

Effect of Altitude and Season on Rectal Temperature, Pulse Rate and Respiration Rate in Mithun (*Bos frontalis*)

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Abstract

The study aimed to investigate the effect of altitude and season on rectal temperature, pulse rate and respiration rate in mithun (*Bos frontalis*). Growing mithuns (n=6 in each location) were selected irrespective of sex from the herds maintained at Jharnapani (300 m MSL) and Porba (2100 m MSL) farms of NRC Mithun, Nagaland. The animals were kept in confinement and fed *ad libitum* mixed green forages and concentrate mixtures. The maximum (Max Temp) and minimum (Min Temp) ambient temperatures, relative humidity (RH), rectal temperature and pulse and respiration rates were recorded at both locations during summer (June to August) and winter (December to February). The values for Min Temp, Max Temp and RH were significantly lower ($P<0.05$) during winter compared to summer at both altitudes. Although the overall Min Temp and RH did not differ significantly between the altitudes, the overall Max Temp was significantly ($P<0.01$) higher at low (Medziphema: 28.7 ± 1.0) compared to high altitude (Porba: 19.6 ± 0.9). During both the seasons, rectal temperature and pulse and respiration rates were significantly ($P<0.01$) lower at high compared to low altitude. At both locations, rectal temperature and pulse rate did not vary significantly between the seasons, but respiration rate was significantly ($P<0.05$) higher during summer compared to winter. In conclusion, altitude exerted a significant influence on the rectal temperature and respiration and pulse rates, which was most likely due to the differences in ambient temperature between the altitudes.

Keywords : Season, altitude, physiological responses, mithun

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Introduction

Mithun, the cattle of mountain, is considered to be the domesticated form of wild gaur (Simoons 1984). The mithun and Gaur were considered to be different species earlier. However, at present, taxonomically mithun and gaur are grouped into the same species *Bos frontalis* and mithun refers to be the domesticated form. This rare bovine species is mainly found in the North-East hill region of India and in parts of Bhutan, Myanmar, China and Bangladesh. This animal is generally found at an altitude between 1000 to 3000 m above mean sea level (MSL) and it is well adapted in the environment of that range. This species is primarily used as a beef animal. Consumers consider mithun meat as more tender and superior compared to the meat of any other species except pork. In recent days, initiatives have been taken to popularise the economic mithun farming under semi intensive condition (Dhali *et al.* 2009). The challenge ahead is to introduce mithun under different climatological conditions as an efficient beef animal. Therefore, before introducing it at a large scale in different locations, it is necessary to understand its capability to adopt with the different climatological conditions.

Currently, the availability of scientific information on the adaptation capability and physiological responses of mithun under different seasons and altitudes is scanty. Therefore, the present study was conducted to investigate the effect of season and altitude on rectal temperature and pulse and respiration rates in this species.

Materials and methods

The experimental animals (n=6 at each location) were selected irrespective of sex from the herds maintained at Jharnapani (300 m MSL) and Porba (2100 m MSL) farms of NRC Mithun, Nagaland, India. The animals were kept in confinement and fed *ad libitum* mixed green forages and concentrate mixtures as per the NRC recommendations for cattle. The experiment was conducted for nine

months simultaneously at each location (Medziphema and Porba). At the beginning of the experiment, average body weights of the experimental animals were 267.72 ± 9.10 and 210.77 ± 15.72 , respectively for Medziphema and Porba.

During the experiment, all data were collected at both experimental locations during summer (June to August) and winter (December to February) seasons. The data were collected daily for minimum temperature (Min Temp), maximum temperature (Max Temp) and relative humidity (RH) using a digital thermo-hygrometer (TFA Dostmann Ltd, Zum Ottersberg, Germany).

Rectal temperature and respiration and pulse rates of the experimental animals were recorded at 07:00 AM before morning feeding. Rectal temperature was recorded using a clinical thermometer. Respiration rate was recorded with the help of a stethoscope. Pulse rate was recorded from the coccygeal artery. The animals were comforted before recording the physiological parameters and disturbance to them was kept at minimum.

All the statistical analyses were performed using the SPSS software package, version 10.0.1 (SPSS, Chicago, IL, USA) and data are presented as mean \pm SE. The overall and season wise variations in the environmental and physiological parameters between the altitudes were analyzed by ANOVA. The model included altitude as source of variation. The variations in the environmental and physiological parameters between the seasons were analyzed for each location by ANOVA. The model included season as source of variation.

Results and discussions

The variations in the environmental parameters by season and altitude are presented in Table 1. The values for Min Temp, Max Temp and RH were significantly lower ($P < 0.05$) during winter compared to summer at both altitudes. On the other hand, the values for Min Temp and Max Temp during summer and Max Temp during winter were significantly ($P < 0.05$) lower at high (Porba) compared to low altitude (Medziphema). Although, the overall Min Temp (Medziphema: 19.3 ± 2.0 ; Porba: 15.8 ± 1.4) and RH (Medziphema: 79.5 ± 1.7 ; Porba: 84.3 ± 2.7) did not differ significantly between the altitudes, the overall Max Temp was significantly ($P < 0.01$) higher at low (Medziphema: 28.7 ± 1.0) compared to high altitude (Porba: 19.6 ± 0.9).

The variations in the physiological parameters by season and altitude are depicted in Fig. 1. During both the seasons, values for all the physiological parameters were significantly ($P < 0.01$) lower at high compared to low altitude. Similarly, the overall rectal temperature ($^{\circ}\text{F}$), respiration rate (/min) and pulse rate (/min) were found significantly ($P < 0.01$) lower as well at high (100.5 ± 0.1 , 19.3 ± 0.1 and 63.8 ± 0.1) compared to low altitude (101.6 ± 0.1 , 25.6 ± 0.2 and 74.6 ± 0.4). The rectal temperature and pulse rate did not vary significantly between the seasons at both altitudes. In contrast, respiration rate was significantly ($P < 0.05$) higher during summer compared to winter at both altitudes.

In cattle, sheep and goat, higher rectal temperature is observed at low altitude with higher ambient temperature compared to high altitude with low ambient temperature (Ghosh and Pan 1994, Pangestu *et al.* 2000). Rectal temperature shows a positive relationship with ambient temperature and humidity (Singh *et al.*, 2003). Respiration is the most sensitive physiological character to the change of climate and physical environment in cattle (Sabuncuoglu 2004). It is proposed in domestic animals that respiration rate increases due to the activation of warm receptors in skin when exposed to higher ambient temperature. Activation of the receptors in turn sends neural signals to the hypothalamus that increases respiratory activity to accelerate heat loss from the body (Hafez 1968). It is reported that respiration rate is positively correlated with ambient temperature and humidity (Brown-Brandl *et al.* 2002, Singh *et al.* 2003). Similarly, pulse rate increases at higher ambient temperature (Brown-Brandl *et al.* 2002). In the current study as well, the values for all the recorded physiological parameters were found lower at high altitude, where overall maximum ambient temperature was significantly lower compared to low altitude. The results indicated that in mithun, the ambient temperature might have a influence on the rectal temperature and respiration and pulse rates.

It is evident from the present study that altitude and season exerts a significant influence on the rectal temperature, respiration rate and pulse rates in mithun. During both the seasons, rectal temperature and pulse and respiration rates were significantly ($P < 0.01$) lower at high compared to low altitude. At both locations, rectal temperature and pulse rate did not vary significantly between the seasons, but respiration rate was significantly ($P < 0.05$) higher during summer compared to winter.

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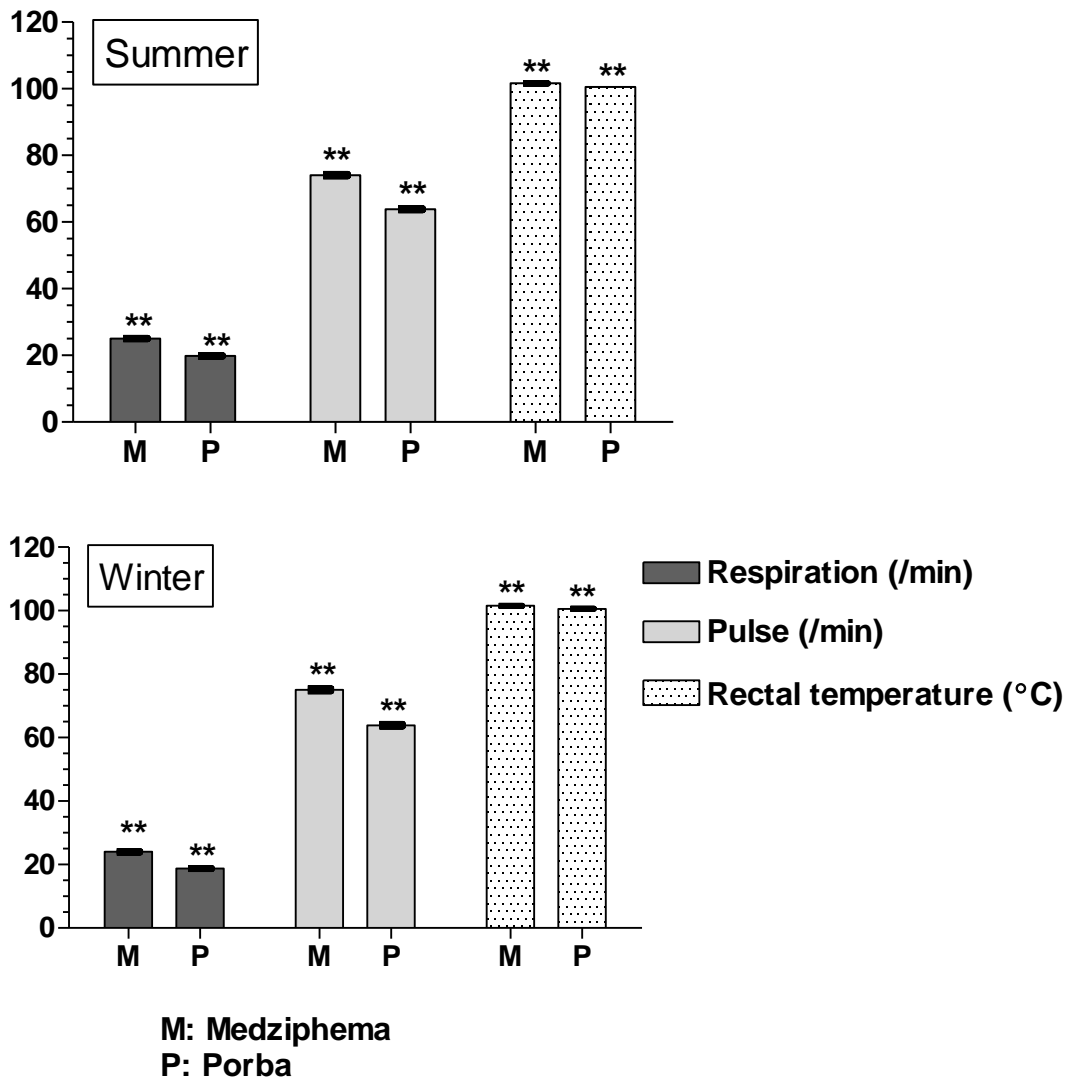


Fig. 1. Variations (Mean±SE) in respiration rate, pulse rate and rectal temperature in mithun during different seasons at Medziphema and Porba farms.

** indicates values differ significantly (P<0.01) between the locations; Effect of season was significant (P<0.05) only for respiration rate at both locations.

Table 1. Variations (Mean±SE) in maximum (Max Temp) and minimum (Min Temp) ambient temperatures and relative humidity (RH) during summer and winter at both experimental locations.

Particulars	Experimental locations	
	Medziphema§	Porba§
Summer		
Max Temp*	32.1 ± 0.1	22.5 ± 0.6
Min Temp*	24.7 ± 0.1	19.5 ± 0.3
RH	83.6 ± 0.5	90.8 ± 1.9
Winter		
Max Temp*	23.8 ± 1.2	14.4 ± 0.2
Min Temp	10.7 ± 1.2	8.3 ± 0.8
RH	76.2 ± 2.9	72.8 ± 3.8

§ indicates within location values for the parameters differ significantly (P<0.05) between seasons

* indicates within a season values differ significantly (P<0.05) between locations

