Indian Journal of Animal Sciences **87** (12): 1536–1538, December 2017/Short communication

Evaluation of serum mineral status of pregnant and non-pregnant Changthangi ewes under different seasons

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Received: 15 December 2016; Accepted: 13 June 2017

Key words: Changthang, Ewes, Mineral, Pregnant, Season

Minerals are important for various biological functions in animal body at an optimum level (Suttle 2010, Yatoo *et al*. 2016a). Increase or decrease in levels may affect animal performance (Yatoo *et al*. 2012, 2016a). Different factors affect these mineral levels in animal body (Suttle 2010, Yatoo *et al*. 2016a, 2016b). Though variations have been studied in large animals but in small animals especially Changthangi sheep reports are lacking. These animals form a major source of economy to Changpas-nomadic inhabitants of Changthang, Ladakh (Yatoo *et al*. 2014). Hence present study was carried out to study the effect of season and pregnancy on serum mineral concentration of sheep.

Changthangi ewes (60) were selected from farmers' herd of cold arid Changthang (Ladakh) and were divided into pregnant and non-pregnant groups having 30 animals each. All animal were of the age of 1–3 years and reared under similar management conditions of cold arid and pastoral system. Blood samples (5 ml) were collected by jugular venipuncture in tubes without any anti-coagulant for harvesting serum. The separated serum was stored at –20ºC pending analysis of minerals. Minerals were estimated either by atomic absorption spectrophotometry (copper (Cu), iron (Fe)) after digesting the serum samples by the procedure of Kolmer *et al.* (1951) using AAS (Model No. AAS 4141) manufactured by Electronic Corporation of India (ECIL), Hyderabad or diagnostic kits (calcium (Ca), phosphorus (P) and magnesium (Mg) kit from Span Diagnostics Ltd; copper, iron, zinc (Zn) and cobalt (Co) from Coral scientific and Sigma). Data collected from this study were analyzed as per the method described by Snedecor and Cochran (1994) for mean, standard error and analysis of variance (ANOVA).

In pregnant ewes, significant ($P<0.05$) difference was noticed in Ca and P levels during summer and winter (Table 1). Similarly, in non-pregnant ewes, significant ($P<0.05$) difference was noticed in Ca and P levels during summer and winter. This may be due to lower nutrient supply during winter than summer due to fodder scarcity. In summer, there was no significant ($P<0.05$) difference in Ca and P level between pregnant and non pregnant ewes; but in winter, there was significant ($P<0.05$) difference between the two. This may be due to adequate nutrient consumption in summer by both pregnant and non-pregnant animals and comparatively lower availability to pregnant animals during winter due to higher requirements. Mg showed non-significant ($P\geq0.05$) variations which may be related to availability of adequate amount in fodders.

In pregnant ewes, Cu, Fe and Zn levels showed significant ($P<0.05$) difference during summer and winter whereas Co differed nonsignificantly ($P\geq0.05$). In non pregnant ewes, Cu and Zn levels showed significant ($P<0.05$) difference during summer and winter whereas Fe and Co differed nonsignificantly ($P\geq0.05$). Significant ($P<0.05$) difference was noticed in Cu and Zn levels between pregnant and non-pregnant ewes during both the seasons whereas Co showed nonsignificant difference when the Fe differed significantly during winter. These variations are attributed to lower nutrient supply during winter as a result of fodder scarcity and higher requirements of pregnant animals.

Significantly low levels of Ca, P, Cu, Fe and Zn in pregnant ewes during winter may be due to the gestational demands for fetus in addition to lower mineral content of feeds and fodders. Low levels of Ca, P, Cu, Fe and Zn in pregnant ewes was also reported by Elnajeeb and Adelatif (2010). In this cold arid region of India there is usually fodder scarcity during winter season and sheep have to rely on poor quality feeds which are deficient in minerals (Yatoo *et al.* 2011, 2014, 2016a). Hence animals especially pregnant ewes are predisposed to mineral deficiency as indicated by low serum mineral levels.

During winter, significantly low level of Ca, P, Cu and Zn in non-pregnant ewes may be attributed to the lower mineral content of feeds and fodders. Khan *et al.* (2005), Xin *et al.* (2011) and Abarghani *et al.* (2013) reported low level of Ca and P in sheep. Low level of Cu and Zn in sheep

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Table 1. Mean±SE of serum mineral level in pregnant and non-pregnant sheep under different seasons

Animal	Season	Macromineral (mg/dl)			Microminerals (ppm)			
		Ca	P	Mg	Cu	Fe	Zn	Co
Pregnant	Summer	9.92±2.53[a]	5.86±1.54[a]	2.88±0.56	0.78±0.55[a]	1.58±0.95[a]	0.65±0.29[a]	0.021±0.003
	Winter	7.11±1.12[b]	4.21±0.51[b]	2.65±0.48	0.62±0.42[b]	1.21±0.54[b]	0.47±0.11[b]	0.018±0.001
Non-pregnant	Summer	10.12±3.21[a]	6.42±2.01[a]	3.21±0.72	0.82±0.62[c]	1.72±1.05[a]	0.78±0.32[c]	0.023±0.004
	Winter	7.93±1.87[c]	5.11±1.12[c]	2.98±0.53	0.71±0.48[d]	1.62±0.83[a]	0.56±0.21[d]	0.020±0.001
Critical level (CL)		8.00^	4.50^	2.00*	0.65*	1.52-1.82[α]	0.60*	0.0241[β]

Values with different superscript within a column differ significantly (P<0.05). Critical level (CL): ^McDowell *et al.* (1984), *McDowell (1985, 1987), [α]Underwood and Morgan (1963), [β]Radostits *et al.* (2007).

during winter was also reported by Khan (2003). Mineral levels of non-pregnant ewes were slightly above critical levels during summer (Table 1). This may be due to the adequate amount of mineral intake through pasture grazing during summer and availability of sufficient fodders. These findings were in corroboration with Lengarite *et al*. (2012). Mineral level of pregnant ewes was lower than critical level during summer. This is related to the increase in requirements due to fetal requirements (Elnajeeb and Adelatif 2010). Mineral requirements of pregnant animals are more than the non-pregnant animals as they have to meet the fetal requirements also.

From this study, it can be concluded that the ewes especially pregnant ewes are predisposed to mineral deficiency and this predisposition is increased in winter when the fodders become scarce especially during the period of snowfall every year. Hence area specific mineral supplementation can be recommended based on physiological requirements of animals.

SUMMARY

The aim of this study was to evaluate the effect of season and pregnancy on serum mineral concentration of Changthangi sheep under cold arid climate. Changthangi ewes (60) were selected and divided in pregnant and non-pregnant groups each containing 30 animals. Sampling was done during summer (May-September) and winter (November-February). Calcium (Ca), Phosphorus (P), Copper (Cu), Iron (Fe) and Zinc (Zn) levels were significantly low in pregnant ewes during winter than summer; whereas in non-pregnant ewes, Ca, P, Cu and Zn levels were significantly low during winter than summer. During summer, Cu and Zn levels differed significantly between pregnant and non pregnant ewes; whereas in winter, Ca, P, Cu, Fe and Zn levels differed significantly between the 2 groups of ewes. Consistently most of the minerals were below critical levels indicating a need for mineral supplementation especially during winter.

ACKNOWLEDGEMENT

Authors are thankful to the Director, Indian Veterinary Research Institute for their support throughout the research work. Thanks are also due to Vice Chancellor of SKUAST-K and staff of KVK, Nyoma for helping in this research. Hospitality of *Changpas* is also acknowledged.

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