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BIOCHEMICAL AND MICRO-MINERAL STATUS OF YAK (*Poephagus grunniens* L.) REARED UNDER HIGH ALTITUDE TRADITIONAL MIGRATORY SYSTEM

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ABSTRACT

The present study was conducted on thirty apparently healthy adult yaks of either sex reared under traditional migratory free range system of rearing. Blood samples were analyzed for normal hematology, serum biochemical parameters and micro-mineral status of yaks when grazed in summer grazing ground and winter grazing ground. Hemoglobin content in yaks in summer grazing grounds was significantly ($P_{0.01}$) higher than that of animals in winter pastures. Red blood corpuscle (RBC) counts, white blood cell (WBC) counts, erythrocytic sedimentation rate (ESR) and packed cell volume (PCV) in yaks were similar in both summer and winter pasture. Similarly, no significant difference was observed in any of the biochemical parameters studied. The mean cobalt and zinc values in blood were significantly higher in animals grazing in summer grazing ground than those in winter grazing ground. However, the mean copper value was lower than the critical value indicating possible Cu deficiency.

Keywords: Biochemical analysis, blood, haematology, high altitude, migratory system, physiological response, trace element, yak

INTRODUCTION

Yak is the unique multipurpose bovid of high altitude (Cai and Gerald, 2003). The natural habitat of yaks is between 3,000 to 6,000 m mean above sea level (masl), which often remains snow-covered in almost whole year. In India, yaks are mostly reared under semi-migratory free range system in high reaches of Jammu and Kashmir, Arunachal Pradesh, Sikkim and Himachal Pradesh (Rahman *et al.*, 2010). In winter, yaks are kept in comparatively lower altitude (3,000 m masl) close to the villages, and during summer they are taken to high altitude alpine pasture (4,500 m masl) (Pal and Barari, 1994). The normal hematological and biochemical parameters in yaks reared under organized sedentary farm conditions have been studied by several workers (Barari *et al.*, 1995, Mondal *et al.*, 1998; and Chatterjee *et al.*, 2004); however the reports on hematology and various biochemical parameters of yak in summer/winter grazing grounds and during the phase of migration or reared under traditional system are scanty. Hence, the present investigation was designed to assess the physiological response of yaks to high altitude when they are in summer- and winter-grazing grounds under traditional management system.

MATERIALS AND METHODS

The present study was conducted on thirty apparently healthy adult yaks of either sex reared under traditional migratory free range system of rearing. The selected animals were equally grouped into two categories. The first group comprised of the animals grazing in winter-grazing ground in Mandala Phudung area of West Kameng district, Arunachal Pradesh which is around 2800-3000 m masl and the second group comprised of the animals grazing in summer-grazing ground in Sela area of Tawang district, Arunachal Pradesh which is 4,600 m masl.

Management practices

In the studied area the yaks start descending from the high altitude alpine pasture in November with the onset of snowfall and are herded to low altitude area upto April. From the month of May onwards they again start ascending to the Greater Himalayas in search of green alpine pastures. The winter pastures are often poor and the yaks generally eat lichen, dry leaves and tree-lopping wherever available. Naturally, the animals lose body condition during winter. Summer pastures are of much higher quality and provide nutrients entirely for the growth and production of yak.

During studies no separate housing was provided to yaks. Only simple enclosures without any roof were provided to calves where they were tied during nights. In winter-grazing grounds, animals were left in forest for grazing. Supplementary feeding was not followed in the farmer's herd, except for maize or wheat flour fed to the lactating animals. Only grazing and feeding of tree lopping was followed with salt.

The traditional way of maintaining the animals is to allow them to put on weight as much as possible in summer and utilize the energy reserves for survival in winter months when there is scarcity of feed (Ramesha *et al.*, 2005). The availability of herbage, its growth stage and nutritive value largely influence the production performance of yaks at high altitude under traditional migratory system of rearing, as the supply of supplementary feeding is limited.

Blood analysis

From each animal, blood samples were collected in duplicate from jugular vein to study the normal haemogram, serum biochemical parameters and micro-mineral status of yaks. EDTA was used as anticoagulant for hematological parameters like red blood corpuscles (RBC), white blood corpuscles (WBC), packed cell volume (PCV), haemoglobin (Hb) and erythrocyte sedimentation rate (ESR) as per the standard procedure of Jain (1986). The serum samples were analyzed within 24 h of collection for different biochemical parameters viz., glucose and total serum protein (Vatzidis, 1977). Biochemical enzymes, serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) were analyzed by UV-spectrophotometer using Ranbaxy kits (Ranbaxy diagnostics Ltd, India) and alkaline phosphatase by the method of Kind and King (1954). The trace elements (copper, cobalt and zinc) in serum were estimated by atomic absorption spectrophotometer (Perkin n Elmer A100) using standard conditions (Perkin, 1996). Standards were prepared by diluting the stock standard solutions (MERCK, Germany) using the same diluents as in case of samples. The data generated was analyzed as per Snedecor and Cochran (1989) to find any variation in physiological response of yaks when they are in winter- and summer-grazing ground.

RESULTS AND DISCUSSION

Hematological parameters

The hemoglobin content in yaks in summer-grazing grounds was significantly higher than those in winter pasture. However, other haematological parameters (RBC, WBC, PCV and ESR) were non-significant in these two seasons. The increase in Hb values alongwith high oxygen affinity of yak

indicates the adaptive feature of yak living in high altitude (Cai and Gerald, 2003). Winter *et al.* (1989) also observed that the yaks reared at an altitude of 4000 m masl had Hb value of 13.5 while yaks reared at an altitude of 2750 m masl had Hb value of 12.0 (Pourouchottamane *et al.*, 2004). Zhang *et al.* (1994) noted that Hb content in Tibetan yaks increased with increase in altitude. WBC count and ESR values were similar in both summer- and winter-grazing grounds (Table 1). Zhang Rongchang (1989) reported WBC count in the range of 9.1 to 12.5 x 10^3 in Tianzhu white yak.

Biochemical parameters

The serum protein levels of yaks were similar in both winter- and summer-grazing grounds (7.16±0.15 and 7.23±0.14 g dL^{-1}, respectively). Chatterjee *et al.* (2004) reported similar levels of serum protein in yaks reared under organized farm. The glucose levels were slightly higher (63.61±2.86 vs 61.23±2.46 mg dL^{-1}) in high altitude summer grazing grounds than the low altitude winter grazing grounds.

The activity of metabolic enzymes SGOT and SGPT were slightly higher in high altitude summer grazing ground as compared to those grazing in winter grounds (Table 1). Even though the difference was statistically insignificant, the trend indicates that metabolic activity was high in yaks reared at cold high altitude. The mean enzyme levels obtained were in higher range than those yaks reared under sedentary farm conditions (Chatterjee *et al.*, 2004). The alkaline phosphatase levels were similar in both the groups.

Table 1: Hematological, biochemical and trace element profile in yaks

Parameters	Winter-grazing ground	Summer-grazing ground	Overall mean
Hematological			
RBC (10^6 μL^{-1})	4.74 ± 0.08	4.99 ± 0.122	4.89 ± 0.08
Hemoglobin (g dL^{-1})	11.04 ± 0.43**	13.72 ± 0.488	10.22 ± 0.75
WBC (10^3 μL^{-1})	9.28 ± 0.14	9.93 ± 0.18	9.73 ± 0.14
PCV (%)	40.97 ± 1.31	41.03 ± 1.076	41.00 ± 0.82
ESR (mm 24 h)	10.00 ± 3.57	10.78 ± 1.38	10.53 ± 1.45
Biochemical			
Serum protein (g dL^{-1})	7.16 ± 0.15	7.23 ± 0.14	7.20 ± 0.108
Glucose (mg dL^{-1})	61.23 ± 2.46	63.61 ± 2.86	62.57 ± 1.91
Serum glutamate oxalo-acetate transaminase (SGOT) [IU L^{-1}]	38.37 ± 2.24	40.18 ± 3.75	39.39 ± 2.29
Serum glutamate pyruvate transaminase (SGPT) [IU L^{-1}]	25.55 ± 2.78	31.84 ± 5.37	29.11 ± 3.27
Alkaline phosphatase [IU L^{-1}]	186.30 ± 16.63	185.50 ± 9.19	185.80 ± 8.67
Trace elements			
Copper (mg L^{-1})	0.193 ± 0.008	0.296 ± 0.058	0.255 ± 0.037
Cobalt (mg L^{-1})	0.457 ± 0.028**	0.785 ± 0.065	0.654 ± 0.058
Zinc (mg L^{-1})	0.789 ± 0.114*	1.247 ± 0.108	1.064 ± 0.097

*Significant at $P_{0.05}$, **Significant at $P_{0.01}$

Micro-mineral status

The overall mean values of Cu, Co and Zn were 0.255±0.037, 0.654±0.058 and 1.064±0.097 mg L^{-1}, respectively. The blood Cu content was low and even non-detectable in some animals. The mean values obtained for Co and Zn were higher than the critical levels, whereas the mean value for Cu was much lower than the critical level (0.654±0.058 mg L^{-1}) reported by McDowell (1985) thereby indicating possible Cu deficiency in yaks under traditional migratory system of rearing in both summer- and winter-grazing pastures. Clauss and Dierenfeld (1999) reported the susceptibility of yak to Cu deficiency. In present study, the mean Co and Zn values were significantly higher in animals grazing in

summer-grazing ground than those in winter-grazing ground. The difference in serum mineral content might be due to the variation in soil type and pH, plant species, stage of maturity of plant, etc.

The haematological and biochemical parameters, except haemoglobin, of yaks were not affected by seasonal grazing under high altitude migratory system of rearing. Serum micro-minerals like Co and Zn were variable which may be due to quality of grazing pastures available during two different seasons.

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