PHYSIOLOGICAL RESPONSE OF MURRAH BUFFALO CALVES TO VARYING TEMPERATURE HUMIDITY INDEX PREVALENT IN CENTRAL KERALA

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Abstract

The present study was conducted to assess the influence of varying temperature humidity index prevalent in central midlands of Kerala on the adaptation capacity of castrated buffalo calves by using physiological parameters. The temperature humidity index varied from 76.5 to 82.0 throughout the year. Rectal temperature remained consistent throughout the experimental period but respiratory rate and pulse rate exhibited a significant positive correlation (P<0.01) with temperature humidity index.

Keywords: *Temperature humidity index, physiological response, Buffaloes, thermoregulation*

In tropical and subtropical areas, a high ambient temperature is the main impediment on animal productivity. This effect is intensified when elevated ambient temperature is accompanied by high ambient humidity. This will causes additional discomfort and increases the stress level of the animal. Temperature humidity index can be used as a means for evaluating the severity of heat stress (LPHSI, 1990). Kerala has a hot and humid climate with unstable weather conditions throughout the year. Buffaloes are one of the livestock kept by the people for milk and meat. The present study was undertaken to investigate the adaption capacity of buffalo calves to the varying temperature humidity prevalent in central midlands of Kerala

Materials and Methods

Six castrated male buffalo calves between four to seven months of age were selected from the University Livestock Farm and Fodder Research and Development Scheme, KVASU, Mannuthy, for the study. The animals were fed as per ICAR feeding standards (Ranjhan, 1998) with concentrates and roughage fed in house and were subjected to grazing from 09:30 am to 12:30 pm throughout the experimental period. The calves

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were dewormed a week prior to the start of the experiment. Scientific management practices were carried out throughout the experimental period. The duration of the study was for one year.Ambient temperature and ambient relative humidity inside and outside the shed were recorded at hourly intervals on all days of the experiment using HOBO data logger (HOBO U 12 Temp/RH/Light/Ext.). Daily average temperature humidity index (THI)was calculated using the equation,THI = db°F - (0.55 – 0.55 x RH) x (db°F – 58), where db°F is the dry bulb temperature in Fahrenheit and RH is the relative humidity (RH%)/100 (LPHSI, 1990).

Rectal temperature was measured using a clinical thermometer by inserting into the rectum for one minute; respiratory rate was recorded by counting the flank movements for one minute from a distance in order to avoid any disturbance to the animals. Pulse rate was recorded by manual palpation of middle coccygeal artery pulse for one minute. These parameters were recorded daily at 09:00 am and 15:00 pm.The data obtained on various parameters were statistically analysed as per the method of Snedecor and Cochran (1994) using Pearson's correlaion. The whole data was analysed using computerized software programme SPSS Ver. 20.0.

Results and Discussion

The values obtained are summarized in Table 1 and 2. Maximum ambient temperature of 36.10 ± 0.31 was noticed in the second half of March while maximum relative humidity (96.00 ± 2.40) was recorded in the second half of August. There was no difference between the in-house and outdoor temperature and relative humidity as animals were housed in open-sided sheds. The highest THI of 82 ± 0.36 was observed in the month of March while the lowest THI of 76.5 ± 0.20 was recorded in the second half of December. In the present study the THI varied from 76.5 to 82 throughout the year. Fuquary (1981) suggested THI as the indicator of thermal stress, where THI up to 72 was considered as absence of heat stress, THI of 73 to 77 denoted mild thermal stress, 78 to 89 as moderate stress and THI above 90 as severe stress. Thus the animals in the present experiment were under mild to moderate heat stress throughout the year.

There was no significant correlation of THI with rectal temperature in buffalo (r = 0.258) at P < 0.01 level. This was in accordance with the study conducted by Zecchini*et al.* (2003) in Azawak cattle andAlam*et al.* (2011) in indigenous goats. On the contrary, Wanker *et al.* (2014) observed a positive correlation between THI and rectal temperature in buffaloes.In the present study, theconsistent maintenance of rectal temperature in varying THI throughout the experimental period might be because the animals had high level of thermal tolerance

A significant positive correlation (P <0.01) was noticed between THI and respiratory rate (r = 0.869) in buffalo calves. This is comparable with the observations of Das *et al.* (1999), who recorded a two and half fold increase in respiratory rate of Murrah buffalo calves exposed to heat stress.

A positive correlation was recorded between THI and pulse rate in buffalo calves (r = 0.921) at P < 0.01 level. These observations were in agreement with the reports of Vaidya*et al*. (2010) and Naik*et al.* (2013), whereas Wanker *et al.* (2014) had reported contradictory statement from our result in dry buffaloes.

The sweat glands in buffaloes are comparatively few and underdeveloped. Buffaloes depend on evaporative cooling through respiratory tract, sensible heat loss by physical means through the skin and insensible heat loss (diffusion of water through skin) to maintain their core body temperature when the THI increases. Exposure to heat stress causes vasodilation of peripheral blood vessels, which results in increased blood flow from the body core to the periphery for facilitating enhanced heat dissipation through skin by sensible and insensible means in order to maintain thermal balance. This might be the reason for increased respiratory rate and pulse rate with increase in THI in the present study. Thus the results indicated that the buffalo calves were adapted to THI range of 76.5 to 82.0.

Table 1. Physiological parameters of buffalo calves in varying THI

Period	THI	Parameter		
		Rectal Temperature (^{0}F)	Respiratory Rate (Breaths/Min)	Pulse Rate (Pulse/Min)
1st half of January	77.5 ± 0.34	102.2 ± 0.02	24.16 ± 0.77	54.23 ± 0.49
2nd half of January	78.5 ± 0.64	102.1 ± 0.02	25.28 ± 0.83	55.73 ± 1.03
1st half of February	78.5 ± 0.57	102.3 ± 0.01	25.37 ± 0.62	55.82 ± 0.68
2nd half of February	77.5 ± 0.63	102.2 ± 0.04	24.62 ± 0.24	53.64 ± 1.34
1st half of March	80.0 ± 0.39	102.2 ± 0.04	26.89 ± 0.23	60.77 ± 0.52
2nd half of March	82.0 ± 0.44	102.1 ± 0.04	38.15 ± 0.12	67.54 ± 0.68
1st half of April	82.0 ± 0.36	102.3 ± 0.03	37.53 ± 0.71	68.52 ± 0.46
2nd half of April	80.0 ± 0.45	102.1 ± 0.01	27.25 ± 0.62	61.57 ± 1.57
1st half of May	81.0 ± 0.23	102.2 ± 0.01	32.66 ± 0.45	63.89 ± 0.73
2nd half of May	81.0 ± 0.39	102.2 ± 0.02	33.16 ± 0.28	64.75 ± 0.76
1st half of June	80.0 ± 0.39	102.1 ± 0.05	28.76 ± 0.73	60.52 ± 0.62
2nd half of June	79.0 ± 0.22	102.1 ± 0.03	27.82 ± 0.54	58.91 ± 1.84
1st half of July	79.5 ± 0.40	102.2 ± 0.03	27.54 ± 0.61	57.60 ± 0.88
2nd half of July	77.5 ± 0.45	102.1 ± 0.03	24.38 ± 0.13	55.21 ± 0.60
1st half of August	78.0 ± 0.20	102.2 ± 0.01	26.54 ± 0.81	56.47 ± 1.17
2nd half of August	79.0 ± 0.34	102.3 ± 0.02	26.83 ± 0.73	56.41 ± 0.77
1st half of September	79.5 ± 0.32	102.3 ± 0.01	27.96 ± 0.66	57.34 ± 0.56
2nd half of September	80.0 ± 0.34	102.1 ± 0.01	27.13 ± 0.27	61.75 ± 1.02
1st half of October	79.4 ± 0.30	102.1 ± 0.03	25.33 ± 0.84	58.32 ± 1.07
2nd half of October	80.5 ± 0.60	102.2 ± 0.01	27.01 ± 0.91	61.76 ± 0.93
1st half of November	78.5 ± 0.36	102.1 ± 0.02	25.68 ± 0.37	55.21 ± 0.25
2nd half of November	78.5 ± 0.40	102.1 ± 0.02	25.43 ± 0.65	56.34 ± 0.64
1st half of December	78.5 ± 0.36	102.1 ± 0.03	24.77 ± 0.73	55.82 ± 0.29
2nd half of December	76.5 ± 0.20	102.1 ± 0.03	24.11 ± 0.59	54.31 ± 0.75

Table 2. Pearson's correlation coefficients (r) of physiological parameters and growth rate of crossbred cattle calves with varying THI

Parameters	Buffalo (r)
Rectal temperature	0.258
Respiratory Rate	0.869**
Pulse rate	0.921**

**Correlation is significant at 0.01 level (2-tailed)

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