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Research Article

EFFECT OF SUPPLEMENTATION OF "*MORINGA OLEIFERA*" LEAF MEAL ON NUTRIENT DIGESTIBILITY AND HAEMATO-BIOCHEMICAL PARAMETERS OF GROWING SHEEP

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ABSTRACT

An experiment was conducted on eighteen (18) growing sheep for a period of thirteen weeks. The selected sheep were allotted randomly to three groups with six animals each. The concentrate mixture was formulated by using locally available common feed ingredients and offered to control group (T0), while T1 and T2 groups received a concentrate mixture with 10% and 20% replacement of cottonseed cake (CSK) by "*Moringa oleifera*" leaf meal (MOLM), respectively. The average digestibility coefficients (%) for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF) and nitrogen free extract (NFE) ranged from 68.32 (T_0) to 69.20 (T_2), 72.26 (T_2) to 72.83 (T_1), 70.90 (T_0) to 72.11 (T_2), 72.16 (T_2) to 73.36 (T_0), 43.77 (T_0) to 47.98 (T_2) and 81.79 (T_2) to 82.62 (T_0), respectively. The average value of hemoglobin (g/dl), packed cell volume (%), blood urea nitrogen (mg/dl), serum total protein (g/dl), serum albumin (g/dl) and serum globulin (g/dl) ranged from 9.34 (T0) to 9.65 g/dl (T_2), 27.48 (T_0) to 28.88% (T_2), 16.39 (T_2) to 17.23 mg/dl (T_0), 6.73 (T_0) to 7.09 g/dl (T_2), and 3.10 (T_0) to 3.30 g/dl (T_2) and 3.62 (T_0) to 3.78 g/dl (T_2), respectively. The average digestibility coefficients and haemato-biochemical parameters differed non-significantly among treatment groups. Thus, it is concluded that MOLM can safely replace cottonseed cake as protein source up to 20 per cent in concentrate mixture of sheep.

Keywords: Concentrate mixture, Cottonseed cake, Growing sheep, *Moringa oleifera*

The population of sheep in the state of Maharashtra in 2012 was reported as 2.58 million and has declined by 11.3% over that of 2007 census (DADF, 2016). The decrease in sheep population of the country can be attributed to scarcity of feedstuffs. In context, the nutritionists are now looking for availability of fodder trees with good nutritional value and are available throughout the year. *Moringa oleifera* is an indigenous native tree from India and is locally popular as "drumstick tree". The average chemical composition of Moringa leaf meal includes 90.46% DM (Dry matter), 20.9% CP (Crude Protein), with about 47% of bypass protein and with adequate amino acid profile (Nouman *et al.*, 2014). Leaves are the most nutritious part of plants, contain vitamins B, C, K, and Vitamin-A precursor, manganese and iron, along with other essential nutrients (Peter, 2008) which are essential for livestock weight gain and milk production. Additionally, it has medicinal properties such as antioxidant, anti-cancer, anti-diabetic, anti-inflammatory and anti-microbial. Due to its benefits, it is popularly known as "Miracle Tree". Thus, the present study was undertaken to ascertain suitability of "*Moringa oleifera*" leaf meal (MOLM) as replacement for cottonseed cake (CSK) in sheep feed.

MATERIALS AND METHODS

An experiment was conducted at Punaya shlok Ahilya Devi Mendhi va Sheli Vikas Prakshtra, Dahiwadi, Tal: Man, Dist-Satara on eighteen (18) growing sheep for a period of thirteen weeks. The selected sheep were allotted randomly into three groups with six animals. The concentrate mixture was formulated by using locally available common feed ingredients and offered to control group (T_0), while T_1 and T_2 groups received a concentrate mixture with 10% and 20% replacement of CSK by MOLM, respectively (Table 1). *Moringa oleifera* leaves were harvested, subsequently dried and fine grinded to powder form and used in concentrate mixture at respective percentage. These animals were offered dry and green roughages in addition with concentrate mixture during stall feeding (Ranjan, 1998). Feed was given daily at early morning and evening time of day. All the feeders were cleaned before feeding. The feed was offered after calculating the remaining amount of feed of previous day. The feeding of concentrates and roughages were followed separately throughout the experiment. The samples from given feed were collected for proximate analysis separately from group T_0, T_1 and T_2. Experimental animals were housed in shed of semi-open type with proper ventilation and flooring. Deworming of all sheep was carried out with broad spectrum anthelmintic before start of the experiment. The blood samples were collected through jugular vein from all experimental sheep at monthly interval (0th day, 1st month, 2nd month and 3rd month) for haematological study (Hb and Packed Cell Volume). Blood samples were collected in EDTA

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(Ethylene Diamine Tetra Acetic acid) containing vial and analysis was carried out with the help of haemoanalyser. For blood serum (blood urea nitrogen, total protein, albumin, and globulin) analysis, blood was collected in plain vial (without EDTA) and serum was separated and stored in deep freeze at -20 °C for further analysis. The blood biochemical parameters were analyzed using commercial kits on auto analyzer (Model FALCON 260). Nutrient digestibility trial was conducted for seven days at the end of experiment. The record of feed offered, feed leftover, feed intake, faeces voided was maintained for 24 Hrs. The feed samples *viz*., concentrate mixture, dry fodder, green fodder fed during trial were analyzed for proximate principles as per AOAC (1995). The obtained data was analyzed by using Complete Randomised Design (CRD) as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The values of Haemoglobin (Hb) increased as the age of animal increased in all the three groups; the values were well within normal physiological range (Bhattacharya, 2011). The overall mean Hb values were marginally higher in *Moringa oleifera* fed group but were statistically non-significant (Table 3). The present study findings are supported by findings of Yusuf *et al.* (2018) who reported that Hb concentration is not significantly influenced by *Moringa oleifera* leaf meal inclusion. However, Asaolu *et al.* (2012) and Bebekar and Badalbagi (2015) reported that values of Hb were significantly higher. The values of Packed Cell Volume (PCV) increased as the age of animal increased in all three groups; values were well within normal physiological range (Bhattacharya, 2011). The overall mean PCV values of T_0, T_1 and T_2 were observed to be 27.48±0.38, 27.89±0.65 and 28.88±0.72%, respectively which indicate that values of PCV was higher in *Moringa oleifera* fed group but statistically non-significant (Table 3). The present study findings are in accordance with Yusuf *et al.* (2018). The present study findings are not in accordance with Asaolu *et al.* (2012) and Bebekar and Badalbagi (2015) who reported significant increase in PCV values in goats fed with Moringa as compared to control group. The values of BUN were within normal physiological range (Swenson, 2004). The overall mean BUN values were somewhat less in *Moringa oleifera* feeding group but it is non-significant (Table 3). The inclusion of MOLM in concentrate diet did not have any adverse effect on BUN. The present study findings disagrees with results observed by Yusuf *et al.* (2018) who reported that blood urea concentration was significantly higher in bucks which were offered MOLM-based diets. The values of Total Protein (TP) were recorded higher as the age of animal increased in all the three groups; the values were well within physiological range (Bhattacharya, 2011). Monthly values of T_0, T_1 and T_2 were observed significantly different among treatments groups and the overall mean TP values were significantly higher in *Moringa oleifera* feeding group (Table 3). So the inclusion of MOLM in concentrate diet did not have any adverse effect on blood TP. The present study findings are supported by Bebekar and Badalbagi (2015) who reported that total protein was recorded positively significant ($P<0.05$) in treatment group than control. The values of albumin increased as the age of animal increased in all

Table 1

Formulation of concentrate mixtures for experimental animals

Ingredient	T_0 (Stall feeding with dry and green fodder + concentrate mixture)	T_1 (Stall feeding with dry and green fodder +concentrate mixture (10% cotton seed cake in concentrate mixture was replaced by *MOLM)*	T_2 (Stall feeding with dry and green fodder+concentrate mixture (20% cotton seed cake in concentrate mixture was replaced by MOLM)
Maize	40	40	40
Wheat bran	11	11	11
Groundnut cake	11	11	11
Cotton seed cake	20	18	16
Moringa oleifera leaf meal	-	02	04
Tur chunni	17	17	17
Salt	0.5	0.5	0.5
Mineral + Vitamin mix	0.5	0.5	0.5
Total	100	100	100

Table 2
Details of digestibility coefficients of nutrients

Parameters	Treatment Groups		
	T_0	T_1	T_2
Digestibility coefficients of nutrients (%)			
Dry matter digestibility (%)	68.32±0.28	68.71±0.09	69.20±0.61
Organic matter digestibility (%)	72.330.24	72.83±0.08	72.26±0.55
Crude protein digestibility (%)	70.90±0.25	71.15±0.17	72.11±0.58
Ether extract digestibility (%)	73.360.24	72.73±0.18	72.16±0.56
Crude fibre digestibility (%)	43.770.63[b]	45.56±0.13[b]	47.98±1.04[a]
Nitrogen free extract digestibility (%)	82.62±0.15	81.95±0.06	81.79±0.36
Feed intake (gm/day)			
Concentrate mixture	193.91±8.55	201.16±9.52	205.78±10
Roughages (Green+Dry)	375.21±8.12	389.70±9.72	396.71±10.81
Total dry matter intake (TDMI)	569.11±16.57	590.85±19.15	602.50±20.79

Note: [a,b]means with different superscript within in a row differ significantly (P<0.05)

three groups; the values were well within physiological range (Bhattacharya, 2011). Monthly values of T_0, T_1 and T_2 did not differ significantly. Overall mean albumin values were higher in *Moringa oleifera* feeding group but statistically these values were not significant (Table 3). The inclusion of MOLM in concentrate diet did not have any adverse effect on blood albumin concentration. The values of globulin increased as the age of animal increased in all three groups; the values were well within physiological range (Bhattacharya, 2011). Monthly values of T_0, T_1 and T_2 did not differ significantly but the overall mean globulin values of T_0, T_1 and T_2 were higher in *Moringa oleifera* feeding groups (Table 3). Inclusion of MOLM in concentrate diet did not have any adverse effect on blood globulin.

The average digestibility coefficient for dry matter (%) did not differ significantly among treatment groups (Table 2). However, the present study findings agree with the findings of Oyedele *et al.* (2016) and Sultana *et al.* (2015) who reported that the dry matter digestibility of goats was significantly (P<0.01) higher in Moringa foliage diet than in other experimental diet groups. The digestibility coefficient of organic matter (%) was recorded as 72.33± 0.24, 72.83±0.08 and 72.26±0.55 in treatment groups T_0, T_1 and T_2, respectively (Table 2). The present results did not agree with *in-vivo* digestibility findings reported by Naula *et al.* (2006) and Tona *et al.* (2013) who indicated the significant increase in digestibility of organic matter of feed containing moringa

Table 3
Details of haemato-biochemical parameters of experimental sheep

Days	Treatment		
	T_0	T_1	T_2
Haemoglobin concentrations (g/dl)			
0	09.08±0.41	09.11±0.36	09.18±0.34
30	09.43±0.41	09.15±0.34	09.50±0.33
60	09.40±0.49	09.55±0.39	09.76±0.28
90	09.48±0.41	09.83±0.38	10.18±0.32
Mean±SE	09.34±0.09	09.41±0.17	09.65±0.21
Packed Cell Volume (%)			
0	27.48±1.34	26.06±1.00	26.98±1.48
30	26.41±1.40	28.75±1.30	28.57±0.89
60	28.01±1.50	27.86±1.55	30.10±1.12
90	28.49±1.30	28.91±1.19	29.91±1.23
Mean±SE	27.48±0.38	27.89±0.65	28.88±0.72
Serum Blood Urea Nitrogen (mg/dl)			
0	17.06±1.35	16.95±2.03	16.91±0.95
30	16.38±1.07	17.21±1.12	16.43±1.48
60	18.61±1.28	17.35±1.65	16.65±1.12
90	16.90±1.22	16.06±1.28	16.58±1.63
Mean±SE	17.23±0.48	16.89±0.28	16.39±0.18
Serum Total Protein (g/dl)			
0	6.58±0.18	6.56±0.26	6.88±0.15
30	6.86±0.23	6.71±0.19	7.03±0.19
60	6.65±0.18	6.93±0.19	7.20±0.10
90	6.83±0.22	6.95±0.19	7.26±0.12
Mean±SE	6.73±0.06[b]	6.78±0.09[b]	7.09±0.08[a]
Serum Albumin (g/dl)			
0	3.10±0.18	3.08±0.23	3.21±0.14
30	3.15±0.15	2.90±0.12	3.38±0.16
60	2.95±0.11	3.18±0.14	3.18±0.18
90	3.23±0.32	3.40±0.12	3.45±0.11
Mean±SE	3.10±0.05	3.14±0.10	3.30±0.06
Serum globulin (g/dl)			
0	3.48±0.28	3.48±0.24	3.66±0.24
30	3.71±0.28	3.81±0.22	3.65±0.12
60	3.70±0.20	3.75±0.28	4.01±0.20
90	3.60±0.21	3.55±0.12	3.81±0.16
Mean±SE	3.62±0.05	3.64±0.07	3.78±0.08

Note: [a,b]means with different superscript within in a row differ significantly (P<0.05)

leaves. The digestibility coefficient of crude protein (%) did not differ significantly among treatment groups (Table 2). The crude protein digestibility increased linearly with increasing level of Moringa foliage in the diet. The digestibility coefficient of ether extract (%) did not differ significantly among treatment groups. The digestibility coefficient of crude fibre (%) differed significantly among treatment groups which may be due to improvement in the healthy microflpra of rumen. The digestibility coefficient of nitrogen free extract (%) was recorded as 82.62±0.15, 81.95±0.06 and 81.79±0.36 in treatment groups T_0, T_1 and T_2, respectively (Table 2). The present study findings agree with the findings of Tona *et al.* (2014), Sultana *et al.* (2015), Akinyemi *et al.* (2010) and Oyedele *et al.* (2016).

CONCLUSIONS

Moringa oleifera leaf meal (MOLM) can be used as replacement for cotton seed cake in concentrate mixture upto 20% in diet, as it is cheaper than cotton seed cake and with low cost of feeding and has no adverse effect on digestibility of nutrients and haematobiochemical parameters of sheep.

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