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EFFECT OF REPLACING CONCENTRATE MIXTURE WITH MORINGA (*MORINGA OLEIFERA*) LEAVES ON BLOOD BIOCHEMICAL AND MINERAL PROFILE OF MEHSANA GOAT KIDS

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ABSTRACT:

Eighteen Mehsana goat kids were randomly divided into three groups of six kids in each group to evaluate the effect of replacing concentrate mixture with *Moringa oleifera* leaves on blood biochemical and mineral profile in diet of growing Mehasana goat kids. The three experimental treatments were T_1: 100% concentrate mixture; T_2: 50% concentrate mixture + 50 % Moringa leaves and T_3: 100 % Moringa leaves. At the end of experimental feeding (90 day), blood samples were collected from each kid to analyze concentrations of aspartate aminotransferase (SGOT), alanine transaminase (SGPT), glucose, total protein, albumin, cholesterol, calcium and phosphorus. The blood micro-minerals viz. copper, zinc, iron, and manganese were analyzed by using atomic absorption spectrophotometer. The serum total protein, albumin, SGOT and calcium levels were found to be significantly ($P<0.05$) higher moringa fed groups as compared to control group. There was no significant difference among different treatment groups for blood concentrations of copper, zinc, iron and manganese content. Based on the results, it was concluded that moringa (*Moringa oleifera*) leaves are rich in protein and minerals. Replacing the concentrate mixture with

moringa leaves in diet of growing Mehsana goat kids increased concentrations of blood total protein, albumin, SGOT and calcium while decreased level of blood cholesterol. Feeding of moringa leaves did not affect blood micro-mineral profile in Mehsana goat kids.

KEY WORD: *Moringa leaves, Blood metabolites, Blood mineral profile, Mehsana goats.*

INTRODUCTION:

Goat production 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 products have provided health promoting constituents to health conscious consumers and thus contribution of goats is increasing to the rising demand of animal products. However, the productivity of farm animals in most tropical countries is generally low, mainly due to poor quality and inadequacy of available feeds. Usually, farmers tried to feed their animals through crop residues and poor quality hay that are little in nitrogen, high in lingo-cellulose (Sultana *et al*., 2014) and poor in vitamin and mineral contents, which leads to low digestibility and reduced voluntary intake (Gerbregiorgis *et al*., 2012). Moreover, the cost of conventional protein supplements is increasing with declining availability and there appears to be an impending need to evolve an appropriate alternative feed resource to supplement ruminant's diet. Also, among the available forage crops, special focus has been given to the effects of *Moringa oleifera* on livestock growth and production (Qwele *et al*., 2013; Sultana *et al*., 2015). *Moringa oleifera* is a rich source for crude protein (CP; varies between 20 and 29% in the leaves) and vitamins (Ferreira *et al*., 2008; Foidl *et al*., 2001), and possesses significant anti-oxidative potential (Verma *et al.,* 2009), attributed to poly-phenols, tocopherols and carotenoids in the foliage. These nutritional traits along with high production of leaf mass, adaptability to grow in all types of soils and tolerance of extreme temperatures, have turned Moringa a potential high quality feed source for livestock (Foidl *et al*., 2001; Sanchez and Ledin, 2006). Recently, focus has been given to the use of moringa leaf meal as a protein source and feed components in animal production especially in goats (Sarwatt *et al*., 2002; Asaolu *et al*., 2012; Moyo *et al*., 2012; Sultana *et al*., 2015). Various studies conducted shown that feeding of moringa leaves in diet of goats, sheep and cattle influenced blood metabolites (Khalel *et al.,* 2014; Kholif *et al*., 2015; 2016; Azzaz *et al.,* 2016). Moreover, effect of moringa leaves feeding on blood mineral profile in livestock has not been investigated yet. Keeping in view of the above mentioned facts, the present study therefore was carried out to determine the effect of replacing concentrate mixture with *Moringa oleifera* leaves on blood biochemical and mineral profile in diet of growing Mehasana goat kids.

MATERIALS AND METHODS:

The study was carried out at the Goat Farm, Livestock Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat. Total 18 Mehsana goat kids (average age 3-4 months) were randomly divided into three treatment groups using completely randomized design, so that each group had six animals per treatment. The three experimental treatments were T_1 = 100% concentrate mixture; T_2 = 50% concentrate mixture + 50 % Moringa leaves and T_3 = 100 % Moringa leaves. All the kids were treated with antihelminthes before the commencement of the experiment to ensure the kids were free of intestinal worm. The kids were kept in individual pens and provided individual feeders and water buckets. The kids were allowed 10 days of adjustment period during which they were gradually introduced to the experimental diets. Conventional concentrate mixture was gradually replaced at 0, 50 and 100% with dried moringa leaves and mixed thoroughly and supplied to animals. *Moringa oleifera* leaves were collected from the locally available moringa plots of the Dantiwada taluka. The collected moringa leaves were dried in shed on thick plastic sheets. Kids were allowed 6 hours daily grazing. In addition to grazing, kids were supplemented with above mentioned diet at the 1% of live body weight. The duration of the feeding trial was of 90 days. The chemical composition of concentrate mixture and moringa leaves was analyzed according to standard procedures of the AOAC (2000).

On day 90th, blood samples were collected from each kid in the morning (before feeding and watering) under aseptic conditions through jugular vein puncture. Immediately after blood collection the vials were kept in slant position without disturbing. After 1 hr and centrifuged at 700xg for 15 min to separate the serum, which was analyzed for serum biochemical constituents. The concentrations of aspartate aminotransferase (SGOT), alanine transaminase (SGPT), glucose, total protein, albumin, cholesterol, calcium and phosphorus were determined by using respective ready to use kits (procured from Agappe Diagnostics Ltd., Kerala, India) by employing Clinical Analyzer-635 (Systronics India Ltd., India).

The micro-minerals were analyzed by digestion of 0.2 ml blood serum sample with 1.8 ml of triple acid mixture (Nitric acid: Sulphuric acid: Perchloric acid @ 4 : 2 : 1) till it becomes colourless. After digestion the final volume was made up to 10 ml with triple glass distilled water. Copper, zinc, iron, and manganese concentration from digested samples were estimated by atomic absorption spectrophotometer (Model AAS 4141, Electronic Corporation of India Ltd.).

STATISTICAL ANALYSIS:

One-way ANOVA procedures by using SPSS (Version 11.0, SPSS Inc, Chicago, USA) were adopted to analyse the data of blood biochemical and minerals. The difference between treatments were analysed by using students''t' test and analysis of variance and the significance was declared at $P<0.05$.

RESULTS AND DISCUSSION:

Chemical and mineral composition of feeds

The chemical and mineral composition of the *Moringa oleifera* leaves and concentrate mixture used in this study are presented in Table 1.

The analyses revealed that the content of crude protein (26.33 vs. 17.59%), crude fibre (8.82 vs. 5.58%), ether extract (5.76 vs. 2.43%), total ash (14.1 vs. 9.20%) and calcium (1.87 vs. 0.96%) were higher in Moringa leaves as compared to the concentrate mixture. But, the levels of dry matter (77.43 vs. 92.00%) and phosphorus (0.13 vs. 0.65%) were lower in Moringa leaves than concentrate mixture. The crude protein content of moringa foliage used in the study was comparable with the values (29.7, 25.95 and 22.6%) obtained by Fadiyimu *et al.* (2010), Manh *et al.* (2005) and Sánchez *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 foliage 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.

Blood biochemical profile

The effect of replacement of conventional concentrate with Moringa leaves on blood biochemical profile in Mehsana goat kids is presented in Table 2.

All the measured blood biochemicals were within the reference ranges (Boyd, 2011). The blood glucose level (mg/dl) observed in different treatment groups were 68.33±1.15, 72.50±2.70 and 70.22±5.19 in T_1, T_2 and T_3 groups, respectively. Result showed that there was comparable effect observed on all over the different treatment groups. The concentration of glucose found in the present study was in agreement with the values reported by Kholif *et al*. (2015). They reported that feeding moringa leaves diets to goats had no significant effects ($P > 0.05$) on glucose concentrations. In contrarily to our findings Kholif *et al*. (2016), Khalel *et al.* (2014) and Azzaz *et al.* (2016) observed that feeding moringa leaves to goat kids had significant effects ($P<0.05$) on glucose concentrations. The serum total protein level (g/dl) found to be significantly ($P<0.05$) higher T_2 (7.35±0.13) and T_3 (7.58±0.14) groups as compared to T_1 (6.86±0.25) group. Similarly, albumin concentrations were significantly higher group T_2 and T_3 than group T_1. The concentration of total protein and albumin found in the present study were in agreement with the values reported by Khalel *et al*. (2014) and Babeker and Abdalbagi (2015). They reported that feeding moringa leaves diets to goats significantly increased total protein and albumin concentrations. However, contrarily to our findings Kholif *et al*. (2015) reported that feeding moringa leaves did not affected serum protein and albumin levels. The higher serum protein and albumin levels observed in the present study may be due to higher protein content of Moringa leaves than the concentrate mixture.

The cholesterol concentration was significantly lower in T_3 group as compared to T_1 and T_2 groups and respective values for groups T_1, T_2 and T_3 were 124.65±1.59, 124.41±1.68 and 110.60±1.86 (mg/dl). Similar to the present findings, Kholif *et al*. (2015; 2016) recorded lower serum cholesterol concentrations in goats fed Moringa leaves in their diets. The enzyme SGPT concentrations were found to be 9.60±1.08, 9.02±1.23 and 12.51±1.05 U/L in T_1, T_2 and T_3, respectively, which were similar ($P>0.05$) among the treatment groups. In line with the present findings, Azzaz *et al.* (2016) reported that feeding of Moringa dried leaves to diets of Rhamani lactating ewes had no significant effect on serum level of SGPT. Similarly, Khalel *et al*. (2014) observed no significant difference in SGPT concentrations in lactating cows fed Moringa leaves, respectively. In contrast, Kholif *et al*. (2015) recorded that feeding of Moringa leaf meal as a protein source min lactating Anglo-Nubian goat's diets significantly increased ($P<0.05$) SGPT concentration. The SGOT concentration was significantly higher in T_3 group than the groups T_1 and T_2. The respective values for groups T_1, T_2 and T_3 were 16.30±1.16, 17.46±1.28and 22.99±2.76 U/L. In agreement with the present results, Kholif *et al*. (2016) reported that feeding of *Moringa oleifera* leaf meal as a protein source in diets of lactating goats had significantly higher serum SGOT levels. The observed SGOT levels in present study were within normal physiological ranges are important indicators of liver activity and function suggesting there were no pathological lesions in the liver (Pettersson *et al.,* 2008) to feeding of Moringa leaves.

Blood mineral profile

The blood mineral profile in Mehsana goat kids fed experimental diets is presented in Table 3.

The level of calcium (mg/dl) was significantly higher in groups T_2 (10.59±0.43) and T_3 (11.18±0.39) as compared to the group T_1 (9.34±0.35). As the chemical composition (Table 1) revealed that the content of calcium was higher in Moringa leaves than the concentrate mixture and same is reflected in blood calcium level in the present study. The blood phosphorus level (mg/dl) observed in different treatment groups were 5.07±0.24, 4.87±0.30 and 5.15±0.27 in T_1, T_2 and T_3 groups, respectively. Result showed that the phosphorus levels were statistically similar ($P>0.05$) among the different treatment groups. There was no significant difference among different treatment groups for blood concentrations of copper, zinc, iron and manganese content. There are no reports of effect of feeding Moringa leaves in diets of goats, sheep and cattle till date. So, this study is first to report the values of blood micro-minerals such as copper, zinc, iron and manganese in goats fed Moringa leaves as replacement of concentrate mixture.

CONCLUSION:

Based on the results, it was concluded that moringa (*Moringa oleifera*) leaves are rich in protein and minerals. Replacing the concentrate mixture with moringa leaves in diet of growing Mehsana goat kids increased concentrations of blood total protein, albumin, SGOT and calcium while decreased

level of blood cholesterol. Feeding of moringa leaves did not affect blood micro-mineral profile in Mehsana goat kids.

REFERENCES:

AOAC. 2000. Official Methods of Analysis. 17th ed. Association of Official Analytical Chemists, Arlington, VA.

Aregheore, E.M. 2002. Intake and digestibility of *Moringa oleifera* and batiki grass mixture by growing goats. Small Ruminant Research, 46(1): 23-28.

Asaolu, V.O., Binuomote, R., Akinlade, J., Aderinola, O. and Oyelami, O. 2012. 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, 2(10): 76-88.

Azzaz, H.H., Eman, S.A., Morsy, T.A., Aziz, H.A., Fatma, I.H. and Abd-Alla, M.S. 2016. *Moringa oleifera* and *Echinacea purpurea* as supplements for Rhamani lactating ewe's diets and their effect on rumen characteristics, nutrients digestibility, blood parameters, milk production, composition and its fatty acid profile. Asian Journal of Animal and Veterinary Advances, 11(11): 684-692.

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. Journal of animal and feed research, 5(2):50-61.

Boyd, J.W. 2011. The interpretation of serum biochemistry test results in domestic animals. In: Veterinary Clinical Pathology. Merck Sharp & Dohme Corp., a subsidiary of Merck & Co., Inc.

Devendra, C. 2013. Investments on pro-poor development projects on goats: ensuring success for improved livelihoods. Asian Australasian Journal of Animal Sciences, 26: 1-18.

Fadiyimu, A.A., Julias, A.A. and Fajemisin, A.N. 2010. Digestibility, nitrogen balance and haematological profile of West African Dwarf sheep fed dietary levels of *Moringa oliefera* as supplement to *Panicum maximum.* Journal of Animal Science, 6(10): 634-643.

Ferreira, P.M.P., Farias, D.F., Oliveira, J.T.D.A. and Carvalho, A.D.F.U. 2008. *Moringa oleifera*: bioactive compounds and nutritional potential. Reviews in Nutrition, 21: 431-437.

Foidl, N., Makkar, H.P.S. and Becker, K. 2001. Potential of *Moringa oleifera* for agricultural and industrial uses. Fugile, L.G. (Ed.). The Miracle Tree: The Multiple Attributes of Moringa, CTA, Wageningen. The Netherlands. 31: 45-76.

Gebregiorgis, F., Negesse, T. and Nurfeta, A. 2012. Feed intake and utilization in sheep fed graded levels of dried moringa (*Moringa stenopetala*) leaf as a supplement to Rhodes grass hay. Tropical Animal Health Production, 44(3): 511-517.

Kakengi, A.M.V., Shem, M.N., Sarwatt, S.V. and Fujihara, T. 2005. Can *Moringa oleifera* be used as a protein supplement for ruminants? Asian-Australian Journal of Animal Science, 18(1): 42-47.

Khalel, M.S., Shwerab, A.M., Hassan, A.A., Yacout, M.H., El-Badawi, A.Y. and Zaki, M.S. 2014. Nutritional evaluation of *Moringa oleifera* fodder in comparison with *Trifolium alexandrinum*

(berseem) and impact of feeding on lactation performance of cows. Life Science Journal, 11(10): 1040-1054.

Kholif, A.E., Morsy, T.A., Gouda, G.A., Anele, U.Y. and Galyean, M.L. 2016. Effect of feeding diets with processed *Moringa oleifera* meal as protein source in lactating Anglo-Nubian goats. Animal Feed Science and Technology, 217: 45-55.

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 Ruminant Research, 129: 129-137.

Manh, L.H., Dung, N.N.X. and Ngoi, T.P. 2005. Introduction and evaluation of *Moringa oleifera* for biomass production and as feed for goats in the Mekong Delta. Livestock Research for Rural Development, 17(9). Retrieved from: http://www.lrrd.org/lrrd17/9/manh17104.htm.

Moyo, B., Patrick, J.M. and Muchenje, V. 2012. 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, 44: 801-809.

Pettersson, J., Hindorf, U., Persson, P., Bengtsson, T., Malmqvist, U., Werkström, V. and Ekelund, M. 2008. Muscular exercise can cause highly pathological liver function tests in healthy men. British Journal of Clinical Pharmacology, 65: 253-259.

Qwele, K., Hugo, A., Oyedemi, S.O., Moyo, B,. Masika, P.J. and Muchenje, V. 2013. Chemical composition, fatty acid content and antioxidant potential of meat from goats supplemented with Moringa (*Moringa oleifera*) leaves sunflower cake and grass hay. Meat Science, 93: 455-462.

Sanchez, N.R. and Ledin, I. 2006. Effect of feeding different levels of foliage from *Cratylia argentea* to creole dairy cows on intake, digestibility, milk production and milk composition. Tropical Animal Health and Production, 38: 343-351.

Sànchez, R.N., Spörndly, E. and Ledin, I. 2006. Effect of feeding different levels of foliage of *Moringa oliefera* to creole dairy cows on intake, digestibility, milk production and composition. Livestock Science, 101(1-3): 24-31.

Sarwatt, S.V., Milangha, M.S., Lekule, F.P. and Madalla, N. 2004. *Moringa oleifera* and cottonseed cake as supplements for smallholder dairy cows fed Napier grass. Livestock Research for Rural Development, 16(6).

Sultana, N., Alimon, A.R., Haque, K.S., Sazili, A.Q., Yaakub, H. and Hossain, S.M. 2014. The effect of cutting interval on yield and nutrient composition of different plant fraction of *Moringa oleifera* tree. Journal Food Agricultural Environment, 12(2): 599-604.

Sultana, N., Alimon, A.R., Khan, S.H., Sazili, A.Q., Yaakub, H., Hossain, J. and Baba, M. 2015. The feeding value of Moringa (*Moringa oleifera*) foliage as replacement to conventional concentrate diet in Bengal goats. Advanced Animal Veterinary Science, 3(3): 164-173.

Verma, A.R., Vijayakumar, M., Mathela, C.S. and Rao, C.V. 2009. *In vitro* and *in vivo* antioxidant properties of different fractions of *Moringa oleifera* leaves. Food and Chemical Toxicology, 47: 2196-2201.

Table 1. Chemical and mineral composition of Moringa leaves and concentrate mixture (on % DM basis) fed to experimental Mehsana goat kids

Chemical composition	Moringa leaves	Concentrate mixture
Dry matter (%)	77.43	92.00
Crude protein (%)	26.33	17.59
Crude fibre (%)	8.82	5.58
Ether extract (%)	5.76	2.43
Total ash (%)	14.1	9.20
Calcium (%)	1.87	0.96
Phosphorus (%)	0.13	0.65
Copper (ppm)	9.48	23.56
Manganese (ppm)	89.68	48.53
Zinc (ppm)	26.78	39.51
Iron (ppm)	365.85	209.26

Table 2. Blood biochemical profile in Mehsana goat kids fed experimental diets (n = 18)

Parameters	Treatments			Significance
	T_1	T_2	T_3	
Glucose (mg/dl)	68.33±1.15	72.50±2.70	70.22±5.19	NS
Total Protein (g/dl)	6.86^{a}±0.25	7.35^{b}± 0.13	7.58^{b}±0.14	*
Albumin (g/dl)	3.78^{a}±0.17	4.56^{b}±0.29	4.71^{b}±0.28	*
Cholesterol (mg/dl)	124.65^{a}±1.59	124.41^{a}±1.68	110.60^{b}±1.86	***
SGPT (U/L)	9.60±1.08	9.02±1.23	12.51±1.05	NS
SGOT (U/L)	16.30^{a}±1.16	17.46^{a}±1.28	22.99^{b}±2.76	*

^{ab}Means in a row with different superscripts differ significantly (*P<0.05; ***P<0.001; NS: non-significant).

Table 3. Blood mineral profile in Mehsana goat kids fed experimental diets (n = 18)

Parameters	Treatments			Significance
	T_1	T_2	T_3	
Calcium (mg/dl)	9.34^{a}±0.35	10.59^{b}±0.43	11.18^{b}±0.39	*
Phosphorus (mg/dl)	5.07±0.24	4.87±0.30	5.15±0.27	NS
Copper (ppm)	0.46± 0.02	0.48± 0.02	0.47±0.02	NS
Iron (ppm)	1.54± 0.01	1.51± 0.01	1.50± 0.05	NS
Zinc (ppm)	0.79± 0.01	0.79±0.01	0.80±0.02	NS
Manganese (ppm)	1.03± 0.20	1.23± 0.25	1.12± 0.29	NS

^{ab}Means in a row with different superscripts differ significantly (*P<0.05; NS: non-significant).