75}$) were higher (P<0.03) for goats in the applicable feed mangement system in comparison with sheep. The range was similar to the values obtained in a previous study. Refusal rate was highest (30%) in the goats under zero grazing and this was significantly (P>0.05) different from the values (21%) obtained in the tethered goats receiving supplementation. It has been reported (1) that refusal rate was not a measure of animal satisfaction. Both species of animals took equal (1 sec) time in exploring forage at their disposal before ingestion, as observed in each of the feed management systems. The degree of forage selectivity (observed through the animal smelling with the nose) was very high in both species across all feed management systems. This finding is in agreement with (14), that sheep and goats select their feed with excellent ability. The range of rumination rate (46-65 chews min^{-1}) and drinking duration (10-12 sh^{-1}) obtained for goats were similar to a previous study (7) and these values were highest (P<0.05) in the sheep (Table 5) which received supplementation under tethering, compared to goats.

CONCLUSION AND APPLICATIONS

From the comparative study of the feed management systems in sheep and goats, the following may be concluded:

1. Generally, sheep performed better under all the feed management systems evaluated in this study, compared to goats.
2. At 0-4 weeks of the study (or about 6-12 months of animal age) both sheep and goats benefited more from zero grazing. followed by tethering with supplementatin, compared to tethering feed mangement system.
3. From 5 weeks of study (or above 12 months of age), sheep and goats preferred tethering, perhaps resulting from better forage selection in relation to bodily requirements.
4. Under tethering feed mangement system with supplementatin of overnight soilage of the same forage species as available in the grazing area did not seem to make additional contribution to the performance of sheep and goats.

It is suggested that sheep and goats from age 6-12 months are raised under zero grazing or under tethering with supplementation. But from 12 months of age, sheep and goats could be raised under tethering as they are better able to cope with environmental stress and can express their selection behaviour for various forage species.

REFERENCES

1. Ogebe, P.O. Uza, D.V and E.J. Ako 1999: Body Characteristics and Ingestion Behaviour of west African Dwarf Goats under Zero-Grazing feeding system (unpublished).

2. Otchere D.D and M.S. Kallah 1990: Small Ruminant Production under traditional mangement in Nigeria. In: The Nigeria Sheep and Goat production Manual. O.O. Osinowo (ED)
3. Ogwu, A.O. 1998: Effect of Tethering Feeding System on the performance of West African Dwarf Goats. P.G.D.Project. Dept of Anim. Prod., University of Agriculture, Makurdi. Nigeria
4. Abubakar, A. 1998 Effect of Tethering Feeding System on the performance of west African Dwarf Sheep. P.G.D Project. dept of Anim. Prod, University of Agriculture, Makurdi
5. Haenlein, G.F.W. 1992. Mineral Nutrition of Goats, their milk feeding, and breeding. Haenlein, G.F.W. (Ed). Proc. AID-ADSA-USDA-UOFD Internatinal Symposium, Utah State Univ, Logan, UT. June 24-28, 1979. J. Diary Sci. 63:1729-48.
6. Ogebe, P.O. 1993. Productivity, Nutrient Utilization and Behaviour Responses of West African Dwarf goats fed on Sodium supplement. Ph.D. Thesis, department of Animal Science University of Ibadan, Ibadan.
7. Ogebe, P.O. B.K. Ogumodede and L.R. McDowell 1996: Acceptaility of mineral supplements by West African dwarf goats. Small Ruminant Research 19:193-200.
8. Onwuka C.F.I. 1983: Nutritional Evaluation of some Nigerian browse plants in the humid tropics. Ph.D thesis. Department of Animal Science, University of Ibadan, Ibadan.
9. Akisoyinu, A.O. 1974: Studies on Protein and Energy Utilization by West African Dwarf goats. Ph.D Thesis. Dept of Anim. Sci. Uni. of Ibadan, Ibadan.
10. A.O.A.C (Association of Analytical Chemists) 1965. Washington, D.C. Official Methods of Analysis, 12th edition.
11. Snedecor, J.W and Cochran, W.G. 1980. Statistical Methods, 6th Edition. The lowa state University Press, Amees, Iowa.
12. Hagger, R.J 1970 Grazing Behaviour of Fulani cattle in Nigeria. Trop. Agric. (Trinidad) 45 (3): 179-198.
13 Ikhatua, U.J., T.I. dede and O.E. Ogbemudia 1987: The grazing behaviour of the west African Dwarf (Forest) Goats in the Humid Environment of Southern Nigeria. A paper presented at the 1987 Conference of the Nigeria Society for Animal production.
14. Morand-Fehr, P., Owen, E. and Giger-Reverdin, S., 1991. Feeding behaviour of goats at the trough. In: P Morand-Fehr (Edition) Goat Nutrition. Pudoc 111 EAAP Publication No.4, Wageningen, pp.3-12