Milk Production Performance of Red Sokoto Goats supplemented with Crop Residues in Potiskum Area of Yobe State, Nigeria

Abstract: The feeding value of groundnut seed cake and millet bran as protein and energy supplements in the diets of Red Sokoto does was investigated in an experiment at different quantities of 200g mixture of ground nut seed cake/millet bran (50:50), 200g groundnut seed cake alone and 200g millet bran alone using groundnut haulms as basal diet for the control. The experiment lasted for twelve weeks during which feed intake and milk production performance were recorded in twenty Red Sokoto goats with five does per treatment using the completely randomized design. The daily supplement intake, total feed intake and milk yield were significant (P<0.01) but differed according to the diet supplement. The milk yield values ranged between 0.2 and 0.6kg. The daily basal feed intake was also significant (P<0.05) but higher in the control. The lactation length was significant (P<0.001) and last longer in the group fed with mixed supplements. The values of lactation length ranged between 46 and 84 days. The daily weight gain and weaning weights were not significant (P>0.05) but the highest weights were recorded for goats in supplements B fed groundnut seed cake/millet bran mixture. The regression coefficient of daily supplement intake, daily weight gain and feed conversion ratios were significant (P<0.01). Findings from the study revealed that the mixture of groundnut seed cake and millet bran supplement diets can increase milk yield and lactation length of lactating goats significantly during dry season.

Keywords: Crop Residues, Milk Yield, Sokoto Red Goats, Dry Season Supplementation

INTRODUCTION

Dry season in Northern Nigeria is characterised by low quality of natural pastures and the inefficient use of fibrous crop residues resulting in inadequate feeding of animals with adverse implications on reproductive efficiency and milk production as feed nutrients become inadequate to support the potential yield of the animals (Adamu et al., 1993). Usually protein is the most limiting nutrient, but energy can be critical in certain periods (Adamu et al., 1993). The production of milk from goats becomes necessary to meet the demand for food of animal origin. Milk therefore is the necessary secretion from the mammary gland of animal for the purpose of feeding the young of such animal. Protein malnutrition is recognized as the most severe cause of infant mortality and general debility in developing countries (PRB 2012). To meet the increasing demand for milk and milk products with rapid growth in human population, the milk from goats is specially recommended for the sick because it is said to be rich in certain nutrients not found in large quantities in other milk sources (Gefu, 2002). It has been reported that the rate and level of performance of livestock production industry have gone down below expectation due to high cost of production (Okpanachi, 2012). It is therefore necessary to improve livestock productivity through the use of relatively low cost and newly improved feed sources that can be used as supplement for the poor forage available to the animals. Some of these feed sources are the oil seeds such as groundnut seed cake and millet bran as protein and energy sources respectively. The oil seeds are useful for several reasons including palatability, digestibility and nutritional balance of the amino acids and presence of anti-nutritional factors.

In this study, groundnut haulms was used as the basal feed supplemented with groundnut seed cake as protein and millet bran as energy source which has been tested to improve the availability of nutrients to the animal for growth and production leading to fast growth and better feed consumption. This study was designed to determine the effects of crop residues supplementation on milk productions performance of lactating Red Sokoto goat.
**Materials and Methods**

**Location of the Experimental Site**

The experiment was conducted during the dry season (February to May 2017) at the Livestock pavilion of the Department of Agricultural Science Education; Federal College of Education (Technical) Potiskum Yobe State Nigeria. Located at latitude 11.42° North; longitude 11.02° East of the Greenwich meridian. 415 m above sea level (Adejuwon, 2005). Yobe State lies within arid and semi-arid ecological zones. The average maximum temperature varies between 30 and 35°C during most of the year with peaks above 40°C during hot summer (April/May). The rainy season extends from June to October, reaching it peaks in August. The annual rainfall ranges from 75 mm in the extreme north to about 662 mm in south and with average 280 mm. The northern part of the state is covered with sandy soils which is originally either stabilized or mobile sand dunes and the southern part is predominantly silty clay. The vegetation varies from North to South with bushes and trees are common in the South which has milder climate (Kowal and Knabe, 1972).

**Experimental Animals and their Management**

Twenty apparently healthy pregnant adult Red Sokoto Goats with an average live weight of 23.4-26.7 kg were used for this study. The goats were selected and bought at Potiskum, Ngalka and Dawasa livestock markets. For easy identification they were neck tagged and managed semi-intensively throughout the remaining gestation period. The animals were kept in a 100 x50m fenced area enclosing a well ventilated 50x20ft.size house. The house served as shelter to the animals against harsh weather while the fenced area served as space for exercise and run.

**Procedure and feed supplementation**

The experiment was carried out on twenty does that kidded in the dry season (February-May) when there was scarcity of feed. The does were randomly allocated to the four treatments with 5 does per treatment (Steel and Torrie, 1980). The control (CTL) group (diets A) was managed on the control diet while the second, third and the fourth groups were supplemented with diets B, C and D respectively.

Diets A = (control) = grazing natural pasture and groundnut haulms supplementation.

- Diet B = Mixture of Groundnut Seed cake 50% and Millet Bran 50 %
- Diet C = Groundnut Seed cake supplementation
- Diet D = Millet Bran supplementation.

**Experimental Design and Treatments**

Twenty lactating does were used in this study. The animals were divided into four groups of five lactating does per treatment in a completely randomized design (Steel and Torrie, 1980). The animals were fed two experimental diets (Supplement and basal). The supplements were groundnut seed cake and millet bran while the basal was groundnut haulms given ad-libitum. The supplements were fed every morning at 7:00am and the basal diet at 8:00am and at 5:00pm. In treatment B, a mixture of groundnut seed cake/millet bran 50:50 at 200g/animal/day was offered, while does on treatment C were fed 200g/animal/day groundnut seed cake and those in treatment D were fed 200g/animal/day millet bran. Animals in treatment A serving as the control however were given only groundnut haulms. Salt lick and clean drinking water and salt lick were provided ad-libitum. Stale feeds were collected and weighed the next morning before allocating fresh feed. All the experimental animals were weighted before and after the experiments and thereafter weekly basis. The experiment lasted for 12 weeks.

**Milk Yield and Composition**

Data collection on milk yield and composition commenced one week after kidding to allow kids access to the colostrums. Milk samples from the twenty lactating does were collected from February 2017 to May 2017. The first part of milk was discarded and milking continued for 2-3 minutes (Luka and Kibon (2014)). Milking was done in such a way to ensure that reserve was left for the kids survival. Milk production was estimated twice/week by hand-milking of does for a period of 12 weeks. On the night preceding the milking, kids were separated from their dams at 6.00pm throughout the night, then weighed at 8.00am the next morning before they were allowed to suck their dam and then reweighed. This was done to find out the amount of milk sucked by each kid. Then the kids were separated again from the dam till 6.00pm (after day grazing) when the same procedures was applied to find out the total milk yield for the day. Before milking, the teats were washed and mopped with cleaned towel and then weighed. Milk yields were measured using a measuring cylinder of 2litre capacity immediately after collection. The collected samples were then fed back to the kids whose mothers were milked while some were consumed by the researcher. Summeration of the morning and evening milking plus the kids off take gives the total milk yield for the day. Portions of the milk were collected from each goat at 4th, 8th and 12th week for milk composition determination. The samples collected were quickly transported to the laboratory, stored in a deep freeze at – 5 °C till required for analysis Weekly live weights of does were also measured; similarly.

**Data Collection**

The weights of the doe were recorded before and after supplementation. Feed intake and weight gain of the does were measured. Live weight gain of each doe was recorded at weekly interval, at 800 hours in the morning before feeding. Average daily gain was...
calculated as the difference between final live weight and initial live weight divided by the number of days of the feeding trial. The composition/quality, yield/quantity of milk produced by each group were also recorded weekly starting from week 2 after kidding through to the 12th week.

Feed intake was determined by subtracting the leftover of feed from the amount of feeds offered for each animal. Feed conversion ratio was measured as the quantity of feed fed/live weight gain. Daily weight gain was determined as the weight of the animals from the beginning to the end of the experiment. It is obtained by subtracting the initial weight from the final weight divided by the number of days the doe were supplemented on the diet. Lactation length was recorded as the period of second weeks after kidding where each doe was hand milked thrice in a week up to the 12th week. Milk yield/goat/week was determined by calculating the volume of milk obtained at each week over the lactation length (84 days). The data generated were analyzed using Analysis of Variance (Steel and Torrie, 1980) and the effect of treatment was tested and differences between treatments means were separated by Duncan’s Multiple Range Test method described according to (Humburg, 1977).

RESULTS

The daily supplement and total feed intakes (Table 1) were significant (P<0.01) affected by the dietary treatments and different from the control. The daily basal feed intake was also significantly (P<0.05) influenced by the dietary treatments and differed from the control. The daily supplement values ranged between 0 and 198.50g/day across the treatments. The daily basal feed intake values were 345.46, 298.48, 322.82 and 320.33g/day across the treatments. The total feed intake for treatments A, B, C and D were 348.40, 488.95, 495.65 and 510.31g/day respectively. Animals in the control group had the lowest daily weight gain compared to the supplemented groups. There were no dietary influence on the daily weight gain and feed conversion ratio. The daily weight gain values were 110.13, 168.73; 121.08 and 115.09g/day respectively. Similarly, feed conversion ratio across the treatments ranged between 3.11 and 4.37%.

Lactation lengths were high in the supplemented groups compared to control group. The lactation however tended to be higher in the group offered groundnut seed cake/millet bran and followed by the group on millet bran alone.

The weaning weight of the Red Sokoto goat kids ranged between 6.72 and 9.05kg. The results showed that kids on supplements B tended to have the highest weight gain of 9.05kg/day at weaning. This was followed by those on supplements C and D with weights of 8.96 and 7.52g/day respectively. The control group had the lowest weaning weight.

The milk yield of the Red Sokoto goats was significantly (P<0.01) affected by dietary treatments and hence different from the control. Milk production was favoured towards the animals in treatment B with a lactation daily milk yield and lactation length values of 0.6 kg and 84 days with the lowest of 0.2kg and 45 days in the control.

In Table 2, the regression coefficient of daily supplement intake and daily weight gain was significant (P<0.01). The daily weight gain and feed conversion ratio were also significant (P<0.01). The regression coefficient of milk yield on daily basal feed intake and feed conversion ratio were not significant.

DISCUSSION

The daily supplement intake (DSI) values of the diet are comparable to those reported by Luka and Kibon (2014). The concentrate intake values obtained in this experiment tended to decrease as a result of the higher basal dietary consumption. This is comparable to the corresponding lower values reported by Ngle (2008) and Luka and Kibon (2014). This low value may be due to the group feeding of the does on 200g/doe/day resulting in competition and inadequacy of the supplements to meet their dietary requirements thus the reason for high intake of the basal diets. This is in agreement with the reports of Yakubu (2004) when bucks were supplemented on 200g levels of supplementation had to eat more browse plants to meet up for their DMI requirement than those on the 400g level of supplementation. The daily supplements feed intake was relatively high for treatments D and B fed maize bran and groundnut seed cake and millet bran mixture. This observation agrees with the findings of Luka and Kibon (2014).

The intake of groundnut haulms in the control tended to be higher than the values obtained for supplemented groups. The dry matter intake from groundnut haulms tended to increase with increase in the types of concentrate supplementation. The higher intake of groundnut haulms by animals in the control diet was probably because animals needed to consume more of the basal diet to meet their nutritional requirements. This is similar to the report of Akinlade et al. (2003) when mucuna was supplemented to guinea grass (Panicum maximum) and fed to West African Dwarf sheep and Luka and Kibon (2014) when cotton seed cake and maize bran was supplemented to red Sokoto goat. The results showed an increase intake of basal diet tended to increase with increase in the intake of protein and energy supplement.

The mean daily total feed intake (basal and supplements) of the goats are quite variable among the treatments. This agrees with the reports of Yakubu.
(2004) and Ngele (2008) where bucks and rams were supplemented respectively. The combined effects of groundnut haulms supplemented with a mixture of millet bran and groundnut seed cake resulted in increased total feed intake. Similar findings have been reported by (Adamu et al., 1995, Luka, 2003).

Animals supplemented with groundnut seed cake and millet bran mixture tended to have higher daily weight gains compared to those on supplements A, C and D.

Table 1. Effects of Supplement diets type on feed intake, Daily Weight Gain, Feed Conversion Ratio, Milk Yield, Weaning Weight and Lactation Length of Red Sokoto Goat

<table>
<thead>
<tr>
<th>Supplements</th>
<th>A GNC/MB mix</th>
<th>B GNC/MB mix</th>
<th>C GNC</th>
<th>D MB</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Supplement Intake (g)</td>
<td>0.00c 198.50a</td>
<td>178.40b 186.42b</td>
<td>26.68**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Basal Feed Intake (g)</td>
<td>345.46a 298.48c</td>
<td>322.82b 320.33b</td>
<td>5.30*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Feed Intake (g)</td>
<td>348.40c 488.95b</td>
<td>495.65a 510.31a</td>
<td>21.26* *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily Milk Weight Gain (g)</td>
<td>110.13 168.73</td>
<td>121.08 115.09</td>
<td>6.50NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed Conversion Ratio (%)</td>
<td>3.12 3.10</td>
<td>4.18 4.37</td>
<td>0.20NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk Yield (kg)</td>
<td>0.2c 0.6a</td>
<td>0.3b 0.3b</td>
<td>1.18**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weaning weight (kg)</td>
<td>6.72 9.05</td>
<td>7.52 8.96</td>
<td>0.35NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactation length (days)</td>
<td>45b 84a</td>
<td>75a 82a</td>
<td>5.29***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Means with different superscripts within a row are significantly different
NS – Not significant GNC/MB=groundnut cake/millet Bran
SEM – Standard Error of Mean
* - (P<0.05), ** - (P<0.01), *** - (P<0.001).

The values obtained in this study were however slightly higher than that earlier reported by Luka and Kibon (2014) in a related study. This low FCR may be attributed to the nutrients distribution for the various body functions (growth, maintenance, milk).

The milk yield was high for does animals on supplements B (GNC/MB) than the other supplemented groups (C and D) which were in turn higher than in the control. This is in agreement with the findings of Luka and Kibon (2014) that within genetic limits, nutrition during lactation is the primary factor that influences milk yield. That is, milk yield tended to increase with increase in protein diets. The milk yield obtained in this study was however lower compared to those of Zahraddeen (2006). Good body condition which is an indicator of good nutrition and hence adequate body tissue reserves for normal function of the body have been attributed to high daily weight gain in sheep (Osinowo and Adu, 1985).

The regression coefficient of daily supplement intake and daily weight gain showed that a unit increase in daily supplement intake leads to a corresponding increase in protein diets. The kids average daily weight gain was higher in animals given supplement B followed by supplements D and C. These values were higher than those obtained by Zahraddeen (2006). Good body condition which is reflection of good nutrition and hence adequate body tissue reserves for normal function of the body have been attributed to high daily weight gain in sheep (Osinowo and Adu, 1985).

Table 2. Regression equation of feed intake and milk yield of Red Sokoto goats

<table>
<thead>
<tr>
<th>Independent variables X</th>
<th>Dependent variables Y</th>
<th>Equation</th>
<th>R2</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSI</td>
<td>DWG</td>
<td>Y = 120.9+0.116 x</td>
<td>0.644</td>
<td>**</td>
</tr>
<tr>
<td>FCR</td>
<td>DWG</td>
<td>Y = 120.9 -0.12 x</td>
<td>0.644</td>
<td>**</td>
</tr>
<tr>
<td>DBF1</td>
<td>Milk yield</td>
<td>Y =3.11+0.014x</td>
<td>0.16</td>
<td>NS</td>
</tr>
<tr>
<td>FCR</td>
<td>Milk yield</td>
<td>Y = 3.11x1.79x</td>
<td>0.16</td>
<td>NS</td>
</tr>
</tbody>
</table>

DSI = Daily Supplement Intake; DBF1 = Daily Basal Feed Intake; FCR = Feed Conversion Ratio
LS = Level of Significance; NS = Not Significant; ** = (P<0.01) = Significant

The milk yield also recorded in treatments B and D in the first lactation is in agreement with the findings of Zahraddeen (2006) where peak of milk yield was observed in the third week of lactation. The milk yield also recorded in treatments B and D in the first lactation is in agreement with the findings of (Luka and Kibon 2014). Osinowo and James (2004) also reported that the West African Dwarf attained peak milk yield in the third week of lactation while Red Sokoto and Sahel goats attain theirs in the second week within the humid environment. The kids were weaned at the age of 84 days. This is because at about 84 days of lactation, milk production in dams decline rapidly (Abolude, 2002). Kids average daily weight gain was higher in animals given supplement B followed by supplements D and C. These values were higher than those obtained by Zahraddeen (2006). Good body condition which is reflection of good nutrition and hence adequate body tissue reserves for normal function of the body have been attributed to high daily weight gain in sheep (Osinowo and Adu, 1985).

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increase in daily weight gain. The daily weight gain and feed conversion ratio indicates that an increase in feed conversion ratio results to a proportionate decrease in daily weight gain with a coefficient of determination being 0.644. The milk yield equation shows that an increase in daily basal feed intake results to a decrease in milk yield while an increase in feed conversion ratio proportionately increases the milk yield as shown in table 2.

CONCLUSION

The study therefore concluded that supplementation of lactating Red Sokoto goat with groundnut seed cake and millet bran mixture at 50:50, groundnut seed cake and millet bran alone was found to increase milk yield by 9.67, 3.94 and 2.80kg respectively over the control which was without supplementation.

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REFERENCES