RESPONSE OF CROSSBRED CATTLE IN TERMS OF RESPIRATION RATE AND RECTAL TEMPERATURE TO MAXIMUM AND MINIMUM THI PERIOD IN KERALA

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The present study assesses the relationship of meteorological variables with physiological stress parameters. Respiration rate was continuously measured (RR) using Physiological monitor with improvised facemask. Rectal temperature (RT) was continuously measured using in- dwelling thermo couple probes attached with data acquisition system. The experiment was conducted in the Livestock Farm of Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur, Kerala. Experimental animals included eight, six months to one year old crossbred female cattle. The study was conducted for a period of 120 days in two seasons, season I and season II covering maximum Temperature Humidity Index (THI) and minimum THI seasons (Season I: 24th March 2017 to 25th May 2017 and Season II: 15th December 2017 to 13th February 2018).

Regarding the physiological response of animals to the prevailing 'seasons' RR is the first one to show changes and hence the first sign of strain. Respiratory rate started increasing at ambient temperature of 30^{0}C and THI of 82. Increase in respiratory rate was found to be the first level of defense to prevent the increase in body temperature as suggested by Kabuga (1992). The accelerated RR may be a thermoregulatory response to increase evaporative heat loss to maintain core temperature (Marai *et al*., 2007).

When the atmospheric temperature increases, panting starts in animals as the first physiological mean of thermoregulation. When the hot air traverse to the upper airways water molecules on surface of the air ways get evaporated taking the latent heat of evaporation from the body. It induces a cooling effect on blood (Sherwood *et al*., 2012). When the fully saturated air comes out during expiration some part of the water vapour of the exhaled air may get condensed on the relatively cooler mucus membrane. When the atmospheric temperature increases the effect of evaporative cooling also increases indirectly increasing the water vapour condensation of the exhaled air on the mucus membrane of the upper air ways there by reducing the absolute humidity of the expired air. This may be the reason for the negative correlation between ambient temperature and absolute humidity of the expired air. But when the relative humidity of the atmosphere increases evaporative cooling of upper air ways become ineffective due to reduced gradient of water vapour partial pressure. This may lead to increase in the amount of water vapour of the expired air and forms the reason for the positive correlation between relative humidity of atmosphere and absolute humidity of expired air. So from these observations it can be inferred that increased respiration rate in conditions of increased THI due to elevated RH not only becomes the less

Table 1. Correlation coefficients of physiological parameters with meteorological variables (Season I – Period of maximum THI and Season II - Period of minimum THI)

Parameters	**Time**	**Season I**		**Season II**	
		AH	RR	AH	RR
Temperature in (^{0}C)	Morning	-0.501*	0.458*	-0.195	0.131
	Evening	-0.418*	0.621**	-0.436*	-0.130
Relative humidity in (%)	Morning	0.408*	-0.476*	0.116	-0.262
	Evening	0.487*	-0.470*	-0.012	-0.231
THI	Morning	-0.376	0.428*	-0.309	-0.303
	Evening	-0.300	0.618**	-0.348	-0.393

**Correlation is significant at the 0.01 level. *AH – Absolute Humidity
* Correlation is significant at the 0.05 level * RR – Respiration Rate

Table 2. Comparison of Physiological parameters in season I and season II (Season I – Period of maximum THI and Season II - Period of minimum THI)

Parameters	Mean ± SE					t-value
	Morning		t-value	Evening		
	Season I	Season II		Season I	Season II	
Ambient Temperature	32.09 ± 0.46	27.97 ± 0.43	6.481**	33.47 ± 0.44	33.11 ± 0.20	0.752ns
Ambient Relative humidity in %	70.72 ± 1.85	66.57 ± 2.22	1.441ns	68.26 ± 1.64	47.26 ± 2.09	7.814**
THI	84.2 ± 0.53	77.48 ± 0.51	9.169**	86.20 ± 0.54	81.77 ± 0.34	7.058**
Absolute humidity in the expired air of the animal	90.32 ± 1.05	87.61 ± 0.77	2.089*	89.31 ± 1.11	75.56 ± 2.23	5.510**
Respiratory rate of the animal	53.97 ± 1.58	33.28 ± 0.91	11.337**	60.90 ± 2.49	37.24 ± 0.75	9.112**

*Means are significantly different at 5% level
** Means are significantly different at 1% level
ns-non significant

Table 3. Correlation coefficients of rectal temperature with meteorological variables (Season I – Period of maximum THI and Season II - Period of minimum THI)

Parameter	Time	In house temperature	In house humidity	Average of THI
Rectal temperature	Season I	0.351	-0.087	0.448*
	Season II	-0.204	-0.248	0.006

*Correlation is significant at 0.05 level. *THI – Temperature Humidity Index

Table 4. Comparison of Rectal Temperature (RT) of season I and season II (Season I – Period of maximum THI and Season II - Period of minimum THI)

Parameters	**Season I**	**Season II**	**t-value**
Rectal temperature	39.72 ± 0.085	39.19 ± 0.049	5.399**

**Means are significantly different at 0.01 level
In season I, RT was significantly different and higher than that of season II (Table 4).

effective thermoregulation in animals but also becomes an extra burden on the system due to increased energy consumption.

In season I and season II the ambient temperature are more or less the same and both exhibited negative correlation with absolute humidity of the expired air. In season I and season II, though the evening ambient temperature was more or less the same, increased relative humidity in season I showed a negative correlation with absolute humidity of the expired air. But in season II no correlation could be observed between RH of the atmosphere and AH of the expired air. So relative humidity affect evaporative cooling negatively, when it cross a particular limit. This limit could be identified by doing experiments at different RH levels using a climate chamber. The absence of correlation between THI and AH may be due to the contradictory correlation exhibited by the components on THI on absolute humidity

Summary

The observation indicated that from THI 82 to 86 the body of the animal could maintain body temperature by physiological means of thermoregulation primarily by increasing respiration. Rectal temperature showed a positive correlation when THI reaches 86 and rectal temperature started increasing at ambient temperature of 34^{0}C and THI 86. But beyond 86 all these mechanisms failed and body temperature started rising. The relative humidity affects evaporative cooling negatively when it cross limit. This limit is very important to adopt management practices and could be identified by doing experiments at different RH levels using a climate chamber. The absence of correlation between THI and AH is also pointing to the fact that temperature and humidity affect the evaporative mechanism independently.

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