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SHORT COMMUNICATION

Effect of replacement of concentrate feed with Moringa leaves on dietary nutrient utilization in non-descript Chhattisgarh goats

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Abstract: An experiment was conducted to analyse the effect of replacing commercially available concentrate mixture with dried Moringa oleifera leaves on the nutrient utilization pattern of diet in non-descript goat breeds of Chhattisgarh. Eight non-descript yearling goats allotted randomly into 2 groups (group1 and group 2) based on their BW (13.48±1.07 kg). Animals in group 1 were offered concentrate @ 1.5% of body weight and hybrid Napier grass ad lib. In the group 2, 50% of concentrate was replaced by Moringa leaves on dry matter basis. Dried leaves were analyzed for their chemical composition. The CP content was 27.52% and Fe and Zn were 125.4 ppm and 29.8 ppm, respectively. There was no significant effect on palatability of feed that was evident from similar DM intake in both the groups. Intake of individual nutrients also did not differ significantly among the groups. There was no effect of moringa leaves inclusion on the nutrient utilization. However significantly higher N retention was observed in Moringa supplemented group compared to commercial concentrate supplemented group. Thus, Moringa supplementation was helpful in reducing the quantity of commercial concentrate mixture inclusion in the diet of non-descript goats.

Keywords: Digestible energy, Moringa leaves, Non-descript goat, Nutrient utilization

Chhattisgarh is a state with typical tropical Indian climate because of its proximity to the tropic of cancer. Major population of the state lives in rural areas and are dependent upon agriculture or related occupations. With the small land holdings of small and marginal farmers, the income from agriculture is not sufficient for their living (Bhakar et al. 2007). In this context livestock gains socio economic and cultural importance in the state. The state is rich in livestock populations with maximum cattle population followed by goat populations. In rural Chhattisgarh rural, cattle are more used for draught purpose, obtaining manure and cow dung for fuel than for milk. Conversely, small ruminant like goat due to its good economic prospects becomes the choicest animal for rearing by rural landless/ marginal farmers. Their small size makes it affordable for their shed construction and management as well. Even the ladies and children of the house are capable to manage them when male of the hose are busy with agriculture related activities. Due to high demand of chevon, farmers hardly face any problem in their marketing. But the main problem faced by them in goat rearing is the feeding cost those alone accounts for about 60% of total expenditure in a goat rearing (Kumar 2007). In the above context a very nutritious leafy tree can act as a game changer and minimize the expenditure on feed cost to great extent. *Moringa oleifera* belong to the family Moringaceae, distributed in all regions of Chhattisgarh. It provides year-round source of nutritious food for the family that grow it (Swati et al. 2018).

Now a days government of the state also encouraging landless or marginal farmers to grow drumsticks/ moringa in the house premises to curb undernourishment in the state. Being a perennial tree, once planted Moringa yields leaves and drumsticks for several years. The leaves, pods, and flowers of Moringa can be used as human food, nevertheless the surplus leaves may also be used as a feed alternative for their goats. So, a trial was conducted in which nutritive value of diet was evaluated by replacing concentrate feed with Moringa leaves.

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Moringa (*Moringa Oleifera*) saplings were prepared from Moringa seed by incubating them in polybag by putting soil and cow dung manure. The saplings were transplanted after a about a month of sowing in rows. The ground for planting the sapling was prepared by mixing goat pellets manure of the goat Unit of the College of Veterinary Science and A.H., Anjora, Durg, Chhattisgarh. They reached a height of about 5 ft within 6 months. To facilitate more branching, they were cut regularly at a height of 4 ft. The leaves from the branches were collected and dried in sun and stored for the experiment. Dried Moringa leaves were analyzed for their chemical composition (AOAC, 2005) and trace mineral (Fe, Zn) profile (atomic absorption spectrophotometer).

The trial was conducted in the Goat Unit of the Anjora Veterinary College, Durg. Eight non-descript yearling goats were selected and allotted randomly into 2 groups (group1 and group2) based on their BW (13.48±1.07 kg). Before conducting the trial, the animals' faecal pellets were collected and tested for the parasitic load and the animals were dewormed. Feeding was done as per ICAR (2013). The animals of group1 were offered concentrate and grasses. The DM offered from concentrate in group 1 was 1.5% of BW and in group 2, 50% of concentrate was replaced by Moringa leaves on dry matter basis. Hybrid Napier grass was provided ad libtum. The animals were fed for a duration of 21 days on the above diet. Then they were kept in metabolic cages for 3 days adaptation followed by conduction of metabolic trail for 5 days. Feed was offered in the morning (8.00 AM) and faeces and urine were collected in the next day morning (8.00AM). Urine was collected into a container with 50 ml of 25% sulphuric acid solution to prevent volatilization of N compounds. The feed offered and faecal sample were analysed for their proximate principles (AOAC, 2005) and the urine samples were analysed for N composition (AOAC, 2005). The Group 1 was fed on commercial concentrate mixture whereas in group 2, 50% of the commercial concentrate mixture was replaced with Moringa. The chemical composition and nutrient composition of Moringa leaves and hybrid Napier grass is provided in Table 1. The crude protein content of dried Moringa leaves was 27.52% that is even higher than oil cakes like sesame cake, sunflower cake (Prusty et al. 2013). High CP content (29.4%) was reported by (Gopalakrishnan et al. 2016). However, Rajput et al. (2019) reported comparatively low CP (20.42%) of dried Moringa powder. The CF, EE and minerals were reported 21.5, 6.6 and 11%, respectively. Rajput et al. (2019) reported crude fibre 22.03%, ether extract 12.47% and total minerals 9.53% in dried Moringa leaves. Ajantha et al. (2018) reported following crude protein (26.01 %), crude fibre (7.08 %), ether extract (6.58 %) and total ash (9.41%) in dried Moringa leaves. Meel et al. (2018) reported CP-23.31%, EE-4.7%, CF-9.26% and minerals-9.76% in Moringa leaves. Damor et al. (2017) reported 26.3% CP, 8.8% CF, 5.7% EE and 14.1% total ash in moringa leaves. Table 1

There was no significant difference ($p>0.05$) in the DM intake among the 2 groups (Table 2). The DMI (g) was 451.42±10.95 and 391.82±8.02 in group 1 and group 2, respectively. No significant different ($P>0.05$) in intake of the nutrients were observed among the 2 groups. Better foliage intake capacity of goats has been reported by Salem et al. (2006). On replacing basal diet with tree leaves no effect on nutrient intake was observed in Surti kids (Patel et al. 2018). No significant effect on DM intake in goat was observed when dietary protein was replaced by Moringa leaves mixture (Patra et al. 2002). The DMI per metabolic weight was fell within reported range (Ndemanisho et al. 1998; Kearl et al. 1982) and somewhat lower than ICAR, 2013 values (70 g/kg $W^{0.75}$). *Moringa oleifera* leaf meal when included in the diet of Anglo Nubian goats replacing sesame meal at 50, 75 and 100% levels increased intake of feed and all nutrients. Damor et al. (2017) and Aregheore (2002) observed no significant effect of Moringa leaves supplementation on DMI in growing goats. A significantly higher DMI was observed when Moringa leaves replaced sunflower seed cake at 75 and 100% levels in goat feed (Sarwatt et al. 2002). The inclusion of MLM at 15% of diet replacing sesame meal increased feed intake, enhanced nutrient digestibility and ruminal fermentation, increased milk yield and modified milk fatty acid profile positively in lactating goats (Kholif et al. 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. Crude fibre content of Moringa leaves was comparable to those of soybean meal, deoiled mustard cake and groundnut cake (NDDB, 2012; Sharma, 2011) may be the factor for its comparable intake to that of concentrate-based feeds. Table 2

The nutrient digestibility was similar among both the groups (Table 3). No adverse effect of Moringa leaves supplementation replacing 50% of concentrate mixture was observed on nutrient digestibility of the diet. When concentrate was replaced by

Table 1 Chemical composition of concentrate feeds and grass (% DM basis)

	Group1 (concentrate)	Group2 (Concentrate+MLM)	Hybrid napier grass	Moringa leaf meal
DM%	90.12	91.5	20	20.05
OM	92.5	90.75	90.5	89
CP	17.5	22.51	7.1	27.52
CF	8.5	8.31	25	8.12
EE	2.4	4.5	4.3	6.6
NFE	64.1	55.43	54.1	46.76

Table 2 Nutrient utilization in goats offered Moringa leaves

Parameter	Group 1	Group 2
Nutrient intake		
Dry matter (g)	451.42±10.95	391.82±8.02
Dry matter (g/kg $W^{0.75}$)	63.78±2.57	56.06±2.42
Organic matter (g)	413.00±10.48	357.35±7.61
Crude protein (g)	49.79±3.80	48.08±3.29
Ether extract (g)	15.85±2.02	19.061.71
Crude fibre (g)	83.75±4.60	75.44±3.41
Nitrogen free extract (g)	263.61±8.38	214.77±5.89
Nutrient digestibility (%)		
DM	67.53	69.91
OM	72.04	73.93
CP	60.63	64.60
CF	52.12	59.56
EE	78.90	82.68
NFE	80.09	80.21
Digestible nutrient (%) and N retention		
Digestible CP (%)	6.67	7.94
DCP (g/kg MBW)	4.30	4.54
Digestible EE (%)	2.78	4.04
Digestible CF(%)	9.70	11.48
Digestible NFE (%)	46.76	43.98
Total digestible nutrient (%)	69.38	72.49
Total N retention (g)	0.75	0.94
N retention (% intake)	9.99	12.64
N retention (% absorption)	16.71	20.45

*DE is calculated from equation 1kg TDN-4.4 Mcal DE

graded levels of Moringa leaves (0, 25%, 50%, 75% and 100%) in diet, except for ADF, no significant difference in digestibility of other nutrients were observed in bengal goats (Sultana, 2015). Feeding of *Moringa oleifera* leaves replacing commercially available concentrate feed at 75% level improved digestibility of dry matter and other nutrients in Sirohi goat kids. Sultana (2015) found higher DM, OM and CP digestibility in goats fed solely on Moringa foliage diet than fed a mixed diet of Moringa and napier grass. Meel et al. (2018) reported improved body weights gain, feed intake and overall health when *Moringa oleifera* leaves replaced concentrate feed.

The TDN of feed was derived from the total digestible individual nutrients (Table 2). DE is calculated from equation 1kg TDN is equivalent to 4.4 Mcal DE. No significant difference was observed in digestible CP, CF, NFE among the groups. A significantly higher DEE% was observed in moringa supplemented group than control ($P<0.01$).There was no significant difference in the total digestible nutrient and digestible energy value among the two groups. The TDN of Moringa based diet was 72.49%, that is optimum for maintenance and growth of goats. Moringa supplementation did not affect the DE value of the diet. The digestible energy (12.76 MJ/kg and 13.33MJ/kg) observed in present study are higher than reported values for growing goats (Sauvant et al. 1991 and Aregheore 2002). The DCP intake was higher than that of maintenance requirement of goats as recommended by ICAR, 2013 (3.32 g/ kg $W^{0.75}$) and Mandal et al. 2005 (3.22g/ kg $W^{0.75}$) for Indian goats. Similar DCP intake (4.32 g/ kg $W^{0.75}$) for goats have been reported by Aregheore (2002) when Moringa leaves replaced 50% of concentrate mixture in growing goat's diet. Fadiyimu (2010) obtained high CP digestibility (84.96%) in goats when fed solely on fresh Moring leaves.

Positive N retention was observed in either group whereas a significantly higher ($p<0.05$) N retention was observed in Moringa leaves supplemented group (Table 4). It indicates the protein in both the diets was adequate to meet the requirement for maintenance and growth of experimental goats. Sultana et al. (2015) observed higher N retention when Moringa leaves when it replaced concentrate mixture at 50% and 75%. There was no significant ($P>0.05$) differences in N retention when expressed on percentage of absorbed N or intake N basis. Higher N retention in sole Moringa leaves diet was observed compared to other fodders like Leucaena and Gliricidia combinations with Moringa leaves (Asaolu et al. 2011). Sultana (2015) and Damor (2017) reported significant increase in average daily body weight gain in goats on supplementing *Moringa oleifera* leaves in their diet. Though CP value of Moringa leaves is comparable to other tree fodders Gliricidia or Leucaena, it has a high content of bypass protein, 47% than others (Becker, 1995) and Moringa leaves are

generally rich in two important amino acids methionine and cysteine (Makkar and Becker, 1996).

Conclusion

Moringa leaves could replace 50% of concentrate mixture on DM without affecting nutrient intake, digestibility of nutrients and body weight gain in non-descript goat breeds of tropical climate.

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References

Ajantha A, Kathirvelan C, Purushothaman MR, Visha P (2018) Study on nutrients, mineral and vitamin profile of *Moringa oleifera* leaf meal. Int J Curr Microbiol App Sci 7: 2478-2481

AOAC (2005) Official Methods of Analysis, 18th edn. Association of Official Analytical Chemists, Arlington, Verginia

Aregheore EM (2002) Intake and digestibility of Moringa oleifera–batiki grass mixtures by growing goats. Small Rumin Res 46: 23-28

Asaolu O, Binuomote RT, Akinwole AJ, Oyelami OS, Kolapo KO (2011) Utilization of *Moringa oleifera* fodder combinations with *Leucaena leucocephala* and *Gliricidia sepium* fodders by west african dwarf goats. Int J Agric Res 6: 607-619

Damor SV, Pawar MM, Ankuya KJ, Gami YM, Srivastava AK, Chauhan HD, Chaudhary KR (2017) Effect of feeding different levels of Moringa (*Moringa oleifera*) leaves on growth performance of Mehsana goat kids. Trends Biosci 10: 3190-3193

Fadiyimu AA, Alokan JA and Fajemisin AN (2010) Digestibility, nitrogen balance and haematological profile of West African dwarf sheep fed dietary levels of *Moringa oleifera* as supplement to *Panicum maximum. J Anim Sci* 6: 634-643

Gopalakrishnan L, Doriyaa K, Kumar DS (2016) Moringa oleifera: A review on nutritive importance and its medicinal application. Food Sci Human Wellness 5: 49-56

ICAR (2013) Nutrient requirements of sheep, goat and rabbit- nutrient requirements of animals. Indian Council of Agricultural Research, New Delhi

Kearl LC (1982) Nutrient requirements of ruminants in developing countries. International Feed Stuffs Institute Utah Agriculture Experimental Station Utah State University Logon, Utah, USA, pp 45–58

Kholif AE, Goudaa GA, Morsya TA, Salemb AZM, Lopezc S, Kholifa, AM (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

Mandal AB, Paul SS, Mandal GP, Kannan A, Pathak NN (2005) Deriving nutrient requirements of growing Indian goats under tropical condition. Small Rumin Res 58: 201-217

Meel P, Gurjar ML, Nagda RK, Sharma MC, Gautam L, Manju (2018) Growth performance of Sirohi goat kids fed different levels of *Moringa oleifera* leaves. J Entomol Zool Studies 6: 786-791

NDDB (2012) Nutritive value of commonly available feeds and fodders in India, National Dairy Development Board, Anand, Gujarat. pp-80

Ndemanisho EE, Mtenga LA, Kimbi EFC, Kimambo AE, Mtengati EJ (1998) Substitution of dry *Leucaena leucocephala* (DLL) for cotton seed cake (CSC) as a protein supplement to urea treated maize stover fed to dairy weaner goats. Anim Feed Sci Technol 73: 365-374

Patra AK, Sharma K, Dutta N, Pattanaik AK (2002) Effect of partial replacement of dietary protein by a leaf meal mixture containing *Leucaena leucocephala*, *Morus alba* and *Azadirachta indica* on performance of goats. Asian-Austr J Anim Sci 15 : 1732-1737

Prusty S, Kundu SS, Sontakke UB, Bala PA (2013) Degradation characteristics and energy value of grains, oil seed cakes and agroindustrial byproducts. Indian J Anim Nutr 30: 381-386

Bhakar R, Banafar KNS, Singh NP, Gauraha AK (2007) Income and employment pattern in rural area of Chhattisgarh: A mircro view. Agric Econ Res Rev 20: 395–406

Rajput H, Prasad SGM, Srivastav P (2019) Nutritional quality analysis of dry Moringa powder varity-PKM-1. Pharma Innov J 8: 95-98

Salem AZM, Salem MZM, El-Adawy MM, Robinson PH (2006) Nutritive evaluations of some browse tree foliages during the dry season: secondary compounds, feed intake and in vivo digestibility in sheep and goats. Anim Feed Sci Technol 127 : 251-267

Sarwatt SV, Kapange SS, Kakengi AMV (2002) Substituting sunflower seed-cake with *Moringa oleifera* leaves as a supplemental goat feed in Tanzania. Agrofor Syst 56: 241–247

Sauvant D, Morand-Fehr P, Giger-Reverdin S (1991) Dry matter intake of adult goats In: Morand-Fehr, P (Ed), Goat Nutrition Pudoc Wageningen, The Netherlands, Chapter 3, pp 25-36

Kumar S (2007) Commercial goat farming in India: An emerging agri-business opportunity. Agric Econ Res Rev 20 (Conference Issue): 503-520

Sharma NK (2011) Chemical composition of oilseed cakes and deoiled cakes in Nepal. Online J Anim Feed Res 3: 74-76

Sultana N, Alimon AR, Huque KS, Sazili AQ, Yaakub H, Hossain J, Baba M (2015) 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

Swati, Virk AK, Kumari C, Ali A, Garg P, Thakur P, Attri C, Kulshrestha S (2018) Moringa oleifera-a never die tree: An overview. Asian J Pharm Clin Res 11: 57-65

Becker K, (1995) Studies on utilization of *Moringa oleifera* leaves as animal feed. Institute for Animal Production in the Tropics and Subtropics, Vol 480 University of Hohenheim, Stuttgart, pp 15

Makkar HPS, Becker K (1996) Nutritional value and antinutritional components of whole and ethanol extracted *Moringa oleifera* leaves. Anim Feed Sci Technol 63: 211-228

Patel VR, Choubey M, Raval AP, Desai, MC (2018) Influence of feeding *Albizia lebbeck* and *Terminalia arjuna* leaves on growth performance and nutrient utilization in Surti kids. Indian J Anim Nutr 35: 76–81

Talpatra SK, Ray SN, Sen, KC (1940) Estimation of phosphorus, chlorine, calcium, magnesium, sodium and potassium in food stuffs. Indian J Vet Sci Anim Husb 10: 243-246