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Effect of micronutrient supplementation on hormonal profile of local goat and sheep breeds of West Bengal

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Agrarian economy of India mostly depends on livestock farming. India ranks second in goat production and third in sheep production in the world (FAOSTAT 2008). Southern part of West Bengal boasts of having unique breeds of goat and sheep, namely Black Bengal goat (*Capra aegagrus hircus*) and Garole sheep (*Ovis aries*). Due to high reproductive efficiency, these 2 breeds are considered as genetic wonder (Singh and Bohra 1996). Effect of trace minerals on steroid and thyroid hormones was attempted sporadically in some goat and sheep breeds (Haenlein 1993, Kalita *et al*. 2006, El-Sisy *et al*. 2008, Shinde *et al.* 2007, Yatoo *et al*. 2013) in India and abroad. Present investigation was carried out to assess the influence of trace mineral supplementation on certain steroid and thyroid hormones that affect reproduction in Black Bengal goat and Garole sheep.

Animals: Experimental animals were maintained at the Sheep and Goat farm of Ramakrishna Mission Ashrama, Narendrapur, South 24 Paraganas, West Bengal. Black Bengal goats and Garole sheep—healthy, properly vaccinated, dewormed, free from any external parasites and not under the effect of any medication prior to beginning of the study—were used. They were all in the same plane of nutrition and dependent on grazing in the pasture without any concentrate mixture or supplementary minerals. Black Bengal doe (10) and Garole ewes (10) of age group 1 to 2.5 years in the month of April – June, 2014, were used for the experiment. All the animals were humanely treated during trial period and the experiment was carried out with the due approval of Institute Animal Ethics Committee (IAEC).

Trace mineral mixture was fed to the experimental animals @ 10g/animal a day for 15 days. The product contains yeast proteinate of trace mineral ingredients such as Cu 1.5%, Fe 5%, Zn 3.5%, Mn 2.2%, I 1%, Co 0.002% and Se 0.45%. The serum hormonal profile such as estradiol-17ß (E_2), progesterone (P), triiodothyronine (T_3), tetraiodothyronine (T_4) and trace mineral profile such as Cu, Zn, Fe and Mn were studied from the experimental animals before and after administration of trace mineral mixture.

Blood was collected in sterilized vial from jugular vein of each animal. Serum was separated by centrifuging the blood samples in centrifuge machine at 3,000 rpm for 3 min and collected in sterile vial and preserved in deep freeze (–20°C) for further analysis.

In this study, the quantitative determination of hormone in sheep and goat serum was done by primary enzyme immunoassay using a commercial kit as per the standard protocol supplied with the kit. The levels of serum trace minerals (Cu, Zn, Fe and Mn) were estimated by atomic absorption spectrophotometer.

Data on hormonal and serum mineral profiles of sheep and goat were partitioned and subjected to statistical test of significance by Student's t-test (Snedecor and Cocharan 1994) at 5% and 1% levels by using STATISTICA software package. Pearson's correlation coefficient was calculated for determination of the relationship between hormone and serum trace mineral values before and after trace mineral supplementation to animals.

Averages of serum trace minerals before and after mineral supplementation are given in Tables 1, 2 for Black Bengal goat and Garole sheep. Serum trace mineral concentration was significantly (P<0.01) increased after supplementary feeding of trace mineral mixture for 15 days in goat breed, except Mn. Similarly in sheep breed, trace mineral concentration of serum after supplementary feeding differs significantly (P<0.01) than that of without supplementary feeding regime except Fe. This clearly showed that supplementary trace mineral feeding for short duration on goat and sheep has positive influence on serum trace mineral concentration. Similar results were also reported by various authors across different regions of the globe (Smith and Akinbamijo 2000, Erdogan *et al*. 2002).

Serum concentrations of most micronutrients increased significantly in both goat and sheep, significant (P<0.01)

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elevation of only estradiol-17ß and T_3 were observed, respectively, in goat and sheep post micronutrients supplementation (Tables 3, 4). There were significant negative correlations between Mn and T_3 ($P<0.05$; r=-0.69) in sheep before micronutrients supplementation. There was no significant correlation between other hormone and minerals in both the species.

Similar steroid and thyroid hormonal profile were reported earlier (Khanum *et al*. 2008, Mondal *et al*. 2014) in different breeds of goats under grazing condition. In the present study, serum estradiol-17ß concentration rose significantly ($P<0.01$) in the goats after micronutrient supplementation. In sheep, estradiol concentration also increased in the same condition (nonsignificant). This indicated micronutrient supplementation has positive influence on serum Estradiol-17ß level in goat and sheep. It is recommended that micronutrient mixtures needs to be supplemented for overall production efficiency including better reproductive performances of local sheep and goat breeds for longer duration of period, particularly for animals kept exclusively on grazing.

Table 1. Measurement of serum trace minerals in goat

Trace minerals	Before mineral supplementation	After mineral supplementation
Copper (ppm)	0.935 ± 0.164^a	1.115 ± 0.061^b
Zinc (ppm)	0.8 ± 0.0904^a	0.984 ± 0.009^b
Iron (ppm)	0.947 ± 0.016^a	0.992 ± 0.018^b
Manganese (ppm)	0.326±0.224	0.515±0.142

Means bearing different superscripts in a row differ significantly ($P<0.01$).

Table 2. Measurement of serum trace minerals in sheep

Trace minerals	Before mineral supplementation	After mineral supplementation
Copper (ppm)	0.851 ± 0.11^a	1.239 ± 0.033^b
Zinc (ppm)	0.8 ± 0.073^a	1.007 ± 0.006^b
Iron (ppm)	1.568±0.40	1.662 ± 0.031^b
Manganese (ppm)	0.823 ± 0.071^a	0.709 ± 0.126^b

Means bearing different superscripts in a row differ significantly ($P<0.01$).

Table 3. Measurement of steroid and thyroid hormone in goat

Hormones	Before mineral supplementation	After mineral supplementation
Estradiol 17-ß (pg/ml)	39.257 ± 9.608^a	65.769 ± 10.502^b
Progesterone (ng/ml)	1.989±2.802	1.474±2.457
T_3 (nmol/L)	5.53±1.13	5.528±0.86
T_4 (nmol/L)	141.15±36.143	154.67±77.528

Means bearing different superscripts in a row differ significantly ($P<0.01$).

Table 4. Measurement of steroid and thyroid hormone in sheep

Hormones	Before mineral supplementation	After mineral supplementation
Estradiol 17-ß (pg/ml)	50.244±20.974	60.606±14.816
Progesterone (ng/ml)	1.718±3.095	0.875±2.016
T_3 (nmol/L)	5.736 ± 0.826^a	4.178 ± 1.732^b
T_4 (nmol/L)	156.187±46.627	169.237±54.104

Means bearing different superscripts in a row differ significantly ($P<0.01$).

SUMMARY

The investigation was carried out to assess the influence of trace mineral supplementation on certain steroid and thyroid hormones that affect reproduction in Black Bengal goat and Garole sheep. Trace mineral feeding to local goat and sheep breeds showed positive influence. Rise of the serum trace minerals does not necessarily influence rising of serum steroid and thyroid hormone levels within short period.

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