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Effect of Feeding *Moringa oleifera* Meal on Feed and Nutrient Intake, Feeding Behaviour and Feed Conversion Ratio of Surti Kids

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ABSTRACT

An experiment was conducted to determine the effect of *Moringa oleifera* meal on feed and nutrient intake, growth performance, feeding and drinking behaviour and feed conversion efficiency of Surti kids. Eighteen growing Surti kids of 6-8 months were randomly allotted to three dietary groups as T_1 control, T_2 - 25% compound concentrate mixture replaced by *Moringa oleifera* meal and T_3 - 50% compound concentrate mixture replaced by *Moringa oleifera* meal. Dry matter and nutrient intake, body weight and feeding behaviour of experimental kids were statistically insignificant, while average daily gain and feed conversion ratio differed significantly ($P<0.05$) between treatment groups. Feed conversion ratio of T_2 was significantly ($P<0.05$) lower than T_3, while the FCRs of T_2 and T_3 were at par with the T_1. It was concluded that 25% and 50% replacement of concentrate mixture with *Moringa oleifera* meal did not affect the nutrient intake, feeding behaviour and growth performance of Surti kids, whereas replacement by 25% *Moringa oleifera* meal showed significantly ($P<0.05$) better feed conversion efficiency.

HIGHLIGHTS

- *Moringa oleifera* meal did not affect nutrient intake, feeding behaviour and growth performance.
- Significantly better feed conversion efficiency was observed.

Keywords: *Moringa oleifera* meal, Nutrient intake, Feed conversion ratio, Surti kids

As per 20th livestock census (BAHS, 2020), total livestock population of India is 535.78 million showing an increase of 4.6% over previous livestock census. With the rising livestock population and limited feed resources, access to affordable good quality animal ration is challenging for the farmers in developing countries. During scarcity periods, various crop residues and poor quality feedstuffs are fed to the animals by the farmers which lead to low digestibility and reduced voluntary intake (Damor *et al.,* 2017) and over a certain period of time low digestible feed resources may not even meet the maintenance requirements of the animals (Tona *et al.,* 2014). The quantity of feed intake depends on various factors like ambient temperature, change in climate, introduction of new feed ingredients in ration, palatability and quality of ration offered to livestock and feed intake may decrease if quality of feed is inadequate (Moyo *et al.,* 2019).

With an average production of 1.1 to 1.3 million tones fruit pods annually, India is the largest producer of *Moringa oleifera* which is cultivated on an area of 380 km². Nutrient rich tree leaves like *Moringa oleifera* leaves are good source of protein, provitamin A as beta-carotene,

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vitamin B, vitamin C, vitamin K, and few minerals like manganese with insignificant amount of anti-nutritive factors (Moyo *et al.,* 2012). *Moringa oleifera* being a perennial plant gained popularity in animal ration and several harvests can be obtained in one growing season, *Moringa oleifera* leaves can be fed fresh or dried without any loss in its nutritive value as a good source of protein. Several scientific reports have documented that dry matter intake (DMI) increases due to higher palatability of *Moringa oleifera* (Sultana *et al*., 2015b), while others observed no statistical difference in the DMI (Damor *et al.,* 2017; Sultana *et al*., 2015a). Current study was designed to evaluate the effect of incorporating 25 and 50% of *Moringa oleifera* meal instead of compounded concentrate mixture as a new source of protein on nutrient intake, feeding behaviour and feed efficiency of Surti kids.

MATERIALS AND METHODS

Location and duration of the experiment

The experiment was carried out at Livestock Farm Complex (LFC), College of Veterinary Science and A.H., Anand from January to April, 2021. Animal handling, care and sampling procedures were approved by Institutional Animal Ethics Committee (IAEC) as per the guidelines recommended by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), India.

Animal grouping and treatments

Eighteen growing Surti kids of 6-8 months age were selected having average body weight of 7-14 kg, and were dewormed initially. The experimental animals were distributed randomly on body weight basis in three treatment groups with six kids in each group (4 females and 2 males). The first group (T_1) was offered TMR having roughage 65% and compound concentrate mixture 35%. The second (T_2) and third (T_3) groups fed experimental TMR contained 25% and 50% of *Moringa oleifera* meal instead of compound concentrate mixture as a source of protein, respectively. *Moringa oleifera* meal consisted of 78% *Moringa oleifera* dry leaves (CP% = 28.6) and 22% *Moringa oleifera* stem powder (CP% = 12.5) to produce 100% *Moringa oleifera* meal. The TMR was fed twice daily, one at 8.30 a.m. and another at 15.00 p.m. (ICAR, 2013). Mineral mixture was offered to the experimental animals at the rate of 2% of feed offered. The kids were tied individually with a cotton rope under a well-ventilated animal shed, and were fed and watered individually.

Feeding Management

Before morning feeding, all animals were weighed fortnightly using an electronic weighing machine. Leftover quantity of feed was weighed every morning. Similarly, water intake was measured by subtracting water offered to the left twice a week. Feed and water intake records were maintained throughout the experimental period. Diurnal feeding behaviour of all the experimental kids was measured during two phases*, viz.,* Phase I (8:00 a.m. to 5:00 p.m.) and Phase II (5:00 p.m. to 8:00 a.m.) twice a week. At 5:00 p.m. left over feed was subtracted with the feed offered in the morning to calculate the day feed intake (g). Day left over was again added in the manger and then evening feed was offered. At 8:00 a.m. next day morning, leftover was subtracted with the feed offered in the previous evening plus day leftover to calculate night feed intake (g). Watering behaviour of experimental kids was recorded bi-weekly by offering measured quantities of water in a plastic tub and water intake was measured by subtracting leftover water with offered water using a measuring cylinder, while total water intake time (sec/drink) was measured by using a stopwatch. Water intake per second was measured (ml/sec) by dividing water intake with duration of water intake. Proximate principles of TMR were estimated as per the methods of (AOAC, 2012).

STATISTICAL ANALYSIS

Experimental data were analyzed using completely random design (factorial) as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The chemical composition of experimental diet offered to all groups is presented in Table 1. On dry matter basis, the crude protein content of TMR was nearly similar.

Table 1: Chemical composition (% DM basis) of experimental Total Mixed Ration (TMR)

Chemical Composition	T_1	T_2	T_3
Dry matter	89.00	90.00	91.00
Crude protein	14.73	14.72	14.73
Ether extract	8.95	9.22	9.60
Crude fibre	25.42	26.09	26.71
Total ash	9.75	10.88	11.45
Nitrogen free extract	41.15	39.09	37.51

Feed and nutrient intake

In the present study, average dry matter intake (DMI) on g/day of all the experimental groups at the end of the experiment was comparable (Table 2). However, DMI on % BW increased significantly (P<0.05) by 6.6% in T_3 (2.88±0.04) and insignificantly by 2.6% in T_2 (2.76±0.06) as compared to T_1 (2.69±0.05). Similar non-significant differences in DMI (g/d) of Mehsana kids among treatment groups were reported by Damor *et al.* (2017). In lactating Anglo-Nubian goats also, the DMI (g/d) was comparable among 25, 50 and 75% *Moringa oleifera* treated diets, but it was significantly (P<0.05) higher at 100% inclusion rate (Kholif *et al*., 2018). Several previous studies however have observed that with the increase in inclusion rate of *Moringa oleifera* in ruminant ration, DMI (g/d) increases significantly (Tona *et al*., 2014; Babeker *et al*., 2015; Sultana *et al*., 2015[a]; Jiwuba *et al*., 2016), which is in contrast with the present findings. Sultana *et al*. (2015[a]) observed non-significant differences in DMI (both on g/d and % BW) among 0, 20, 50, 75% *Moringa oleifera* treatment diets, but DMI (g/d) was significantly (P<0.05) higher at 100% inclusion rate in Bengal male kids. Significantly higher DMI (% BW) of *Moringa oleifera* treated groups than control was attributed to the optimum level of fiber and a favorable combination of forage to concentrate ratio that improved palatability (Sultana *et al*., 2015b). Further, in contrast to present findings, DMI (% BW) of West African Dwarf (WAD) goats was statistically similar among *Moringa oleifera* leaf meal fed groups (Jiwuba *et al*., 2016). The average digestible crude protein (DCP) and total digestible nutrient (TDN) intake (g/d and % BW) of all the experimental groups at the end of the experiment were comparable. However, DCP and TDN (g/d) intake of animals fed at 50% inclusion rate of MOM showed numerically higher value followed by 25% inclusion rate and control. The average water intake (ml/d and % BW) also were statistically similar between three treatments (Table 2). These findings were in accordance with Srivastav (2018), while Kholif *et al*. (2015) reported lower DCP and TDN intake in *Moringa oleifera* fed group as compared to control group. A comparable DCPI of experimental kids observed in the present study may be due to the equal protein level in TMR among dietary groups (Table 1). *Moringa oleifera* leaves are enriched with various vitamins, minerals, phosphorus, calcium, carotenes and negligible amounts of saponins and tannins (Moyo *et al*., 2012). Due to the additional solutes in ration, water requirement of livestock rises to maintain blood osmotic balance. In the present study, the water intake (ml/d and % BW) did not differ between treatment groups, which shows that up to 50% inclusion of *Moringa oleifera* meal in concentrate do not affect the blood osmotic balance.

Table 2: Feed and nutrient intakes and average body weight gain of Surti kids fed with different level of *Moringa oleifera* meal

Vaiables	T_1	T_2	T_3
DMI (g/d)	317.97 ± 8.45	324.94 ± 5.94	339.38 ± 7.01
DMI (% BW)*	2.69^{a} ± 0.05	2.76^{ab} ± 0.06	2.88^{b} ± 0.04
DCPI (g/d)	29.89 ± 0.79	30.38 ± 0.56	31.56 ± 0.65
DCPI (% BW)	0.25 ± 0.00	0.26 ± 0.01	0.27 ± 0.00
TDNI (g/d)	191.58 ± 5.09	192.95 ± 3.53	198.54 ± 4.10
TDNI (% BW)	1.70 ± 0.03	1.64 ± 0.03	1.68 ± 0.02
Water intake (ml/d)	957.59 ± 28.55	976.96 ± 33.46	964.49 ± 34.77
Water intake (% BW)	0.27 ± 0.01	0.27 ± 0.01	0.24 ± 0.01
Initial BW (kg)	10.80 ± 0.98	10.80 ± 0.84	10.79 ± 0.72
Final BW (kg)	12.63 ± 1.02	12.97 ± 0.93	12.58 ± 0.79
ADG (g/d) *	18.96^{b} ± 0.86	22.14^{a} ± 1.22	18.33^{b} ± 0.94
FCR*	18.80^{ab} ± 0.67	17.40^{b} ± 0.91	21.11^{a} ± 0.96

Means with different superscripts (a,b) within a row differ significantly (P<0.05).

The final body weight (kg) of all experimental animals at the end of the experiment was comparable (Table 2). The average daily body weight gain (g) of experimental animals was significantly (P<0.05) higher in T_2 (22.14±1.22) as compared to the T_1 (18.96±0.86) and T_3

(18.33±0.94). These findings were in accordance with Mahmoud (2013) and Meel *et al*. (2018), who observed non-significant effect of feeding *Moringa oleifera* on kids and lambs. Kumar *et al.* (2018) also observed that final body weights were comparable among the *Moringa oleifera* treated groups when protein level was maintained at similar level. However, improved body weight in *Moringa oleifera* fed animals was observed by Choudhary *et al*. (2018) and Babeker *et al.* (2015), which contradict the present findings wherein protein level in TMRs fed to the experimental Surti kids was equal in all groups.

The present result revealed that there was no significant difference in FCR between control and *Moringa oleifera* fed groups, whereas 25 and 50% *Moringa oleifera* inclusion groups showed significant (P<0.05) difference among them. Babekar *et al.* (2015) reported higher FCR at 20% inclusion as compared to 50% inclusion. Mahmoud (2013) and Yusuf *et al*. (2018) also observed no significant difference in FCR of lambs at 0 and 50% inclusion rate of *Moringa oleifera,* which agreed with the present results. Generally poor FCRs obtained were probably due to the relatively lower growth rates (Babekar *et al.,* 2015). Higher the value of the feed conversion ratio, the less desirable is the diet, as the animal consumes more feed to produce a unit weight gain (Tona *et al*., 2014). Hence, in the present experiment the feed was better utilized at the 25% level of *Moringa oleifera* inclusion.

Feeding and watering behaviour

The feeding behaviour of experimental kids (Table 3) revealed that the average DMI (g/d) was comparable in both the day and night phases. The average DMI (% BW) in Phase I was significantly (P<0.05) higher in T_3 (1.45±0.02) as compared to T_1 (1.34±0.03), while T_2 (1.38±0.03) was at par with T_1 and T_3. In Phase II (5:00 p.m. to 8:00 a.m.) however, the DMI (% BW) showed no significant differences among treatment groups. Non-significant differences in DMI (g/d) among all dietary groups in present study indicates unchallenging acceptance of *Moringa oleifera* meal (unconventional feed resource) in animal ration. Also, uniform feeding behaviour indicates that incorporation of novel feed stuff do not affect the quality of TMR offered in treatment groups (Mayo *et al.,* 2019).

In the present study, total water intake time (sec./drink) was significantly (P<0.05) higher in T_2 (43.52%) and T_3 (21.25%) as compared to T_1. These findings reflect that the animals under *Moringa oleifera* fed groups drank water faster than control group. Further, the water intake (ml/sec.) was significantly (P<0.05) lower in T_2 (14.38±0.57) to the tune of 34.35% compared to T_1 (19.32±0.55), while T_1 and T_3 (18.86±0.88) were at par (Table 3). Drinking larger volumes of water in one bout indicates water deprived condition in animals (Sahana, 2019), which may occur due to increase in the fiber quantity in ration or blood osmotic imbalances, hence drinking behaviour of animals can be affected. Significantly (P<0.05) smaller volumes of water in one bout was observed in T_2 compared to T_1 and T_3 with no adverse effect on haemato-biochemical profile (Pandey, 2021) indicating that there was no physiological stress to Surti kids due to *Moringa oleifera* meal inclusion in ration.

Table 3: Effect of feeding *Moringa oleifera* meal on feeding and drinking behaviour of Surti kids

Variables	T_1	T_2	T_3
Feeding Behaviour			
Phase – I: DMI (g/d)	158.15 ± 4.34	162.30 ± 3.32	170.54 ± 3.72
DMI (% BW)*	1.34^{b} ± 0.03	1.38^{ab} ± 0.03	1.45^{a} ± 0.02
Phase – II: DMI (g/d)	165.06 ± 4.79	166.12± 3.55	171.71± 3.86
DMI (% BW)	1.41 ± 0.03	1.41 ± 0.03	1.46 ± 0.02
Drinking Behavior			
Water intake time (sec. /drink)*	51.39^{c} ± 0.79	73.76^{a} ± 0.56	62.32^{b} ± 0.65
Water intake per second (ml/sec)*	19.32^{b} ± 0.55	14.38^{a} ± 0.57	18.86^{b} ± 0.88

Means with different superscripts (a,b,c) within a row differ significantly (P<0.05).

CONCLUSION

Results of the present study indicate that 25% inclusion of *Moringa oleifera* meal in concentrate mixture improved the growth performance of Surti kids without affected feed, water and nutrient intake under an intensive system of management.

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REFERENCES

AOAC. 2012. Official Methods of Analysis, 19th edn., Association of Official Analytical Chemists, Virginia, USA.

Babeker, E.A. and Abdalbagi, Y.M. 2015. Effect of feeding different levels of *Moringa oleifera* leaves on performance, haematological, biochemical and some physiological parameters of Sudan Nubian goats. *Online J. Anim. Feed Res.,* **5**(2): 50-61.

BAHS. 2020. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi, India.

Choudhary, R.K., Roy, A., Roy, P.S., Singh, K.M. and Kumar, P. 2018. Effect of replacing concentrate mixture with moringa leaves (*Moringa oleifera*) on performance of lactating Bengal goats in Kishanganj district of Bihar, India. *Int. J. Curr. Microbiol Appl Sci.*, **7**: 2895-2900.

Damor, S.V., Pawar, M.M., Ankuya, K.J., Gami, Y.M., Srivastava, A.K., Chauhan, H.D. and Chaudhary, K.R. 2017. Effect of feeding different levels of Moringa (*Moringa oleifera*) leaves on growth performance of Mehsana kids. *Trends Biosci.*, **10**(18): 3190-3193.

ICAR. 2013. Nutrient Requirements for Sheep, Goat and Rabbit. Indian Council of Agricultural Research, New Delhi, India.

Jiwuba, P.C., Ahamefule, F.O., Okechukwu, O.S. and Ikwunze, K. 2016. Feed intake, body weight changes and hematology of West African Dwarf goats fed dietary levels of *Moringa oleifera* leaf meal. *Agricultura.,* **13**(1-2): 71-77.

Kholif, A.E., Gouda, G.A., Morsy, T.A., Salem, A.Z.M., Lopez, S. and Kholif, A.M. 2015. *Moringa oleifera* leaf meal as a protein source in lactating goat's diets: feed intake, digestibility, ruminal fermentation, milk yield and composition, and its fatty acids profile. *Small Rumin. Res.*, **129**: 129-137.

Kholif, A.E., Gouda, G.A., Olafadehan, O.A. and Abdo, M.M. 2018. Effects of replacement of *Moringa oleifera* for berseem clover in the diets of Nubian goats on feed utilization, and milk yield, composition and fatty acid profile. *Animal,* **12**(5): 964-972.

Kumar, M., Prasad, S., Minj, N., Kumar, R., Kumar, R., Patel, N. and Kumar, M. 2018. Effect of feeding *Moringa oleifera* leaf powder on growth performance of growing female Black Bengal goat under intensive system of management. *J. Pharmacogn Phytochem*., **4**: 295-298.

Mahmoud, A.E.M. 2013. Effect of feeding on *Moringa oleifera* stems on productive performance of growing lambs. *EJNF.*, **16**(2): 281-292.

Meel, P., Gurjar, M.L., Nagda, R.K., Sharma, M.C. and Gautam, L. 2018. Growth performance of Sirohi kids fed different levels of *Moringa oleifera* leaves. *J. Entomol. Zool.*, **6**(4): 786-791.

Moyo, B., Oyedemi, S., Masika, P.J. and Muchenje, V. 2012. Polyphenolic content and antioxidant properties of *Moringa oleifera* leaf extracts and enzymatic activity of liver from goats supplemented with *Moringa oleifera* leaves/sunflower seed cake. *Meat Sci.*, **91**(4): 441-447.

Moyo, M., Adebayo, R.A. and Nsahlai, I.V. 2019. Effects of diet and roughage quality, and period of the day on diurnal feeding behaviour patterns of sheep and goats under subtropical conditions. *Asian-Australas. J. Anim. Sci.*, **32**(5): 675.

Pandey, A. 2021. Effect of feeding Moringa olifera on growth performance of Surti kids. M.V.Sc. thesis, Anand Agricultural University, Anand, Gujarat, India.

Sahana, M. 2019. Performance of indigenous sheep under different watering frequencies. M.V.Sc. thesis, Anand Agricultural University, Anand, Gujarat, India.

Snedecor, G.W. and Cochran, W.G. 1994. Statistical Methods (8th ed.). The Iowa State University press, Ames, Iowa, USA.

Srivastav, J. 2018. Effect of supplementation of *Moringa oleifera* leaves on nutrient utilization and growth performance in goats. Ph D. thesis, Rajasthan University of Veterinary and Animal Sciences, Bikaner, India.

Sultana, N., Alimon, A.R., Huque, K.S., Baba, M. and Hossain, J. 2015a. Evaluation of Moringa foliage (*Moringa oleifera*) as goat feed. *Iran. J. Appl. Anim. Sci.*, **5**(4): 865-871.

Sultana, N., Alimon, A.R., Huque, K.S., Sazili, A.Q., Yaakub, H., Hossain, J. and Baba, M. 2015b. The feeding value of Moringa (*Moringa oleifera*) foliage as replacement to conventional concentrate diet in Bengal goats. *Adv. Anim. Vet. Sci.,* **3**(3): 164-173.

Tona, G.O., Ogunbosoye, D.O. and Bakare, B.A. 2014. Growth performance and nutrient digestibility of West African Dwarf goats fed graded levels of *Moringa oleifera* leaf meal. *Int. J. Curr. Microbiol. Appl. Sci.*, **3**(8): 99-106.

Yusuf, A.O., Mlambo, V. and Iposu, S.O. 2018. A nutritional and economic evaluation of *Moringa oleifera* leaf meal as a dietary supplement in West African Dwarf goats. *S. Afr. J. Anim.*, **48**(1): 81-87.