EVALUATION OF THREE ISO-NITROGENOUS SUPPLEMENTS BASED ON LOCAL FEED RESOURCES FOR GROWTH RATE IN MALE RED SOKOTO GOATS

S.M. Otaru, C. A.M. Lakpini, O.W. Ehoche, H.J. Makun, D.D. Dung and C. U. Osuhor
National Animal Production Research Institute, Ahmadu Bello University, P.M.B. 1096, Shika, Zaria, Nigeria
otarusm@yahoo.com Phone: 08054524985

Abstract
Thirty male Red Sokoto goats of average liveweight of 16.40 ± 0.14 were used in a randomized complete block design to evaluate the efficacy of three isonitrogenous supplements or concentrate mixtures based on local feed resources for growth rate in Red Sokoto goats. The animals were blocked according to weight and allocated randomly to one of the three concentrate mixtures designated as Diet A, Diet B and Diet C. They were fed the diets individually at the rate of 2% of body weight. Feed intake and liveweight changes were measured. Fifteen of the goats were slaughtered at the end of feeding trial, and dressing percentage determined. The results indicated that the three diets promoted considerable growth rate (range, 61- 79 g ADG) and appreciable dressing percent but goats fed Diet C had the least total dry matter intake, average daily gain (ADG), slaughter weight and dressing percent ($P<0.05$) compared to diets A and B. It is concluded tentatively that the diets formulated and compounded from locally available feed stuff has some promise in providing nutrients for an appreciable growth rate in Red Sokoto goats.

Introduction

In Europe and United States of America, rations are formulated to meet 'the nutrient needs of ruminants for production but in Nigeria and other developing countries, small ruminant farmers feed all sorts of feed resources to their animals to merely meet their appetite and not necessarily for production. The feed resources fed are usually deficient in one or some of the critical nutrients (protein, energy, vitamins and minerals) required for production. Consequently, the productivity of farmers's goats is sub-optimal. Continual interaction of the scientists of the National Animal Production Research Institute (NAPRI) with farmers shows that small ruminant farmers yearn for the availability of commercial feed supplements which can be bought to address the problem of poor quality of feeds. The importance of adequate intake of true protein, energy and other essential nutrients on growth, reproduction and milk production in ruminants has been well documented (Preston and Leng, 1987; Rabelo et al., 2003). While there are quality and commercial feed supplements for poultry there are none for goats. There is a need therefore to develop commercial feed supplements to meet goats production requirements and farmers's desire for quality feed supplements for improved productivity in goats. This study is aimed at evaluating the efficacy of three feed supplements compounded from locally available feed stuffs with respect to growth performance of Red Sokoto goats. It is hypothesized that there would be no difference in performance amongst the goats fed the supplements.

Materials and Methods

The study was conducted at the National animal Production Research Institute, Ahmadu Bello University, Shika, zaria, Nigeria. Shika is located within the Northern Guinea Savannah Zone at Latitude 11° 11'N and Longitude 7° 34'E, and is 640m above the sea level.

Preparation of Concentrate mixtures

Three concentrate mixtures designated as diet A (control), diet B and Diet C were formulated to be iso-nitrogenous (17% crude protein) (Table 1). They were compounded by grinding and mixing the ingredients at the Institute's feed mill following the particle size guide of ASAE (2001). This was to enable proper mixing of the ingredients into mash form.

Animal management

Before the commencement of the trial, the 30 bucks were dewormed against internal parasites and dipped in acaricide solution to control ecto-parasites. They were then weighed before being assigned randomly to one of the three treatment groups (Diet A, Diet B and Diet C) to give 10 animals per treatment group. These weights (averaging 16.4 kg) were taken as the initial weights of the bucks. The animals were housed in individual pens and supplemented with the concentrate mixture at 2% of body weight, and the *Digitaria smutsii* hay offered as basal diet at 3% of body weight. The goats were fed concentrate mixture first at between 08 and 09 h after the pens would have been swept and orts taken and weighed. The animals were allowed 2-3 h to consume the mixture before the grass hay was offered. Water was provided *ad libitum*. After 2

–week adjustment period, daily feed intake were recorded and fortnightly liveweights of the bucks taken. The final liveweights of the animals were taken at the end of the 90-day feeding trial.

Slaughtering and carcass dressing percent

A total of 15 bucks with 5 animal representatives from each treatment were slaughtered for carcass analysis at the Meat Lab of the Department of Animal Science, ABU, Zaria. Slaughtering was done for five periods and three animals were slaughtered each period with a replicate from each treatment. Animals were fasted for 16 -18 h before slaughtering. After slaughtering, the hot carcass weight was taken and the carcass then kept in a deep freezer for 24 h after which it was removed and weighed to get the chilled carcass weight. The chilled carcass weight was used to calculate the dressing percent.

Chemical and statistical analyses

Feed samples were analysed for DM, CP, CF, EE, NFE and ash according to the method of AOAC (1980), while the NDF and ADF were determined according to the method of Goering and Van Soest (1970). All the intake, liveweight and slaughtering data were subjected to the analysis of variance using PROC GLM of SAS 2000. Contrast Statement of SAS was used to separate the means were the F-ratio was significant at $P<0.05$.

Results and Discussion

Table 1 shows the ingredient and chemical composition of the diets. The diets were formulated to be iso-nitrogenous (17% CP) but as evident in Table 1 the CP of the diets ranged from 18 – 20%. The least squares means of intakes of concentrate, hay and total dry matter, initial, final weight, average daily gain (ADG) and feed conversion efficiency, slaughter weight, hot and chilled carcass and dressing percent are presented in Table 2. Total dry matter intake (TDMI) were significantly lowest ($P<0.05$) for goats fed diet C, while the intake values were comparable between diets A and B even though diet B had the highest hay and total DMI values. The low TDMI of diet C could be attributed to its comparatively higher NDF content. High NDF content has been linked to low DMI (Luginbuhl et al., 2000). The final live weight (FLW), average daily gain (ADG) and Feed Conversion efficiency (FCE) of the goats as presented in Table 2, shows that for the three variables, diets A and B were statistically similar, but differed significantly ($P<0.01$) from diet C with the least values. The lower performance of goats fed diet C could be due to higher NDF value associated with lower DMI, thus agreeing with the observation of Luginbuhl et al. (2000) who reported decreasing ADG and FCE in growing male goat as the dietary level of NDF was increased. Generally, the ADG of 61 – 79 g of the test diets (B and C) are lower than the ADG of 85 - 118 g recorded for the Red Sokoto bucks fed 250 g concentrate mixture of Maize, groundnut cake, bone meal and common salt as supplement to 750 g of groundnut haulms or *Digitaria smutsii* hay (Ikhatua and Adu, 1984). As evident from Table 2, goats receiving the control diet (diet A) significantly ($P<0.05$) outperformed those fed either diet B or diet C whose values are comparable. Increase in intake of concentrate can increase dressing percent (Safari et al., 2009) but it is not clear whether the performance of diet A animals was due to the unintended comparatively higher dietary crude protein level of 20 %. Generally, however, the range of dressing percent of 42 – 47 across diets or 42 – 43 % for the test diets (B and C) is comparable to those reported for Small East African goats (38 – 46 %) (Safari et al., 2009) and Barbari goats (42-46%) (Agnihotri et al., 2006), but lower than the range of 47 – 57% recorded for heavier breeds (boer X Spanish and Spanish goats (McMillin and Brock, 2005).

Conclusion

From the results of this trial, it may be concluded tentatively that the diets formulated and compounded from locally available feed stuff has some promise in providing nutrients for an appreciable growth rate in Red Sokoto goats.

Acknowledgements

The authours wish to thank profoundly, the Agricultural Research Council of Nigeria (ARCN) for funding the Project through its Competitive Agricultural Research Grant Scheme (CARGS). We also express our gratitude to the Director of NAPRI for providing facilities for research as part of the counterpart funding of the Project.

References

A.O.A.C. (1980). Association of Official Analytical Chemists. Official Methods of Analysis. (13th Ed.). Washington, D.C.

Agnihotri, M.K., Rajkumar, V and Dutta, T.K. (2006). Effect of feeding complete rations with variable protein and energy levels prepared using by-products of pulses and oilseeds on carcass characteristics, meat and meat ball quality of goats. *Asian-Aust. J. Anim. Sci.*, 19 (10): 1437 – 1449.

ASAE, 2001. S424. Methods of determining and

expressing particle size of chopped forage materials by sieving. In Standards Am. Soc. Agric., St. Joseph, MI.

Goering, H.K and Van Soest, P.J. (1970). Forage fibre analysis (Apparatus, reagents, procedures and some applications). *Agricultural Handbook* No. 379. Agricultural Research Services, U.S.A. Department of Agriculture, Washington, D.C.

Ikhatua, U.J. and Adu, I.F. (1984). A comparative evaluation of the utilization of groundnut haulms and *Digitaria smutsii* hay by Red Sokoto goats. *Journal of Animal Production Research*, 4 (2): 145 – 152.

Luginbuhl, J. M., Poore, M. H. and Conrad, A.P. (2000). Effect of level of whole cottonseed on intake, digestibility, and performance of growing male goats fed hay-based diets, *Journal of Animal Science*, 78: 1677-1683.

McMillin, K.W. and Brock, A.P. (2005). Production practices and processing for value-added goat meat. *Journal of Animal Science*, 83: E57 –E68.

Preston, T.R. and Leng, R.A. (1987). ***Matching Ruminant Production Systems with Available Resources in the Tropics and Sub-Tropics***. The Technical Centre for Agricultural and Rural Co-operation (CTA). Wageningen, Netherlands. 245pp.

Rabelo, E., Rezende, R.L., Bertics, S.J. and Grummer, R.R. (2003). Effects of transition diets varying in dietary energy density on lactation performance and ruminal parameters of dairy cows. *Journal of Dairy Science*, 86: 916–925.

Safari, J., Mushi, D.E., Mtenga, L.A., Kifaro, G.C. and Eik, L.O. (2009). Effects of concentrate supplementation on carcass and meat quality attributes of feedlot finished Small East African goats. Livestock Science, 125: 266–274.

SAS (2000). Statistical Analysis Systems Institute. SAS User's Guide. Statistics, Version 8.1 Edition. SAS Inst., Inc., Cary, NC.

Table 1: Ingredient and Chemical composition of experimental diets

Ingredients, % (as fed)	Diet A	Diet B	Diet C	
Maize grain	28	15.5	-	
Maize offal	14	45	38.30	
Wheat offal	14	-	19.20	
Sorghum threshed panicle	-	3	-	
Cotton seed cake	41	23	-	
Whole cotton seed	-	-	24	
Moringa leaf meal	-	10	-	
Groundnut haulms	-	-	10	
Cowpea shell	-	-	5	
Urea	-	0.5	0.5	
Bone meal	2	2	2	
Common salt	1	0.5	0.5	
"Kanwa"	-	0.5	0.5	
	100	100	100	
Chemical Composition, % (DM basis)	**Diet A**	**Diet B**	**Diet C**	**D. smutsii hay**
Dry matter	96	96.74	96.94	95.30
Crude protein	20.06	18.38	18.13	6.50
Ether extract	7.69	9.16	11.08	7.84
Crude fibre	15.37	18.82	21.22	33.67
Neutral detergent fibre	40.65	43.75	48.10	67.26
Acid detergent fibre	22.77	24.12	25.67	51.58
Non-structural carbohydrates	21.18	17.40	10.45	8.52
Ash	10.42	11.31	11.99	9.88
Gross energy (MJ/kg DM)	16.35	16.49	17.29	16.27

Table 2: Least squares means of dry matter intake, average daily gain, slaughter weight and dressing percent

Parameters	Diets			SEM	Level of significance			
	A	B	C		A vs BC	A vs B	A vs C	B vs C
Dry matter intake (g)								
Concentrate	393.46	396.50	397.32	0.09	***	***	***	***
Hay	341.20	360.40	307.30	9.49	NS	NS	*	***
Total	734.66	756.85	704.60	9.46	NS	NS	*	**
Liveweight (kg)								
Initial	16.6	16.4	16.2	0.14	NS	NS	NS	NS
Final	23.70	23.52	21.70	0.31	*	NS	***	***
ADG (g)	79.24	79.10	61.14	3.70	NS	NS	**	**
FCE, g gained/kg DMI	108.90	104.50	86.40	4.40	*	NS	**	**
Carcass weight (kg)								
Slaughter weight	26.29	25.60	23.64	0.71	TBS	NS	*	TBS
Hot carcass weight	12.66	11.45	10.36	0.29	**	*	***	*
Chilled carcass weight	12.34	11.04	10.04	0.29	**	*	***	*
Chill los (kg)	0.32	0.41	0.32	0.05	NS	NS	NS	NS
Dressing percent	47.00	43.02	42.33	1.11	*	*	*	NS

*= (P<0.05), ** = (P<0.01), *** = (P<0.001), TBS = Tended to be significant (P<0.09)
NS = Not significant (P>0.05)