PERFORMANCE, MILK YIELD AND COMPOSITION OF GRAZING SAHEL DOES SUPPLEMENTED WITH COTTONSEED CAKE-MAIZE BRAN MIXTURE

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ABSTRACT

Sixteen (16) lactating grazing Sahel goat breed does (23.20 ± 0.69kg) were used for a 9-week trial to determine the effect of supplementation with cottonseed cake and maize bran mixture (CSC-MBM) of ratio 1:1 on their performance, milk yield and milk composition. The does were assigned to four treatments: T1, T2, T3 and T4, which were control, 100g CSC-MBM/animal/day, 200g CSC-MBM/animal/day and 300g CSC-MBM/animal/day, respectively. The mean values for crude protein, dry matter, crude fibre, ether extract and ash for concentrate diet were 21.83%, 98.96%, 13.73%, 5.50% and 3.87%, respectively. Observed result indicated that T4 consistently had significantly ($p<0.05$) higher milk yield throughout weeks 1 to 9. Similarly, T4 resulted in significantly higher ($p<0.05$) weight gains for both does and kids. The protein content of milk in the T4 group was significantly higher ($p<0.05$) than T3, T2, and T1. However, for milk fat, T1 (control) had the highest value while T4 had the lowest value. Total solids content was significantly affected ($p<0.05$) by level of supplementation. Observed value for solid non-fat for T4 was significantly ($p<0.05$) higher compared to T1, T2 and T3. Lactose content was significantly ($p<0.05$) higher in T1 compared to T2, T3 and T4. Calcium, magnesium, potassium, and ash contents were not significantly ($p>0.05$) influenced by dietary treatment. Supplementation of grazing lactating sahel goats with CSC-MBM resulted in improved doe and kid performance, besides milk yield. Hence, supplementation is recommended as production ration for lactating goats for better performance during the dry season.

Keywords: Sahel, supplementation, lactose, doe, cottonseed cake, maize bran

INTRODUCTION

The goat as domesticated small ruminant has served man for long and is usually managed for the production of milk, meat and wool in both temperate and tropical regions of the world (Bustwat *et al.,* 2002). According to Odeyinka *et al.* (2003), goats are considered superior to other ruminant species in their utilization of poor quality and highly fibrous forages for maintenance and production. With growing awareness of the importance of goats as a source of milk for man (Malau-Aduli *et al.*, 2001) coupled with the absence of allergic reactions present in cow milk (Bawala *et al.*, 2006), it's high digestibility and presence of anti-inflammatory compounds, among others, goat milk remains food to beat. Goat milk is more widely produced than sheep milk, and globally, goat production yields 60% of its value as milk, 35% as meat and 5% as skin (Devendra and McLeroy, 1982; Malau-Aduli *et al.*, 2001). According to Odunsi *et al.* (2004), goat skin produced in Nigeria is used as raw material in local leather industry, although sometimes eaten; they are also used as ornamentals. Odunsi *et al.* (2004) further opined that goat meat is regarded as cheap source of protein as the meat contains lower fat than sheep and cattle.

Goats possess the ability to thrive in high temperature environment, with low rainfall. Under this condition, they can utilize a wide variety of grasses, leaves and twigs not appreciated by sheep and cattle, hence are able to meet their nutrient requirements during adverse conditions (Odeyinka *et al.,* 2003). However, for higher productivity just like the cattle or any other livestock or poultry there is need for supplementation. In livestock production, appropriate supplementation of poor quality natural pasture and crop residue basal diets appeared to be the necessary step to alleviate the nutritional problem of goats (Adugna *et al.*, 2000). The authors further opined that priority could be given to lactating does so as to boost their productivity.

Cottonseed cake is one of the most common protein supplement used in feeding ruminant animals. Ubosi (2006) reported that cottonseed cake (CSC) and cottonseeds are satisfactory protein supplements in adult ruminant diet because of their ability to detoxify gossypol in the rumen with the help of ruminal micro-organisms. Singh (1996) observed that supplementation improved milk yield and composition of sirohi goats during pregnancy and lactation.

MATERIALS AND METHODS

Experimental Site

The study was carried out at the University of Maiduguri Teaching and Research Farm. Maiduguri is located on latitude 11^0 15' North and longitude 30^0 05' East, altitude 354m above sea level (Alaku, 1983). The study location falls within the semi arid zone of West Africa which is characterized by 3 - 4 months of rainfall and 8 – 9 months of dry season, with ambient temperature ranges of 39^0C - 41^0C in April and 30^0C - 32^0C between December and January (Alaku, 1983)..

Experimental Diets, Animals and Management

Cotton seed cake and maize bran were purchased from the open cattle market and mixed in the ratio 1:1. Sixteen (16) lactating Sahel goat breed does with average weight 23.20 ± 0.69 kg were selected from the flock kept by the University of Maiduguri Teaching and Research Farm. They were de-wormed before the commencement of the feeding trial. The feeding trial commenced on the sixth day after parturition and lasted 9 weeks. The animals were

weighed individually and randomly assigned into four treatment groups of four replicates each in a Completely Randomized Design. Thereafter, the does and their kids were weighed on weekly basis. The four treatments (T_1, T_2, T_3 and T_4) were control, 100 g cottonseed cake-maize bran mixture (CSC-MBM)/animal/day, 200 g cottonseed cake-maize bran mixture/animal/day and 300 g cottonseed cake-maize bran mixture/animal/day, respectively. Each treatment group was fed the concentrate supplement for ten (10) days as adaptation period before data collection. The animals were allowed to go out for grazing from 8.00 am – 5.00 pm, and housed at night in pens made of cement blocks. Herbage materials in the grazing area included *Acacia albida*, *Balanites aegyptica*, *Zizipus mauritania*, *Tamarindus indica* and left over of crop residues which comprised of groundnut hay, millet stover and sorghum stover. Drinking water and salt lick were provided *ad libitum*. Samples of the concentrate supplements and grazing materials were collected for proximate analysis.

Milking

Hand milking was carried out in the morning, after restraining the animals, by massaging the udder with the thumb and fore-finger. The milk collected into a container is measured with the aid of measuring cylinder and the volume recorded prior to laboratory analysis. The kids were usually separated from their mother overnight prior to each milking in order to prevent them from sucking before the morning milking.

Proximate Analysis of Supplementary Feed, Browse plants, Crop residues and Milk

Supplementary feed samples, grazed browse plants and crop residues were analyzed for their proximate composition according to the procedure of Association of Official Analytical Chemists (AOAC) (1995). Milk samples were analyzed for total solids, solid non-fat, protein, ether extract, crude fibre and ash using the procedure described by AOAC (1995). Lactose was determined by the method reported by Barnet and Tawab (1957) while the Roese-Gottlieb method was used for fat determination. Spectrophotometry was used to analyze for milk calcium, potassium, phosphorus and magnesium.

Data Collection and Analysis

All data collected were subjected to Analysis of Variance (ANOVA) as outlined by Steel and Torrie (1980). Where differences in means were observed, they were separated using Least Significant Difference (LSD) method at probability of 5% (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The proximate composition of concentrate diets and grazed herbage are shown in Table 1 and Table 2, respectively. The mean crude protein content of the concentrate (CSC-MBM) diet was 21.38%. The value of crude protein for the CSC-MBM obtained in this study is greater than 20.01% reported by Malau-Aduli *et al*. (2003). The difference might be due to processing, agronomic/cultural practices, soil composition and stage of maturity of the cotton whose seeds were used before harvest, among other things. The mean value for dry matter content of the concentrate was 98.96%. The mean value of the crude fibre, ether extract and ash for concentrate diets were 13.73%, 5.50% and 3.87% , respectively. These values are within the ranges reported by Mecha and Adegbola (1980). The ash content of the concentrate diet was higher than the value obtained by Malau-Aduli *et al*. (2003) but lower than the value reported by Abou Ward (2008). However, observed crude protein, dry matter and ash values are in conformity with the values obtained by Sarwatt *et al*. (2004).

Table 2 shows the chemical composition of the grazed herbage within the grazing area which consisted of browse plants and post harvest crop residues. The dry matter content of the browse plant ranged from 89.75 - 91.25% with a mean value of 90.33%. Dibal (1991) reported a mean value of 52% dry matter for semi-arid browse plants in Nigeria which is lower than the value obtained in this study. The crude protein content of the browse plants ranged from 10.10 -25.75%, which is higher than 14.80% reported by Le Houerou (1980) for browse plants. The mean crude fibre content of the browse plants recorded in this study is higher than the 18.6% reported for browses by Okoli *et al*. (2003). The mean ether extract content of the browse plants in this study was 3.03%. This is lower than the 5.05% reported by Okoli *et al*. (2003). The mean ash content of browse plants selected in this study was 4.98%, which is lower than the 7.83% reported by Dibal (1991). The dry matter content of groundnut hay, sorghum husks and millet husk were 93.65%, 91.3% and 93.87%, respectively. The values of crude protein, crude fibre, ether extract and ash of groundnut hay, millet husks and sorghum husk were lower than the values reported by Gohl (1981). The differences might be due to agronomic/cultural practices, soil composition and location among other things.

The effect of concentrate level on milk yield is shown in Table 3. T4 consistently had significantly ($p<0.05$) higher milk yield throughout weeks 1 to 9, while T1 had the lowest milk yield. The observed milk yield tended to increase as the level of CSC-MBM supplementation increased. This may suggest that supplementation furnished the does with more nutrients for milk synthesis. The results obtained on milk yield is in conformity with the report of Adugna *et al*. (2000) who reported that supplementation with concentrates improved body condition score of goats and that this had a direct relationship with milk yield. Also, variability in milk yield observed across the treatment groups agrees with the findings of Akpa *et al*. (2000) who reported that variation in milk yield of goats is accountable to nutritional inputs and management system. Ahmed *et al*. (2001) had equally reported that milk yield of goats could be improved by supplementing their pasture diets with concentrates.

Table 4 shows the effect of concentrate supplementation on the intake and live-weight change of does and kids. The animals fed concentrate supplement of 300 g/animal/day (T4) had significantly highest ($p<0.05$) values for both does and kids than other treatment groups. There was live weight loss (does only) in the unsupplemented group (control). The weight changes of the kids in T4 was significantly ($p<0.05$) higher than other treatments. The growth response of the kids of does followed the same pattern as the milk yield which agrees with the fact that pre-weaning growth is mainly dependent on milk production (Singh, 1996). The milk intake of the kids might have been adequate enough to induce positive live weight changes of the kids and the does

of the supplemented groups. This is in agreement with the supplementation of does increases milk production and growth rates of the kids. However, the supplement intake of the animals in T4 was found to be significantly ($p<0.05$) higher than the other treatment groups. The higher weight gain and supplement intake obtained in T4 is in agreement with the results obtained by Babayemi and Bamikole (2006), who reported that the West African Dwarf (WAD) goats fed with cottonseed cake had higher weight changes and feed intake. Adugna *et al*. (2000) also reported that goats supplemented with cottonseed cake and maize bran, had higher growth rate, attributable to the higher energy supply from the cottonseed cake. They further observed that supplementation with cottonseed cake and maize bran improved body condition scores and carcass weight of goats. Tolera and Sundstol (2000) reported that provision of sufficient amount and right combination of protein and energy supplements appeared to be a critical factor for enhancing productivity of goats so as to prevent body weight loss during the dry season.

findings of Alexandre *et al*. (2002), who reported that The milk composition of the experimental does in terms of protein, fat, solid non-fat, ash, lactose, potassium, calcium, magnesium and phosphorus is shown in Table 5. The protein content in the T_4 group was significantly higher ($p<0.05$) than T_3, T_2, and T_1. Protein content increased with increased level of supplementation. The value of protein obtained in this study is higher than the 3.84% reported by Zahraddeen *et al*. (2007), who evaluated some factors such as nutrition, season, and parity as they affect milk composition of indigenous goats in Nigeria. The results obtained in this study are in agreement with those obtained by Malau-Aduli *et al*. (2001), who reported that milk yield and composition was affected by factor such as plane of nutrition. The higher value of protein content obtained in this study might be due to the protein source used as the concentrate supplement. Fat content was affected significantly ($p<0.05$) by level of supplementation. T_1 had the highest value while T_4 had the lowest value.

Table 1: Chemical Composition of Supplementary Diets (DM %)

Parameters	100g CSC/ day	200g CSC/ day	300g CSC/ day	Mean value
Dry matter %	98.96	98.95	98.96	98.96
Crude protein %	21.83	21.84	21.83	21.83
Crude fibre %	13.73	13.72	13.72	13.73
Ether extract %	5.50	5.60	5.50	5.50
Ash %	3.87	3.87	3.86	3.87

CSC: Cotton seed cake

Table 2: Proximate Composition of Grazed Browse Plant and Crop Residues (DM %)

Parameters	Aa	Zm	Ti	Ba	Gh	Ms	Ss	Mean
Dry matter %	89.75	87.70	91.25	89.60	93.65	93,87	91.30	90.33
Crude protein %	25.75	10.10	14.70	10.14	15.63	4.37	3.50	14.20
Crude fibre %	23.50	23.40	29.50	17.40	23.26	36.50	35.50	30.35
Ether extract %	4.00	5.10	1.00	3.90	2.40	1.00	1.00	3.03
Ash %	1.00	6.30	1.00	6.50	8.00	3.03	5.00	4.98

Aa- *Acacia albida*, Zm-*Zizipus muritania*, Ti-*Tamarindus indica*, Ba-*Balanite aegyptica*, Gh -Groundnut hay, Ms- Millet stover, Ss- Sorghum stover

Table 3: Effect of Concentrate Supplementation on Weekly Milk Yield of Does (ml)

Week	0g CSC/day	100g CSC/ day	200g CSC/ day	300g CSC/ day	SEM
1	134.00^{c}	144.75^{c}	271.75^{b}	354.38^{a}	18.50
2	107.50^{c}	127.50^{c}	217.15^{b}	325.75^{a}	11.54
3	99.75^{c}	105.63^{c}	209.25^{b}	305.75^{a}	12.85
4	93.13^{c}	95.13^{c}	205.25^{b}	290.50^{a}	10.45
5	86.50^{c}	89.25^{c}	198.75^{b}	270.50^{a}	11.56
6	76.38^{c}	80.00^{c}	158.00^{b}	260.82^{a}	15.74
7	59.38^{c}	75.00^{c}	136.25^{b}	233.00^{a}	17.03
8	56.25^{c}	66.13^{c}	106.28^{b}	229.09^{a}	12.46
9	38.12^{d}	61.87^{c}	96.76^{b}	211.69^{a}	10.23

CSC: Cotton seed cake, SEM: standard error of mean, abcd: means on the same row with different superscripts are significantly different ($p<0.05$)

Total solids content was significantly affected ($p<0.05$) by level of supplementation. T4 had the highest value while T_1 had the lowest value. The observed trend in this study is in agreement with the findings of Ngo *et al*. (2010) who worked on the effect of cassava hay supplementation on milk production of lactating goats and concluded that total solids increased as level of supplementation increased. Observed value for solid non-fat for T_4 was significantly ($p<0.05$) higher compared to T_1, T_2 and T_3. The values obtained are within the range obtained by Mmbengwa *et al*. (2008) who stated that solid non-fat contents of indigenous goats ranged between 10.42-10.69%.

Lactose content was significantly ($p<0.05$) higher in T_1 compared to T_2, T_3 and T_4. However lactose was found to be higher in this study compared to the value reported by Zahraddeen *et al.* (2007) for Red Sokoto goats (4.90%). The 5.72% obtained for the

Table 4: Effect of Concentrate Supplementation on Weekly Growth Performance of Does and Kids

Week	0g CSC/d	100g CSC/ d	200g CSC/ d	300g CSC/ d	SEM
Initial weight of doe (kg)	23.30	23.45	23.25	23.07	0.30ns
Final weight of doe (kg)	23.28[ab]	22.97[b]	23.95[a]	23.31[ab]	0.44
Weight change of doe (kg)	-0.02[d]	0.47[c]	0.79[b]	1.27[a]	0.14
Initial weight of kid (kg)	3.23	3.20	3.79	3.68	0.06ns
Final weight of kid (kg)	4.75[ab]	4.38[b]	5.25[a]	5.25[ab]	0.30
Weight change of kid (kg)	1.18[b]	1.49[ab]	1.53[a]	1.61[a]	0.30
Supplement intake (g)	0[d]	394.00[c]	760.70[b]	1099.60[a]	11.87

CSC/d: Cotton seed cake per day, SEM: standard error of mean, ab: means on the same row with different superscripts are significantly different ($p<0.05$), ns: not significant ($p>0.05$)

Table 5: Effect of Concentrate Supplementation on Milk Composition of Does

Parameter (%)	0g CSC/d	100g CSC/ d	200g CSC/ d	300g CSC/ d	SEM
Protein	4.12[d]	4.52[c]	4.83[b]	5.04[a]	0.07
Fat	5.60[a]	5.08[ab]	5.23[ab]	4.49[b]	0.55
Total solids	10.32[b]	12.48[ab]	12.70[ab]	13.70[a]	1.64
Solid non-fat	8.00[b]	8.77[b]	10.22[a]	10.60[a]	0.57
Ash	0.56	0.58	0.62	0.62	0.03ns
Lactose	5.72	0.28	0.29	0.29	0.16 ns
Calcium	1.24	1.39	1.33	1.22	0.06 ns
Phosphorus	0.02	0.02	0.02	0.02	0.01 ns
Potassium	0.08	0.10	0.21	0.10	0.05 ns
Magnesium	0.29	0.29	0.26	0.37	0.03 ns

CSC/d: Cotton seed cake per day, SEM: standard error of mean, ab: means on the same row with different superscripts are significantly different ($p<0.05$), ns: not significant ($p>0.05$).

control in this study is also higher than that reported by Agbede *et al*. (1997) in WAD does. It is also higher than the 4.46% reported by Hadjipanayiotou (1988). Supplementation with concentrate seemed to lower milk sugar. Calcium, magnesium, potassium, and ash contents were not significantly ($p>0.05$) influenced by dietary treatment. The ash content obtained in this study is lower than the value reported by Zahraddeen *et al*. (2007). This might probably be due to the level of concentrate supplementation used in this study and perhaps difference in breed of goat.

CONCLUSION AND RECOMMENDATION

Observation from this feeding trial showed that supplementation of grazing lactating Sahel goats during the dry season with CSC-MBM resulted in improved doe and kid performance, as well as increased doe milk yield. Furthermore, supplementation of the diets of grazing lactating goats impacted more on the milk components. Consequently, supplementation is recommended as production ration for lactating goats for better performance during the dry season. In addition, further study should be carried out with higher levels of CSC-MBM than levels used in this study.

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