Journal of Animal Research: v.5 n.2, p. 263-268. June 2015

DOI Number: 10.5958/2277-940X.2015.00045.5

Effect of Area Specific Mineral Supplementation on Biochemical Profile in Female Black Bengal Goats

Ranjeet Singh Godara[1*], Syamal Naskar[1], Bikash C. Das[1], Asu Singh Godara[2], Manoj K Ghosh[3], Mohan Mondal[3] and Showkat A. Bhat[4]

[1]Eastern Regional Station, Indian Veterinary Research Institute, 37, Belgachia Road. Kolkata. INDIA.
[2]Section of Livestock Production and Management, Indian Veterinary Research Institute, Izatnagar, Bareilly, INDIA
[3]Eastern Regional Station, National Dairy Research Institute, Kalyani, Nadia. INDIA.
[4]Division of Livestock Production and Management, National Dairy Research Institute, Karnal. INDIA.

**Corresponding author: RS Godara; Email: ranjeetgodara5@gmail.com*

Received: 20 September, 2014 **Accepted:** 15 April, 2015

ABSTRACT

To discern the effect of area specific mineral supplementation (ASMS), on some plasma parameters viz. glucose, non-esterified fatty acids (NEFA), alpha amino nitrogen (AAN), alanine transaminase (ALT) and aspartate transaminase (AST), the intensive study was conducted on 24 female Black Bengal goats at around of 4-5 months of age. The animals were divided into four groups viz. Group I (control), II, III supplemented with 0, 1 and 2% area specific mineral supplementation, respectively. Whereas, in another group (Group-IV), commercial mineral mixture fortified concentrate was given. Blood samples were collected at monthly interval and estimated five prime plasma parameters. Present study revealed that plasma glucose concentration was in normal range and differed significantly ($P < 0.05$) in groups. Highest plasma glucose concentration was observed in group IV and lowest in control group. Whereas, NEFA differed significantly in different groups. Plasma AAN level was higher in Group IV followed in Group III, II and I respectively. AAN did not differ significantly in groups. Plasma ALT and AST level differed significantly but highest Plasma ALT and AST level observed in Group II. Present study revealed that ASMS improved plasma biochemical profile in Black Bengal goats.

Keywords: AAN, ALT, ASMS, AST, Black Bengal goat and glucose

The Black Bengal goat (Capra hircus bengalensis), the most common breed of goat is mostly found in the Eastern and North-Eastern region of India, is a dwarf meat type highly prolific breed of goat and has several desirable characters like early sexual maturity and can be bred round the year. Other factors for rearing Black Bengal goat includes low capital intensity, prolific breeding, superior chevon quality, early sexual maturity, high-quality skin, low kidding intervals, good adaptability, no religious taboo against consumption, and steady returns (Dixit and Shukla, 1995). Micro-minerals have a great impact on animal's productive and reproductive physiology. It is known that most of the roughages, greens, concentrates are deficient in very essential trace mineral elements, which we often neglect and correcting the imbalances can solve the aging problem by improving reproductive performance and health with very meagre additional cost (Kumar *et al.*, 2011). Health and production of livestock is thus greatly influenced by optimal level of essential and trace mineral in the body (Sharma *et al.*, 2009). If there is imbalance between these minerals either due to deficiency or interaction, the animal suffers from poor health, fertility, immunity and ultimately affecting production. Study report revealed that six minerals are deficient in lower Gangetic part of West Bengal which are Ca, P, Zn, Co and Mn (Ghosh *et al.*, 2013). Keeping these in view, the present study was undertaken to find the effect of area specific mineral supplementation on biochemical profile of some plasma parameters of female Black Bengal goat.

Table 1. Effect of ASMS on plasma glucose, NEFA and AAN level in goats (Mean ± SE)

Treatment	0 Day	30 Day	60 Day	90 Day	Overall Mean
			Glucose (mg/dl)		
Group I (0% ASMS)	41.83 ± 0.88^{a}	43.25 ± 0.75^{a}	43.00 ± 0.93^{a}	45.17 ± 1.25^{a}	43.31 ± 0.52^{a}
Group II (1% ASMS)	44.00 ± 0.58^{a}	45.33 ± 0.84^{a}	50.17 ± 1.72^{b}	54.00 ± 1.46^{b}	48.38 ± 1.01^{b}
Group III (2% ASMS)	43.50 ± 0.76^{a}	45.83 ± 1.04^{a}	49.50 ± 1.80^{b}	57.33 ± 1.89^{b}	49.03 ± 1.29^{b}
Group IV (2% MM)	43.50 ± 0.96^{a}	45.50 ± 0.96^{a}	51.83 ± 1.49^{b}	56.50 ± 1.61^{b}	49.33 ± 1.29^{b}
			Non esterified fatty acids(µmol/L)		
Group I (0% ASMS)	82.24 ± 14.9^{a}	99.86 ± 19.9^{a}	105.48 ± 17.5^{a}	114.92 ± 18.3^{a}	100.63±8.63^{a}
Group II **(1% ASMS)**	76.09 ± 21.58^{a}	147.27 ± 44.2^{a}	116.12 ± 25.67^{a}	151.59 ± 36.32^{a}	122.77 ± 25.86^{ab}
Group III **(2% ASMS)**	85.11 ± 16.74^{a}	103.74 ± 21.2^{a}	109.71 ± 18.5^{a}	120.54 ± 21.1^{a}	104.77 ± 9.47^{a}
Group IV **(2% MM)**	136.05 ± 41.36^{a}	151.64 ± 49.8^{a}	140.61 ± 35.97^{a}	199.56 ± 76.01^{a}	156.96 ± 20.62^{b}
			Alpha Amino Nitrogen(µg/ml)		
Group I (0% ASMS)	27.31 ± 4.47^{a}	40.33 ± 4.18^{a}	37.33 ± 4.38^{a}	32.00 ± 2.02^{a}	34.24 ± 2.094^{a}
Group II (1% ASMS)	29.36 ± 5.03^{a}	43.51 ± 4.44^{a}	38.83 ± 3.70^{a}	34.81 ± 2.39^{a}	36.63 ± 2.16^{a}
Group III (2% ASMS)	39.42 ± 6.22^{a}	42.38 ± 7.12^{a}	31.29 ± 2.19^{a}	34.61 ± 5.79^{a}	36.92 ± 2.78^{a}
Group IV (2% MM)	32.95 ± 1.99^{a}	43.45 ± 4.47^{a}	34.82 ± 5.09^{a}	53.37 ± 6.29^{b}	41.15 ± 2.78^{a}

Values bearing different superscripts in column differ significantly ($P < 0.05$) from each other

Table 2: Effect of ASMS on ALT and AST level in goats (Mean ± SE)

Treatment	0 Day	30 Day	60 Day	90 Day	Overall Mean
			ALT(IU/ml)		
Group I (0% ASMS)	12.33 ± 2.74^{a}	17.33 ± 3.83^{a}	18.50 ± 3.14^{a}	19.17 ± 4.56^{a}	16.83 ± 1.78^{a}
Group II (1% ASMS)	43.36 ± 6.64^{b}	36.16 ± 91.77^{b}	18.08 ± 3.77^{a}	26.99 ± 8.67^{a}	31.15 ± 4.05^{b}
Group III (2% ASMS)	16.28 ± 2.50^{ab}	21.33 ± 6.16^{b}	16.75 ± 3.21^{a}	21.53 ± 7.98^{a}	18.97 ± 2.58^{a}
Group IV (2% MM)	13.39 ± 2.76^{a}	20.00 ± 2.76^{a}	19.68 ± 4.16^{a}	22.69 ± 5.17^{a}	18.94 ± 2.05^{a}
			AST(IU/ml)		
Group I (0% ASMS)	96.50 ± 4.99^{a}	89.17 ± 8.21^{ab}	105.17 ± 6.06^{a}	155.00 ± 10.25^{a}	111.46 ± 6.45^{a}
Group II (1% ASMS)	157.05 ± 19.48^{b}	130.67 ± 5.62^{b}	112.00 ± 9.19^{a}	148.33 ± 11.55^{a}	137.01 ± 6.87^{b}
Group III (2% ASMS)	141.19 ± 24.67^{a}	127.83 ± 9.21^{ab}	113.00 ± 6.76^{a}	157.67 ± 10.37^{a}	134.92 ± 7.60^{b}
Group IV (2% MM)	101.00 ± 4.37^{a}	88.17 ± 4.36^{a}	112.00 ± 3.79^{a}	166.00 ± 9.38^{a}	116.79 ± 6.99^{a}

Values bearing different superscripts in column differ significantly ($P < 0.05$) from each other

MATERIALS AND METHODS

The study was carried out on 24 female Black Bengal goats of 4-5 months of age and managed at IVRI, ERS at Kalyani goat farm. The farm is located at an altitude of 11 M above the mean sea level, at latitude of 22°98' North and at longitude of 88°44' East. The place falls in lower Gangetic Plain Region of India, as described by Sastry (1995). All experimental animals were pure Black Bengal goats. Animals were divided randomly into four groups (6 in each group) on basis of initial body weight (6.00 ± 0.33 kg) and kept almost same in each group. Group I was kept as control, provided concentrate without mineral mixture or any kind of deficient mineral supplementation. Group II and group III were treated as treatment I and treatment II, fed concentrated feed fortified with 1 and 2% area specific mineral supplementation, respectively. Whereas, Group IV considered as treatment III was fed concentrated added with commercial mineral mixture (2%). Respective concentrate feed was given @ 100 g/animal/day in the morning time in all the groups. Vaccination and deworming schedule followed in experimental animals were as per standard schedule. Animals were maintained under semi-intensive system. In night time, animals were kept in pucca house and floors are made up of concrete. Each group was kept in separate shed, and in each shed there was ample supply of water for animals. After feeding each group was turned out for natural grazing at 8 am to 12.30 pm and again at 2.30 pm to 5.30 pm. This schedule was followed till the end of experiment. Necessary blood samples were collected from jugular vein in heparin coated vial at monthly interval from each animal. Plasma glucose was estimated by GOD-POD, End Point method using commercial kits (Span Diagnostics Ltd., India).The copper soap extraction method modified by Shipe *et al.*

(1980) was adopted for the determination of plasma NEFA. Plasma alpha amino nitrogen was estimated by the method given by Goodwin (1970). ALT and AST were estimated by 2, 4-DNPH (Reitman and Frankel Method), using commercial kit (Span Diagnostics Ltd., India). Different statistical designs were considered to analyze data as per Snedecor and Cochran (1994) and analysis through SPSS programme. One way ANOVA was employed to test the difference between various plasma parameters amongst treatment groups.

RESULTS AND DISCUSSION

Glucose level in plasma in different groups has been presented in table 1. Overall mean glucose level differed significantly ($P < 0.05$) in Group I from other groups (II, III and IV) but there was no significant difference among treatment groups II, III and IV. Several previous studies also support the fact that mineral mixture supplementation have had a positive effect on plasma glucose level in goat (Jain *et al.*, 2005; kiomurasi *et al.*, 2011). Contrary to this Sharma *et al.* (2011) reported that minerals supplemented group of crossbred heifers had lower glucose level than control group. ASMS might be enhanced the process of gluconeogenesis because of this, higher plasma glucose level observed in mineral supplemented groups than to control group.

Plasma NEFA level in different groups has been presented in table 1.Overall mean NEFA level differed significantly ($P < 0.05$) in Group IV from other groups (I and III). NEFA values did not differ significantly ($P < 0.05$) among groups at different intervals. Fluctuation observed in the level of NEFA within group was found inconsistent during experimental period which did not show any linear pattern. This might have occurred due to no effect of minerals on NEFA level. Solaiman *et al.* (2006) reported that increase level of Cu supplementation resulted in decreased NEFA level at 112 days in goat kids.

Plasma AAN level in different groups has been presented in table1. The plasma AAN concentrations did not differ ($P > 0.05$) among the groups at the beginning of the experiment (day 0). Though the levels showed an increasing trend till day 30 post-treatment in all the groups, declined non-significantly($P > 0.05$) thereafter on day 60 and maintained the concentrations with minor fluctuation till day 90 in all the groups except group IV, where the AAN levels showed an increasing trend again on day 90. Blood AAN is an indicator of protein synthesis status of the animal (Mondal and Prakash, 2004). Plasma AAN has been reported to increase during growth and stabilizes or decreases after completion of active phases of growth (Hornick *et al.*, 1996, 1998; Mondal and Prakash, 2004). The increase in the plasma AAN on day 30 post-treatment in all groups may be due to higher tissue release or a decrease of tissue fare up of amino acids from plasma as also recorded in other species of animals (Simon, 1989; Mondal and Prakash, 2004). Increase of plasma AAN on day 90 in the animals of group-IV clearly indicates that the prepubertal growth process in terms of protein synthesis in this group was geared up again during this period (Mondal and Prakash, 2004).

ALT level in different groups has been presented in table 2. Present study revealed that serum ALT level up to 30 days of experiment differed significantly ($P <0.05$) among different groups, thereafter did not differed significantly($P > 0.05$) among different groups up to 90 days of experiment. At the end of first month of experiment value of ALT showed inclined trend except Group II where it declined. During end of second month of experiment, ALT level showed declined trend in all groups except Group I. In last month of experiment, ALT level again showed inclined trend in all groups. Normal levels of plasma ALT in goats has been reported to be within the range of 15.3–52.3 IU/L (Oni *et al.*, 2012) and in Black Bengal goat its physiological concentration is found to be 52.91±0.90 IU/L (Hossain *et al.*, 2011). In the present study, though there were differences in plasma ALT levels among the groups at different time points, it is within the normal physiological range (Oni *et al.*, 2012). At the start of the experimentation, the plasma levels of ALT were either below or very close to lower limit i.e. 15.0 IU/L indicating their poor nutritional status (Tiwari *et al.*, 2012). After supplementation of ASMS, the levels increased to normal physiological values in all groups including in the animals of group-II where it maintains normal concentrations throughout the experimental period.

AST level in different groups has been presented in table 2. Overall mean AST level differed significantly ($P < 0.05$) in Group II from other groups (I, III and IV). AST level was found higher in supplemented groups than control group. These findings are in agreement with previous studies (Exton, 1980; Jain *et al.*, 2005; Sharma *et al.*, 2011;

Tiwari *et al.*, 2012). AST level up to 30 days of experiment differed significantly ($P < 0.05$) among different groups, thereafter did not differed significantly among different groups up to 90 days of experiment. At the end of first month of experiment value of AST showed declined trend. During end of second month of experiment, AST level showed declined trend in group II and III but inclined trend in groups I and IV. In last month of experiment, AST level showed again inclined trend in all groups. Normal levels of plasma AST in goats has been reported to be within the range of 66–230 IU/L (Oni *et al.*, 2012) and in Black Bengal goat its physiological concentration is found to be 112.51±0.91 IU/L (Hossain *et al.*, 2011). In the present study, average plasma ALT activity increased in supplemented groups this may be attributed due to increase in transamination reaction (Sharma *et al.*, 2011) but ALT concentration was normal to physiological concentration in control group (111.46 ± 6.45).

CONCLUSION

ASMS have a positive effect on plasma parameters. It is concluded that plasma biochemical profile did not differ significantly between ASMS and commercial mineral mixture. Hence, ASMS can be recommended for better growth and early maturity in Black Bengal goats.

REFERENCES

Dixit, A.K. and Shukla, B.D. 1995. Efficiency of different marketing channels for goats in Etawah district of Uttar Pradesh. *Indian J. Agr. Econ.,* **50**(3): 331

Exton, J.H. 1980. Effect of diets low in calcium and phosphorus on development of growing lambs. *Am. J. Physiol*., **3**: 235-38.

Ghosh, M. K., Chatterjee, A., Mondal, A., Das, S.K. and Dutta, T.K. 2013. Area specific mineral mixture (CALMIN-ERS) for livestock in lower Gangetic region of West Bengal. http://www.ndri.res.in/ndri/Design/ERS.html

Hornick, J.L., Van Eenaeme, C., Diez, M., Minet, V. and Istasse, L. 1998. Different periods of feed restriction before compensatory growth in Belgian Blue bulls. 2. Plasma metabolites and hormones. *J. Anim. Sci.*, **76***:* 260-271.

Hornick, J.L., Van Eenaeme, C., Gauthier, S., Baldwin, P. and Istasse, L. 1996. Glucose, alpha-amino nitrogen, and amino acid exchange across the hind limb in young double-muscled type bulls maintained at two growth rates. *Can. J. Anim. Sci.*, **74**: 193-202.

Hossain, F.M.A., Hasnath, M.R and Kabir, M.S. 2011. Hematobiochemical dynamics and body weight gain of Black Bengal goat following urea molasses block (UMB) supplementation. *Online J. Anim. Feed Res.*, **1**(5): 182-185.

Jain, N., Tiwari, S.P. and Singh, P. 2005. Effect of urea molasses mineral granule on rumen fermentation pattern and blood biochemical constituents in goat kids fed sola grass based diet. *Vet. Arhiv.*, **75**(6):521-530.

Kioumarsi, H., Yahaya, Z.S., and Rahman, A.W. 2011. The effect of molasses/mineral feed blocks along with the use of medicated blocks on haematological and biochemical blood parameters in Boer goats. *Asian J. Anim. Vet. Adv.*, **6**: 1683-991.

Kumar, S., Pandey, A.K., Razzaque, W.A.A. and Dwivedi, D.K. 2011. Importance of micro minerals in reproductive performance of livestock. *Vet. World.*, **4**(5): 230-233

Mondal, M. and Prakash, B.S. 2004. Changes in plasma non-esterified fatty acids (NEFA), glucose and alpha- amino nitrogen and their relationship to body weight and plasma growth hormone (GH) in growing buffaloes (*Bubalus bubalis)*. *J. Anim. Physiol. Nutr.,* **88**(5-6):223-8.

Oni, A.O., Arigbede OM, Sowande, O.S., Anele, U.Y., Oni, O.O., Onwuka, C.F., Onifade, O.S., Yusuf, K.O., Dele, P.A. and Aderinboye, R.Y. 2012. Haematological and serum biochemical parameters of West African Dwarf goats fed dried cassava leaves-based concentrate diets. *Trop. Anim .Health Prod.* **44**(3):483-90

Sastry, N.S.R. 1995. Livestock sector of India: regional aspect. International Book Distributing Company, Lucknow, 46-52.

Sharma, J., Kumar, A., Tiwari, D.P. and Mondal, B.C. 2011. Effect of dietary supplementation of calcium, copper and manganese on nutrient utilisation, growth and blood-biochemical and mineral profile in crossbred heifers. *Indian J. Anim. Sci.*, **81**(5): 493-497.

Sharma, M.C., Tiwari, R. and Kumar, P. 2009. Area specific mineral mixture: need and importance. *Vet. Commun*., **4**: 3- 8.

Shipe, W.F., Senyk, G.F. and Fountain, K.B. 1980. Modified copper soap extraction methods for measuring free fatty acids in milk. *J. Dairy Sci*., **63**(2): 193-198.

Simon, O. 1989. Metabolism of proteins and amino acids. In: Protein Metabolism in Farm Animals. Bock, H.D., Eggum, B.O., Low, A.G., Simon, O. and Zebrowska, T., (eds), Oxford Scientific Publications, Deutscher, Landwirtsschaftsverlag, Berlin, pp. 273.

Solaiman, S.G., Shoemaker, C.E., Jones, W.R. and Kerth, C.R. 2006. The effects of high levels of supplemental copper on the serum lipid profile, carcass traits, and carcass composition of goat kids. *J. Anim. Sci*., **84**: 171-177.

SPSS. Windows for version-13.3. Release on 27.10.1999

(Microsoft Corp. 1998).Trends SPSS Inc., Michigan Avenue, Chicago, IL. 19-182.

Tiwari, M.R., Shrestha, B.K., Mandal, P. and Pandey, L.N. 2012. Growth performance of Khari goats on supplementation of UMMB in fodder based diets. *Nepal J. Sci. Tech.*, **13**(2): 29-32.

Tiwari, S.K., Kumar, A., Tiwari, D.P., Mondal, B.C. and Saxena, P.C. 2012. Response to strategic dietary mineral mixture supplementation in cattle and buffaloes under field condition (Hill region) of Nainital district of Uttarakhand. *Indian J. Anim. Sci.,* **82(**11): 1381-1385.