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Growth performance of sirohi goat kids fed different levels of *Moringa oleifera* leaves

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Abstract
A 26 week study was carried out on forty Sirohi goat kids, which were randomly divided into five groups of eight in each group on the basis of same age and uniform conformation to evaluate the effect of *Moringa oleifera* leaves feeding on body weight changes, average daily weight gain and feed intake. Methi straw (*Trigonella foenum-graecum*), were used as a roughage, commercially available readymade feed were used as a concentrate feed and *Moringa oleifera* dry leaves were used as an experimental feed for feeding of sirohi goat kids. The group T_1 offered 60% roughage and 40% commercially available readymade concentrate and in groups T_2, T_3, T_4 and T_5, the commercially available readymade concentrate were replaced by *Moringa oleifera* leaves at 25%, 50%, 75% and 100% levels, respectively. During entire period of experiment, measured quantity of feed were provided to each animal every morning and the left over were weighted in next morning to assess daily consumption. The body weights were measured individually at the beginning and at fortnightly intervals. Results showed that the dry matter intakes of the kids in all the groups were significant. The overall body weight changes and average daily body weight gain in goat kids were higher in group T_4 followed by group T_3, group T_5, group T_2 and group T_1. It was concluded that feeding of Moringa oleifera leaves replacing concentrate feed improved body weights and average daily body weight gain as well as feed intake and overall health of Sirohi goat kids.

Keywords: Goat, Moringa leaves, feed intake, growth performance

Introduction
India is predominantly an agricultural country, where livestock and agriculture are closely associated with each other. In spite of 2 percent of geographical area, India has the pride of place on the livestock map of the world due to enormity of livestock wealth with amazing genetic diversity.

In India, there are 135.17 million goats, 26.40% of total livestock population out of which 16.03% goats found in the state of Rajasthan (Indian livestock census (2012) [1]. India ranks first among the countries of the world in respect to goat population. Goat is most hardy animal and during drought and famine conditions the goat is the last animal to die. Goats are very adaptable and versatile animals and they can thrive on diverse types of grasses and tree leaves. It is also well known that goat is superior to other ruminants in efficiency of nutrient utilization.

This huge population of livestock requires about 475 million tones dry fodder, 800 million tones green fodder and 78 million tones concentrates annually. Whereas one of the estimates indicates that there is availability of 358 million tons of dry fodder, 641 million tones of green fodder and 53 million tones of concentrates to meet the nutritional demand of existing livestock strength Gorti *et al.*, [2]. In present scenario the acute shortage of feed and fodder existing to the tune of 32.05% for concentrate, 24.63% for dry fodder and 19.87% for green fodder appear to be worse. The situation seems to aggravate further, as probably no food grain would be spread for the feeding of livestock due to the ever-growing human population.

A major constraint to animal production in developing countries is the scarcity and fluctuating quantity and quality of the year-round feed supply. These countries experience serious shortages in animal feeds of the conventional type. Usually, farmers tried to feed their animals through crop residues and poor quality hay that are little in nitrogen, high in lingo-cellulose Sultana [3] and poor in vitamin and mineral contents, which leads to low digestibility and reduced voluntary intake. Poor quality roughages fed to ruminants without supplementation,

especially during the dry season caused considerable weight losses and sometimes resulted in the death of the animals. Utilization of fodder trees and shrubs could be a potential strategy for increasing the quality and availability of feeds for resource-limited livestock farmers during the dry season. The trees provide a good and cheaper source of protein and micronutrients.One of the abundantly available top feed resources, *Moringa oleifera* tree is a drought-tolerant, fast-growing, multi-purpose and one of most useful tree due to its medicinal and nutritional properties in world and therefore described as a 'miracle tree' Fuglie [4], Amaglo [5], Yisehak [6], Ashfaq [7]. On a dry matter basis, *Moringa oleifera* leaves contain 27.2% protein, 17.1% fat, 5.9% moisture and 38.6% carbohydrates. Keeping the aforesaid facts in view, the present investigation was planned to find out the possibilities of utilization of *Moringa oleifera* leaves feeding on feed intake and growth performance of sirohi goat kids.

Materials and Methods

Forty post-weaned Sirohi goat kids of same age and uniform conformation were selected from the Livestock Research Station, Bojunda, Chittorgarh. They were allocated into five groups with eight kids per treatment using completely randomized block design. All the experimental kids were housed separate from other animals in well ventilated and protected shed and provided individual feeder and water buckets. All kids were managed under standard caring, feeding and management practices. The kids were allowed 10 days of adjustment period prior to experimental feeding. All the Experimental kids were dewormed at the beginning of experiment by using Albendazole as an anthelmintic and were examined periodically for parasitic infestation. Kids did not show any symptoms of clinical ailment or external injury and were looked quite healthy during whole experimental period. Methi straw (*Trigonella foenum-graecum*) were used as a roughage, commercially available readymade feed were used as a concentrate feed and *Moringa oleifera* dry leaves were used as a experimental feed for feeding of sirohi goat kids. *Moringa oleifera* leaves were harvested from the moringa plots of the Livestock Research Station, Bojunda, Chittorgarh. The collected moringa leaves were sun dried on thick plastic sheets and used for feeding. The group T_1 offered roughage and commercially available readymade concentrate feed in ratio of 60:40 and groups T_2, T_3, T_4 and T_5, the readymade concentrate feed were replaced by *Moringa oleifera* leaves at 25%, 50%, 75% and 100% levels, respectively. Feeding trials of Twenty six weeks were conducted for all the treatment groups. During entire period of experiment, measured quantity of feed were provided to each animal every morning and the left over were weighted in next morning to assess daily consumption. The body weight was measured individually at the beginning and at fortnightly intervals during morning hours before feeding and watering during the entire experimental period of Twenty six weeks. The average daily body weight gain was calculated for first ninety days (0 to 90 days) as ADG 1 and next ninety days (90 to 180 days) as ADG 2. The chemical composition of feed ingredients and experimental diet were analyzed according to standard procedure of the AOAC [14].

Statistical Analysis

Analysis of variance of the data obtained in the experiment was conducted based on a completely randomized block design using the general linear model procedure of SPSS (SPSS 22.0). The differences in the means were compared by least significant differences at 5% level ($p<0.05$).

Results and Discussion

Chemical composition of feed ingredients

The percent chemical composition of methi straw, readymade concentrate and *Moringa oleifera* dried leaves on dry matter basis has been presented in table 1.

Table 1: Percent chemical composition of experimental diet

Nutrients	Feed ingredients		
	Methi straw	Readymade concentrate	*Moringa oleifera* dried leaves
DM	93.88	89.00	85.69
OM	90.79	91.84	90.24
CP	09.68	20.00	23.31
EE	01.80	04.00	04.70
CF	38.26	10.00	09.26
NFE	41.05	57.84	52.97
TA	09.21	08.16	09.76

The dry matter, organic matter, crude protein, ether extract, crude fibre, nitrogen free extract and total ash in the methi straw were 93.88, 90.79, 9.68, 1.80, 38.26, 41.05 and 9.21 percent, respectively, in the readymade concentrate were 89, 91.84, 20, 4, 10, 57.84 and 8.16 percent, respectively and in the *Moringa oleifera* leaves were 85.69, 90.24, 23.31, 4.7, 9.26, 52.97 and 9.76 percent, respectively. The crude protein content of *Moringa oleifera* leaves used in the study was comparable with the values 25.95, 22.6, 29.7, 23.24, 29.14 and 26.3% obtained by Manh [8] , Sánchez [9], Fadiyimu [10], Jiwuba [11] , Oyedele [12] and Damor [13], respectively, but higher than the values 19.3, 19.5, 18.26 and 20.56% reported by Aregheore [14], Kakengi [15], Sultana [16] and Ali S. B. [17], respectively. The variations in nutritive value of *moringa oleifera* could be due to the age of harvest, soil type and fertility, proportion of leaf and stem and agroecological zone where trees are growing.

Chemical composition of experimental diet

The percent chemical composition of experimental diets of different groups on dry matter basis has been presented in table 2.

Table 2: Chemical composition of experimental diet (%DM basis)

Nutrients	T_1	T_2	T_3	T_4	T_5
DM	91.928	91.597	91.266	90.935	90.604
OM	91.21	91.05	90.89	90.73	90.57
CP	13.808	14.139	14.542	14.873	15.204
EE	02.68	02.75	02.82	02.89	02.96
CF	26.956	26.882	26.808	26.734	26.66
NFE	47.766	47.279	46.792	46.305	45.818
TA	08.79	08.95	09.11	09.27	09.43

The dry matter, organic matter, crude protein, ether extract, crude fibre, nitrogen free extract and total ash were 91.928, 91.21, 13.808, 2.68, 26.956, 47.766 and 8.79%, respectively in group T1 diet, 91.597, 91.05, 14.139, 2.75, 26.882, 47.279 and 8.95%, respectively in group T2 diet, 91.266, 90.89, 14.542, 2.82, 26.808, 46.792 and 9.11%, respectively in group T3 diet, 90.935, 90.73, 14.873, 2.89, 26.734, 46.305 and 9.27%, respectively in group T4 diet and 90.604, 90.57, 15.204, 2.96, 26.66, 45.818 and 9.43%, respectively in group T5 diet. The chemical composition of experimental diet for all

groups was nearly similar in term of protein contents.

Dry matter intake

The acceptability of feed is probably one of the prime parameter for ascertaining utilizability of the non-conventional feed resource. The average daily dry matter intake per goat kids in all the treatment groups was calculated from the data of feed intake recorded during the study and the values of average fortnightly dry matter intake are presented in table 3.

Table 3: Average fortnightly dry matter intake (g/d) in experimental groups

Fortnights	Treatment groups					Significance
	T_1	T_2	T_3	T_4	T_5	
F1	498.09±6.97	492.59±4.35	507.38±1.92	508.6±2.23	506.8±5.82	NS
F2	520.91±1.96	544.88±4.36	558.19±5.43	561.74±8.41	555±6.30	NS
F3	524.69±3.17	541.59±5.85	567.25±5.14	582.56±5.05	56.5±7.81	*
F4	527.09±9.17	544.53±11.9	579.5±7.3	587.97±12.56	567.09±11.61	*
F5	530.88±13.96	538.8±12.25	588.55±11.8	590.33±10.8	589.61±12.8	*
F6	528.81±12.06	548.84±11.68	582.56±15.62	592.09±14.04	583.14±12.9	*
F7	541.78±9.77	530.51±10.6	583.53±11.4	598.75±9.61	585.44±12.68	*
F8	540.5±8.25	577.13±7.3	569.78±10.35	602.72±7.82	575.94±10.81	*
F9	542.84±6.94	549.69±6.44	585.84±4.8	602.91±8.18	588.66±6.71	*
F10	544.56±6.23	554.69±2.08	592.13±6.11	590.86±7.62	591.47±6.26	*
F11	548.13±5.49	557.74±6.35	593.75±6.87	607.78±9.29	592.66±6.54	*
F12	548.37±9.73	562.22±6.38	598.28±7.4	616.31±5.8	593.59±7.55	*
Overall Mean ±SE	533.51±4.21[a]	545.72±5.93[a]	575.25±7.0[b]	586.78±8.16[b]	572.24±7.03[b]	*

* Significant difference (p<0.05) NS Non-significant difference

The statistical analysis of data revealed significant (p<0.005) effect of different treatments for dry matter intake per day in every fortnight except 1st and 2nd fortnight. The overall mean values for daily dry matter intake were found to be 533.51±4.2, 545.72±5.93, 575.25±7.01, 586.78±8.16 and 572.24±7.03 for group T_1, T_2, T_3,T_4 and T_5. The overall mean of dry matter intake of goat kids was higher in group T_4 followed by T_3, T_5, T_2 and T_1. The statistical analysis of data as shown in table 3 revealed significant (p<0.05) effect of treatments. The Group T_3, T_4 and T_5 were shown statistically significant (P<0.05) difference with $T_1$and T_2 whereas the difference between T_3 and T_4 and T_5 were non-significant and difference between T_1 and T_2 were also non-significant.

The results obtained in present study are in concurrence with Sarwatt [18], Sanchez [9], Tona [19], Sultana [3], Babeker and Bdalbagi [20], Kholif [21] and Suliman [22] who reported significant increase in dry matter intake. In contrary to our findings Aregheore [14] Asaulo [23] , Ali S. B. [17] , Damor [13] who were reported non-significant effect in dry matter intake among the treatment groups.

Body weight changes

The body weight of each goat kids from all the groups were recorded at fortnightly interval during the experimental period and is presented in table 4 and Analysis of variance of initial, mid (90day), final (180 day) and overall body weight is presented in Table 5, 6, 7, and 8.

Table 4: Average fortnightly body weight (Kg) of experimental goat kids

Fortnights	Treatment groups					Significance
	T_1	T_2	T_3	T_4	T_5	
F0	14.93±0.79	15.13±0.98	15.69±0.92	15.41±0.56	15.59±1.01	NS
F1	15.39±0.78	15.48±0.97	16.24±0.78	16.1±0.49	16.11±0.88	NS
F2	15.86±0.78	15.99±1	16.83±0.75	16.91±0.71	16.64±0.87	NS
F3	16.31±0.7	16.54±0.94	17.59±0.73	17.82±0.78	17.30±0.8	NS
F4	16.69±0.68	16.94±0.97	18.48±0.98	18.69±0.78	18.16±0.95	NS
F5	17.02±0.65	17.45±0.97	19.11±0.96	19.68±0.98	18.71±0.98	NS
F6	17.28±0.63	17.73±0.97	19.9±1.07	20.71±0.88	19.51±0.87	*
F7	17.86±0.7	18.3±1.04	20.58±1.22	21.46±1.09	20.39±0.86	NS
F8	18.33±0.67	19.05±1.07	21.18±1.33	22.22±1.13	21.05±0.83	NS
F9	18.81±0.58	19.75±1.09	21.86±1.36	23.03±1.1	21.74±0.85	*
F10	19.32±0.59	20.48±1.14	22.76±1.45	23.82±1.07	22.58±0.87	*
F11	19.84±0.63	21.24±1.14	23.71±1.56	24.73±1.03	23.38±0.89	*
F12	20.27±0.64	22.04±1.12	24.73±1.59	25.77±1.04	24.23±0.86	*
Overall Mean±SE	17.53±0.24[a]	18.16±0.34[a]	19.89±0.42[cd]	20.49±0.4[d]	19.65±0.36[bc]	*

Significant difference (p<0.05) NS Non-significant difference

Table 5: Analysis of variance of Initial Body weight

Source of variance	Df	SS	MSS	F – value
Treatment	4	3.23725	0.80931	0.1339
Error	35	211.55	6.04428	

Table 6: Analysis of variance of 90 days Body weight

Source of variance	Df	SS	MSS	F – value
Treatment	4	68.5284	17.1321	2.66614
Error	35	224.9031	6.425802	

Table 7: Analysis of variance of 180 days Body weight

Source of variance	Df	SS	MSS	F – value
Treatment	4	157.4943	39.37358	4.1041
Error	35	335.7802	9.593719	

Table 8: Analysis of variance of overall Body weight

Source of variance	Df	SS	MSS	F – value
Treatment	4	642.9577	160.7394	12.30644
Error	515	6726.624	13.0614	

All groups exhibited similar trend of fortnightly increase in average live body weight throughout the experimental period which revealed linear growth in control and experimental groups. The average initial body weight of selected goat kids were 14.93±0.79, 15.13±0.98, 15.69±0.92, 15.41±0.56 and 15.59±1.01 kg under treatment groups T_1, T_2, T_3, T_4 and T_5, respectively which was statistically non-significant (p<0.05). The average mid (90 day) body weight of selected goat kids were 17.28±0.63, 17.73±0.97, 19.9±1.07, 20.71±0.88 and 19.51±0.87 kg under treatment groups T_1, T_2, T_3, T_4 and T_5, respectively which was statistically significant (p<0.05). The average final (180 day) body weight of selected goat kids were 20.27±0.64, 22.04±1.12, 24.73±1.59, 25.77±1.04 and 24.23±0.86 kg under treatment groups T_1, T_2, T_3, T_4 and T_5, respectively which was statistically significant (p<0.05). The overall body weight changes of goat kids was higher in group T_4 (20.49±0.40 kg) followed by group T_3 (19.89±0.42), group T_5 (19.65±0.36), group T_2 (18.16±0.34) and group T_1 (17.53±0.24kg). The statistical analysis of data as shown in table 4 revealed highly significant (p<0.05) effect of treatments. The Group T_4, T_3 and T_5 were shows statistically significant (P<0.05) difference with $T_1$and T_2 whereas the difference between T_4 and T_3 were non-significant and difference between T_3 and T_5 were also non-significant. The difference between T_4 and T_5 were statistically significant.

The results obtained in present study are in agreement with Asaolu [23], Tona [19], Babeker and Bdalbagi [20], Melesse [24], Sultana [16], Oyedele [12], Damor [13] and R. K. Choudhary [25] who reported that feeding of Moringa leaves significantly increased body weight in goat kids. In disagreement to our findings Mahgoub [26], Jiwuba [11] and Ali S. B. [17] who reported non-significant difference in live body weight changes among the treatment groups.

Body Weight Gain

The average daily body weight gain was calculated for first ninety days (0 to 90 days) as ADG 1 and next ninety days (90 to 180 days) as ADG 2. The observations of calculated average daily body weight gain are presented in table 9 and Analysis of variance of ADG 1, ADG 2 and overall average daily body weight is presented in Table 10, 11, and 12.

Table 9: Average daily body weight gain (gm/d) of experimental goat kids

ADG	Treatment groups					Significance
	T_1	T_2	T_3	T_4	T_5	
ADG 1	26.14±5.38^{a}	28.93±5.66^{a}	46.78±6.62^{ab}	58.9±7.24^{b}	43.63±10.49^{ab}	*
ADG 2	33.3±2^{a}	47.94±2.16^{b}	53.65±6.83^{b}	56.27±3.51^{b}	52.44±5.73^{b}	*
ADG Overall	29.72±2.35^{a}	38.43±2.93^{ab}	50.22±4.07^{c}	57.59±4.91^{c}	48.03±5.41^{bc}	*

* Significant difference

Table 10: Analysis of variance of Body weight gain from 0 to 90 days (ADG 1)

Source of variance	Df	SS	MSS	F - value
Treatment	4	5818.486	1454.622	3.402978
Error	35	14960.94	427.4555	

Table 11: Analysis of variance of Body weight gain (ADG 2)

Source of variance	Df	SS	MSS	F - value
Treatment	4	2667.057	666.7642	4.148214
Error	35	5625.734	160.7353	

Table 12: Analysis of variance of Body weight gain (ADG Overall)

Source of variance	Df	SS	MSS	F - value
Treatment	4	3769.449	942.3622	4.804635
Error	35	6864.763	196.1361	

The means of average daily body weight gain of ADG 1 were 26.14± 5.38, 28.93±5.66, 46.78±6.62, 58.90±7.24 and 43.63± 10.49 gm/d for group T_1, T_2, T_3, T_4 and T_5 respectively. The average daily body weight gain of ADG 1 was higher in group T_4 followed by group T_3, T_5, T_2 and T_1. Highest average daily weight gain was found in goat kids fed with T_4 diet while the lowest was found in goat kids fed with T_1 diet. The statistical analysis of data as shown in table 10 revealed significant (p<0.05) effect of treatments. The Group T_4 was shown statistically significant (p<0.05) difference with $T_1$and T_2 whereas the difference between T_3, T_4 and T_s were non-significant and difference between T_1, T_2, T_3 and T_5 were also non-significant.

The means of average daily body weight gain of ADG 2 were 33.3±2, 47.94±2.16, 53.65±6.83, 56.27±3.51 and 52.44±5.73 gm/d for group T_1, T_2, T_3, T_4 and T_5 respectively. The average daily body weight gain of ADG 2 was higher in group T_4 followed by group T_3, T_5, T_2 and T_1. Highest average daily weight gain was found in goat kids fed with T_4 diet while the lowest was found in goat kids fed with T_1 diet. The statistical analysis of data as shown in table 11 revealed significant (p<0.05) effect of treatments. The Group T_1 was significantly (p<0.05) lower than T_2, T_3, T_4 and T_5 whereas the difference between T_2, T_3, T_4 and T_s were non-significant.

The overall means of average daily body weight gain were 29.72±2.35, 38.43±2.93, 50.22±4.07, 57.59±4.91 and 48.03±5.41 gm/d for group T_1, T_2, T_3, T_4 and T_5 respectively. The average daily body weight gain was higher in group T_4 followed by group T_3, T_5, T_2 and T_1. Highest average daily weight gain was found in goat kids fed with T_4 diet while the lowest was found in goat kids fed with T_1 diet. The statistical analysis of data as shown in table 12 revealed significant (p<0.05) effect of treatments. The Group T_3 and T_4 were shown statistically significant (p<0.05) difference with $T_1$and T_2 whereas the difference between T_3, T_4 and T_s were non-significant and difference between T_2 and T_5 were also non-significant. The difference between T_1 and T_5 were statistically significant.

The present findings are in agreement with Moyo [27], Tona [19], Bebaker and Bdalbagi [20] , Sultana [16], Damor [13] and Ali

S. B. [17] who reported that feeding of *Moringa oleifera* leaves significantly increase in Average daily body weight gain in goats. In disagreement to our findings with Mahgoub [26] who reported non-significant difference in average daily body weight gain among the treatment groups.

Conclusion

Based on the results of the present study, it was concluded that feeding of *Moringa oleifera* leaves replacing concentrate feed improved body weights and average daily body weight gain as well as feed intake and overall health of Sirohi goat kids. *Moringa oleifera* leaves can be used as an alternate for concentrate feed in the diet of goat kids due to its high crude protein contents. It is recommended that replacing *Moringa oleifera* leaves at 75% (T_4) with concentrate feed could be used as a cheap protein supplement for goat kids.

References

1. Livestock census. Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India, 2012. www.dahd.nic.in
2. Gorti RK, Suresh KP, Sampath KT, Giridhar K, Anandan S. Modeling and forecasting livestock and fish feed resources: requirement and availability in India. National Institute of Animal Nutrition and Physiology, Bangalore, 2012.
3. Sultana N, Alimon AR, Haque KS, Sazili AQ, Yaakub H, Hossain SM. The effect of cutting interval on yield and nutrient composition of different plant fraction of *Moringa oleifera* tree. Journal Food Agricultural Environment. 2014; 12(2):599-604.
4. Fuglie LJ. The Moringa trees a local solution to malnutrition. Dakar, Senegal, 2003.
5. Amaglo N. Moringa and other highly nutritious plant resources: Strategies, standard and markets for a better impact on nutrition in Africa. Accra, Ghana, 2006.
6. Yisehak K, Solomon M, Tadelle M. Contribution of Moringa (*Moringa stenopetala*, Bac.) a Highly Nutritious Vegetable Tree, for Food Security in South Ethiopia: A Review. Asian Journal of Applied Sciences. 2011; 4:477-488.
7. Ashfaq M, Basra SMA, Ashfaq U. Moringa: A miracle plant of agroforestry. Journal of Agriculture and Social Science. 2012; 8:115-122.
8. Manh LH, Dung NNX, Ngoi TP. Introduction and evaluation of Moringa oleifera for biomass production and as feed for goats in the Mekong Delta. Livestock Research for Rural Development. Retrieved from http://www.lrrd.org/ lrrd17/9/manh17104.htm. 2005; 17(9).
9. Sànchez RN, Spörndly E, Ledin I. Effect of feeding different levels of foliage of *Moringa oleifera* to creole dairy cows on intake, digestibility, milk production and composition. Livestock Science. 2006; 101(1-3):24-31.
10. Fadiyimu AA, Julias AA, Fajemisin AN. Digestibility, nitrogen balance and haematological profile of West African Dwarf sheep fed dietary levels of *Moringa oleifera* as supplement to Panicum maximum. Journal of Animal Science. 2010; 6(10):634-643.
11. Jiwuba PDC, Ahamefule FO, Okechukwu OS, Ikwunze K. Feed intake, body weight changes and haematology of west African dwarf goats fed dietary levels of *Moringa oleifera* leaf meal. Agricultura. 2016; 13(1, 2):71-77.
12. Oyedele OJ, Asalou VO, Odeyinka SM. Nutrient digestibility and growth performance of west African dwarf (WAD) goats fed foliage combinations of *Moringa oleifera* and *Gliricidia sepium* with equal proportions of a low – cost concentrate. Journal of Natural Sciences Research. 2016; 6:18.
13. Damor SV, Pawar MM, Ankuya KJ, Gami YM, Srivastava AK, Chauhan HD *et al*. Effect of feeding different levels of Moringa (*Moringa oleifera*) leaves on growth performance of Mehsana goat kids. Trends in Biosciences. 2017; 10(18):3190-3193.
14. Aregheore EM. Intake and digestibility of *Moringa oleifera*–batiki grass mixtures by growing goats. Small Ruminant Research. 2002; 46:23-28.
15. Kakengi AMV, Shem MN, Sarwatt SV, Fujihara T. Can *Moringa oleifera* be used as a protein supplement for ruminants? Asian-Australian Journal of Animal Science. 2005; 18(1):42-47.
16. Sultana N, Alimon AR, Huque KS, Sazili AQ, Yaakub H, Hossain J *et al*. The feeding value of Moringa (*Moringa oleifera*) foliage as replacement to conventional concentrate diet in Bengal goats. Advance Animal Veterinary Science. 2015; 3(3):164-173.
17. Ali SB. Growth performance of goats fed *Moringa oleifera* leaf meal incorporated in concentrate mixture. MVSC thesis submitted to Maharashtra Animal and Fishery Sciences University, Nagpur, 2017.
18. Sarwatt SV, Milangha MS, Lekule FP, Madalla N. Moringa oleifera and cottonseed cake as supplements for smallholder dairy cows fed Napier grass. Livestock Research for Rural Development. 2004; 16(6).
19. Tona GO, Ogunbosoye DO, bakare BA. Growth performance and nutrient digestibility of west African dwarf goats fed graded levels of *Moringa oleifera* leaf meal. International Journal Current Microbiology Applied Science. 2014; 3(8):99-106.
20. Babekr EA, Bdalbagl YMA. Effect of feeding different levels of *Moringa oleifera* leaves on performance, hematological, biochemical and some physiological parameters of Sudan Nubian goats. Online Journal of Animal and Feed Research. 2015; 5(2):50-61.
21. Kholif AE, Morsy TA, Gouda GA, Anele UY, Galyean ML. Effect of feeding diets with processed Moringa oleifera meal as protein source in lactating Anglo-Nubian goats. Animal Feed Science and Technology. 2016; 217:45-55.
22. Suliman AIA, Solimanand AAM, Ahmed AAM. Productive performance of growing lambs fed diets supplemented with different levels of dried *Moringa oleifera* leaves. Egyptian Journal of Sheep & Goat Sciences. 2016; 3(11):13-24.
23. Asaolu VO, Binuomote R, Akinlade J, Aderinola O, Oyelami O. Intake and growth performance of West African Dwarf goats fed *Moringa oleifera*, *Gliricidia sepium* and *Leucaena leucocephala* dried leaves as supplements to Cassava Peels. Journal of Biology, Agriculture and Health Care. 2012; 2(10):76-88.
24. Melesse A, Meskel DH, Banerjee S, Abebe A, Sisay A. The effect of supplementing air-dried *Moringa stenopetala* leaf to natural grass hay on feed intake and growth performances of Arsi-Bale Goats. Agriculture. 2015; 5:1183-1194.
25. Choudhary RK, Roy A, Roy PS, Singh KM, Kumar P. Effect of replacing concentrate mixture with Moringa

leaves on performance of lactating Bengal goats in kishanganj district of Bihar, India. International Journal of current Microbiology Applied Science. 2018; 7:2895-2900.
26. Mahgoub O, Lu CD, Hameed MS, Richie A, Al-Halhali AS, Annamalai K. Performance of Omani goats fed diets containing various metabolizable energy densities. Small Ruminant Research. 2005; 58(2):175-180.
27. Moyo B, Patrick JM, Muchenje V. Effect of supplementing crossbred Xhosa lop-eared goat castrates with *Moringa oleifera* leaves on growth performance, carcass and non-carcass characteristics. Tropical Animal Health Production. 2012; 44:801-809.