Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 2895-2900

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 2895-2900**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Replacing Concentrate Mixture with Moringa Leaves (*Moringa oleifera*) on Performance of Lactating Bengal Goats in Kishanganj District of Bihar, India

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A B S T R A C T

The experiment was conducted on Bengal female goat's to evaluate the effect feeding moringa leaves on body weight, growth rate, milk yield and composition changes. Twelve (18) does of Bengal goat aged 13-16 months were used in these experiments. The goats were divided randomly into three groups; each group (6 females) in complete randomized design. The results revealed that the group three (T3) which fed 50% concentrate mixture + 50% moringa leaves showed the highest growth rate as 34.64 g/day compared with other feeds. The 50% inclusion of moringa leaves in concentrate mixture increased milk yield (330g/day), fat% (3.12%), lactose% (4.02%) and solid non-fat% (8.08%). An inclusion rate of 50% moringa leaves (replacing 50% of concentrate mixture) in the diet was the most suitable level for lactating goats under the current experiment conditions.

Keywords

Bengal goats, moringa, concentrate mixture, body weight, milk yield

Introduction

Human population in developing countries (Africa, Asia and the Americas) is increasing rapidly (Allen, 1983). Jasiorowski (1975) stated that world demand for animal protein is growing continuously. The main reason for the present low per capita consumption of animal protein is the low livestock productivity rather than the low livestock numbers (Jasiorowski, 1975; FAO, 1994). Among animal protein goat rearing for its meat is an important sector of the agro-economy in India and in Indian sub-continents. Low capital investments and higher economic returns have been the unique features of small and marginal goat production systems (Devendra, 2013). Goat meat has provided health promoting constituents to health conscious consumers and thus contribution of goats is increasing to the rising demand of animal products. The productivity of small ruminants in most tropical countries is generally low, mainly due to poor quality and inadequacy of available feeds. Protein is the most expensive feed ingredient in animal ration and there was always shortage in its supply particularly in developing countries. This shortage is very critical in both human and animal nutrition (Yagoub and Talha, 2009). Moreover, conventional feed ingredients

(grains, cereals, oil cakes, etc.) for animal production are scarce and highly expensive in many parts of the world. Thus searching for alternative unconventional feed sources that may have valuable components of animal diets is indispensable (Szumacher-Strabel *et al.,* 2011; Zhou *et al.,* 2012). The use of tree parts as alternative feed resources for ruminant livestock is becoming increasingly important in many parts of the tropics and sub-tropics (Silanikove, 2000; Melesse *et al.,* 2009). In fact, trees and shrubs are increasingly recognized as important components of animal feeding, particularly as suppliers of protein and especially in harsh environmental conditions. Moringa (*Moringa oleifera*) trees are multi-purpose trees of economic importance with several industrial and feeding values (Babker and Abdalbagi, 2015). The traditional feeding systems, particularly in tribal areas, make maximum use of local resources like crop residues, tree leaves, pods, seeds, etc. (Pradhan *et al.,* 1991) to improve the animal production and reduce the animal mortality. In Kishanganj district of Bihar generally Bengal goat found which are only dependent on grazing. Due to the unbalanced feeding in pregnant goats are results low weight and lower milk yield. The objective of this study is to evaluate the effect of replacing conventional concentrate mixture with *Moringa oleifera* leaves on body weight, growth rate, milk yield and composition changes of Bengal goats.

Materials and Methods

The study was conducted at the village of Kishanganj Block, by Krishi Vigyan Kendra, Kishanganj under Bihar Agricultural University, Sabour. Total eighteen (18 nos.) lactating Bengal does (average age 13-16 months) were randomly divided into three treatment groups using completely randomized design, so that each group had six animals per treatment. The dietary treatment groups were as follows:

T1 = 100% concentrate mixture

T2 = 70% concentrate mixture + 30% Moringa leaves

T3 = 50% concentrate mixture + 50% Moringa leaves

All the does were treated with antihelminthes before the commencement of the experiment to ensure the does were free of intestinal worm. The does were kept in individual pens and provided individual feeders and water buckets. The does were allowed 10 days of adaptation period during which they were gradually introduced to the experimental diets. Conventional concentrate mixture was gradually replaced at 0, 30 and 50% with dried moringa leaves and mixed thoroughly and supplied to animals. *Moringa oleifera* leaves were collected from the locally available of Moringa plants nearby house of the village and also from KVK campus. The collected moringa leaves were dried in shed on thick plastic sheets. Does were allowed 6 hours daily grazing. In addition to grazing, does were supplemented with above mentioned diet at the 2% of live body weight. All does were at their first lactation and were approximately at the same stage of lactation. The duration of the feeding trial was of 8 weeks.

The chemical composition of concentrate mixture and moringa leaves was analyzed according to standard procedures of the AOAC (2000). Live weight each animal were recorded at the start of experiment, then every two weeks until the end of the experiment in 56 days, using electronic balance, the animals were weighed in the morning. Does were hand-milked in every

two weeks interval upto end of experiments (56 days) and samples (10% of recorded milk yield) were collected and stored immediately at 4° C, send to the laboratory and kept frozen at −18 °C for further analyses. Milk samples were analyzed in the department of Animal Nutrition under West Bengal University of Animal and Fishery Science, Belgachia, Kolkata-37 for fat, protein, lactose, total solids and solid non-fat using infrared spectrophotometry (Foss 120 Milko-Scan, Foss Electric, Hillerod, Denmark). The data generated were tabulated and subjected to statistical analysis as per the method of Snedecor and Cochran (1994).

Results and Discussion

Proximate Composition of feeds

The chemical composition of the *Moringa oleifera* leaves and conventional concentrate mixture used in this study are presented in Table 1. The analyses showed that the content of crude protein (21.37 vs. 16.51%), ether extract (6.06 vs. 2.53%) and total ash (12.3 vs. 9.48%) were higher in Moringa leaves as compared to the concentrate mixture. But, the levels of dry matter (87.13 vs. 91.60%) and crude fibre (4.82 vs. 5.34%) were lower in Moringa leaves than concentrate mixture.

The crude protein content of moringa leaves used in the study was comparable with the values (25.95 and 22.6%) obtained by Manh *et al.,* (2005) and Sanchez *et al.,* (2006), respectively, but higher than the values (19.5 and 19.3% in DM) reported by Kakengi *et al.,* (2005) and Aregheore (2002), respectively. The variations in nutritive value of moringa leaves could be due to the age of harvest, soil type and fertility, proportion of leaf and stem and agro-ecological zone where trees are growing.

Body weight and growth rate

Does fed with experimental diets under study showed increase in body weight in Table 2. The initial and final average body weight were 10.74, 9.14, 9.64 kg and 12.04, 10.58, 11.58 kg in T1, T2 and T3 groups respectively. The final body weight of experimental does had progressively increased with the increasing level of moringa leaves supplementation in the diet. Consequently, daily growth rate was progressively increased in does on the T1, T2 and T3 groups. The highest (34.64 g/day) growth rate was obtained with the T3 diet and lowest (23.21 g/day) growth rate was obtained with the T1 diet. The highest growth rate of doe in T3 group may be due to high protein in the diet.

This result showed similer results with results of Mushi *et al.,* (2009) and Mahgoub *et al.,* (2005) who observed that increasing concentrate in the diet increased growth rate of goats while there was low quality and rhode grass hay as basal diet respectively. The lowest growth rate obtained from the sole concentrate diet in this study might have been due to low protein in the diet also. Feeding a large amount of grain promote the growth of lactic acid bacteria, which reduced pH in the rumen and could lead to acidosis (Owens *et al.,* 1998). Growth of cellulolytic bacteria and protozoa are inhibited by a pH below 6.0 which decreases the fibre digestibility in the rumen that leads to reduce feed intake resulted decrease body weight (Russell and Wilson, 1996).

In general, it is shown that increasing moringa leaves with conventional concentrate increased live weight gain of goats. There were no health implications when conventional concentrate was replaced with dry moringa leaves over the experimental period. Mandal (1997) has

been stated that the leaves, shoots and twigs of legume/browse plants can help overcome the nutritional constraints of tropical grass species that are low in nutritive quality and play an especially important role in improving dietary protein (Aregheore *et al.,* 1998). Generally moringa leaves are also a good protein source that is a convenient substitute of some meals (soybean and rapeseed) for ruminants, and they are able to improve the microbial protein synthesis in the rumen (Soliva *et al.,* 2005).

Table.1 Chemical composition of Moringa leaves and conventional concentrate mixture (on % DM basis) fed to Bengal Does

Chemical composition	Moringa leaves	Concentrate mixture
Dry matter (%)	87.13	91.60
Crude protein (%)	21.37	16.51
Crude fibre (%)	4.82	5.34
Ether extract (%)	6.06	2.53
Total ash (%)	12.3	9.48

Table.2 Body weight (kg) and growth rate Bengal goats fed with different diet

Traits	T1	T2	T3
Initial BW (Kg) (on 0 day)	10.74	9.14	9.64
2^{nd} BW (Kg) (on 14^{th} day)	11.02	9.46	10.14
3^{rd} BW (Kg) (on 28^{th} day)	11.38	9.88	10.60
4^{th} BW (Kg) (on 42^{nd} day)	11.68	10.20	11.10
Final BW (Kg) (on 56^{th} day)	12.04	10.58	11.58
Growth rate (g/day) (Initial to final BW)	23.21	25.71	34.64

Table.3 Milk yield and composition of Bengal goats fed with different diet

Parameter	T1	T2	T3
Milk yield (kg/day)	0.27	0.29	0.33
Fat (%)	2.35	2.71	3.12
Protein (%)	2.71	2.77	2.79
Lactose (%)	3.61	3.77	4.02
Total solids (%)	11.78	11.89	11.91
Solid non-fat (%)	7.93	8.01	8.08

Milk yield and composition

Table 3 shows the milk yield and composition does fed with T1, T2 and T3 diet. Does feed with T3 diet had higher milk yield than those fed with T2 and T1 diet. Similarly higher fat, lactose, and solid non-fat contents were observed in the milk of does fed on T3 than T2 and T1 diet. T1, T2 and T3 feeding had no differential effect on the protein, total solids of does' milk. For does, feeding with T3 increased milk yield during the feeding period. *Moringa oleifera* (50%) diet improved the milk yield may be due to increased feed intake and enhanced nutrient digestibility and ruminal fermentation. There is slightly higher protein value of T3 diet as compared to T2 and T1 diet, moringa protein has excellent

rumen bypass characteristics (Sarwatt *et al.*, 2004). According to Zarkadas *et al.*, (1995), feeding on moringa leaves prolongs lactation period because due to high concentration of amino acids. There are increase in milk fat, lactose and solid non-fat in does fed with T3 diet confirms the findings of previous works that diets supplemented with vitamins and minerals rich diets for dairy goats (Kholif *et al.*, 2015), also improves in milk production. The observation of the present study regarding the dietary effect on milk protein is similar to the finding observed in goats (Kholif *et al.*, 2015).

The results of this study suggest that 50:50 replacement of concentrate feed with *M. oleifera* in the diet of does positively affected their milk yield and composition. Moringa leaves had a greater effect on the milk yield of does and growth performance. Thus, *M. oleifera* may supplement in ruminant diets to improve the growth performance, milk yield and composition. Lastly it may conclude that an inclusion rate of 50% moringa leaves (replacing 50% conventional concentrate feed) in the diet was the most suitable level for lactating goats under the current experiment conditions.

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