



Variation in α -amino nitrogen, NEFA, urea and THI in mithun calves at various altitudes

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ABSTRACT

A comparative study on variation in α -amino nitrogen, NEFA, urea and THI at various altitudes in mithun calves was carried out at Medziphema farm at an altitude of 300 MSL (A_1) and Porba farm at altitude of 2100 MSL (A_2) Nagaland, India. The mithuns of either sex were selected and blood was collected at weekly interval. The values for α -amino nitrogen (mg/dl), NEFA (mg/l), Urea (mg/dl) and THI at A_1 and A_2 altitudes were 2.81 ± 0.54 and 17.71 ± 0.56 ; 22.16 ± 1.95 and 31.25 ± 1.63 ; 21.65 ± 0.7 and 11.29 ± 0.71 ; 72.01 ± 0.32 and 63.47 ± 0.31 , respectively. The values obtained for α -amino nitrogen, NEFA, urea and THI differed significantly between the two altitudes. It was concluded that there was significant variation in α -amino nitrogen, NEFA, urea and THI at various altitudes in mithun calves.

Key words: Altitude, α -amino nitrogen, Mithun, NEFA, THI, Urea

Mithun (*Bos frontalis*), the cattle of mountain, probably originated more than 8000 years ago, is considered to be domesticated from wild gaur (Simoons *et al.* 1984). The mithun and gaur were considered to be different species earlier; however, at present taxonomically, mithuns and gaur are grouped into the same species (*Bos frontalis*). Mithun refers to be the domesticated form (Wilson *et al.* 1993). This free-range bovine species has a limited geographical distribution and is mainly found in the North-Eastern hilly region of India and in many locations of South-East Asia like Myanmar, Bhutan, China and Bangladesh. In India, it is mainly found in the tropical rainforest of the North Eastern hill states (Arunachal Pradesh, Nagaland, Manipur and Mizoram). Mithuns are generally found at an altitude between 1,000–3,000 m MSL and are quite adaptable in that range.

Determination of metabolites or nutrient levels in readily available body fluids (Blood and Urine) was long established practice in studying metabolic changes in intact animals. Blood alpha amino nitrogen is an indicator of protein synthesis status of the animal. Plasma alpha amino nitrogen and free amino acids (AA) levels had been determined to assess protein status more clearly. Van Saun (2000) suggested that the measurement of non-esterified fatty acids (NEFA) as a determination of energy balance and many research studies had shown good correlations between energy balance and serum NEFA concentrations.

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Bertoni *et al.* (1990) reported the usefulness of urea in blood and milk as an indicator of dietary protein and energy in dairy cattle and suggested that increased level of urea in blood and milk itself was not an indicator of excess protein but should be considered in relation to other factors such as type of protein. Vale (2007) suggested that THI value more than 75 had a negative effect on reproductive performances of buffaloes.

The challenge lies ahead to introduce mithun at different altitudes as an efficient beef animal. Hence, before introducing of mithun at large scale in different places, it is necessary to understand its capability to adapt with different altitudes. However, availability of scientific information on the adaptation capability of mithuns under different altitudes till date is scanty. Considering all the above points, the present research work was carried out to determine the variation in α -amino nitrogen, NEFA, urea and THI at various altitudes in mithun calves.

MATERIALS AND METHODS

Animals and collection of blood: Mithun calves (6) were selected irrespective of sex and strains at National Research Centre on Mithun each from Jharnapani, Medziphema and Porba farms, which are situated at 300 m MSL (A_1) and 2,100 m MSL (A_2), respectively. The blood samples were collected at weekly intervals during the whole experiment. The blood was drawn from the jugular vein into properly labeled test tubes containing heparine solution (20 IU heparine per ml) in the morning at 6.30 AM before feeding. Immediately after sampling, the blood was centrifuged at 3,000 rpm for 15–20 min; the plasma was separated and

was stored in frozen form cryovials at -20°C for further analysis.

Analysis of blood samples and THI: Plasma alpha amino nitrogen (AAN) was estimated according to Godwin (1970). Non-esterified fatty acid (NEFA) in plasma estimation was estimated by the copper soap extraction method modified by Shipe *et al.* (1980) and standard curve by Koops and Klomp (1977). Plasma urea was estimated according to Rahmatullah and Boyde (1980). Thermo humidity index (THI) data were collected daily for minimum temperature (Min. temp), maximum temperature (Max. temp) and relative humidity (RH) using a digital thermo hygrometer. Variations in THI, blood metabolites (α -amino nitrogen, NEFA and urea) at different altitudes were analyzed using general linear model procedures of SPSS (SPSS 10.0.1). All the data are expressed as Mean \pm SE.

RESULTS AND DISCUSSION

The values for overall variation in α -amino nitrogen (AAN), NEFA, urea and THI at Medziphema (A_1) and Porba (A_2) are presented in Table 1. The values for α -amino nitrogen (mg/dl) at Medziphema (300 m MSL) and Porba (2100 m MSL) were 2.81 ± 0.54 and 17.71 ± 0.56 ; respectively. The value was significantly ($P<0.01$) higher at Porba farm (A_2) as compared to Medziphema farm (A_1). Similar results were reported by Keretsu (2010) in case of mithuns. Higher values of alpha amino-nitrogen at Porba as compared to Medziphema might be attributed to more availability of AAN for protein synthesis in the mithuns at respective altitude.

The values for NEFA (mg/l) at Medziphema (300 m MSL) and Porba (2100 m MSL) farms were 22.16 ± 1.95 and 31.25 ± 1.63 , respectively. The values differed significantly ($P<0.01$) between both the altitudes and was significantly ($P<0.01$) higher at Porba farm (A_2) as compared to Medziphema farm (A_1). The plasma NEFA concentration found in the present observation was within the range described by Singh (1992) in cows and buffaloes. Mondal *et al.* (2005) found the NEFA ($\mu\text{mol/L}$) to be 229.3 and 310.2 during postprandial (period I) and interprandial period (period II) in mithun heifers. Higher plasma NEFA values at Porba as compared to Medziphema might be due to lipolysis of fat in the mithuns at higher altitude to cope up with the demand for energy requirement.

The values for urea (mg/dl) at Medziphema (300 m MSL) and Porba (2100 m MSL) were 21.65 ± 0.70 and 11.29 ± 0.71 , respectively and the values were significantly ($P<0.01$) higher at lower altitude, i.e. Medziphema farm (A_1) as compared to the higher altitude, i.e. Porba farm (A_2). Ahmad *et al.* (2004) observed the urea level of blood serum (mg/dl) in cyclic, non-cyclic and endometritic crossbred cows to be 30.88 ± 2.42 , 33.80 ± 3.43 and 37.12 ± 3.45 , respectively. The mean serum urea nitrogen level in cattle and buffaloes were within normal range, i.e. 2.80–8.80 mmol/l (Boyd 1984) and 4.28–19.28 mmol/l (Dubey *et al.* 2006). In general, the concentration of serum urea was found higher in buffaloes than that of cattle. Higher plasma

Table 1. Variation in the plasma concentration of α -amino nitrogen, NEFA, urea and THI at different altitudes

| Particular | A_1 | A_2 |
|----------------------------------|-------------------|-------------------|
| α -amino nitrogen (mg/dl) | $2.81^a\pm 0.54$ | $17.71^b\pm 0.56$ |
| NEFA (mg/lit) | $22.16^a\pm 1.95$ | $31.25^b\pm 1.63$ |
| Urea (mg/dl) | $21.65^a\pm 0.70$ | $11.29^b\pm 0.71$ |
| THI | $72.01^a\pm 0.32$ | $63.47^b\pm 0.31$ |

^{a,b}Mean bearing different superscripts in a row differ significantly ($P<0.01$)

urea values at Medziphema as compared to Porba might be due to increased proteolysis at lower altitude (A_1) as compared to the higher altitude (A_2).

The values for overall variation in THI at Medziphema (300 m MSL) and Porba (2100 m MSL) were 72.01 ± 0.32 and 63.47 ± 0.31 , respectively. The value was significantly ($P<0.01$) higher at lower altitude, i.e. Medziphema farm (A_1) as compared to the higher altitude, i. e. Porba farm (A_2). However, THI values at both the altitudes were within the mean critical value for THI and well corroborated with the findings of Igono *et al.* (1992) who determined the critical values for minimum, mean and maximum THI to be 64, 72 and 76, respectively. Vale (2007) suggested that a THI value of more than 75 had a negative effect on reproductive performances of buffaloes which supported that mithuns at both the altitudes were stress free. Lower value of THI at Porba may be attributed to lower ambient temperature and humidity during the entire year.

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