INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Haematological Responses of Murrah Buffalo Calves to Varying Temperature Humidity Index

Aziz Z.
Assistant Professor, Department of Veterinary Physiology, Veterinary College, Mannuthy, Kerala, India
Varma G. G.
Dean, College of Dairy Science, Mannuthy, Kerala, India
Raji K.
Assistant Professor, Department of Veterinary Physiology, Veterinary College, Mannuthy, Kerala, India
Beena V.
Assistant Professor, Department of Veterinary Physiology, Veterinary College, Mannuthy, Kerala, India
Anil K. S.
Professor and Head, University Livestock Farm, Mannuthy, Kerala, India

Abstract:
The current study was undertaken to investigate the adaptation of Murrah buffalo calves to varying temperature humidity index in the central midlands of Kerala using rectal temperature and haematological parameters. The temperature humidity index recorded throughout the experimental period varied from 76.5 to 80.0. A negative significant correlation was observed between temperature humidity index and haematological parameters (total erythrocyte count, haemoglobin concentration and haematocrit) at P<0.01 level. A significant positive correlation was observed between the temperature humidity index and plasma volume of the experimental animals at P<0.01 level.

Keywords: *temperature humidity index, buffalo, haematological parameters, rectal temperature, plasma volume*

1. Introduction

Buffaloes are considered as the second most important milch animals worldwide. Their heat tolerance capacity is very poor compared to other ruminants owing to their dark skin, less hair on the skin and scantly scattered sweat glands. Climate change is one of the major factor affecting the livestock worldwide. Climatic variables like humidity and temperature have profound effect on the productivity of the animal. The animals will exhibit compensatory mechanisms to maintain thermal balance when exposed to a moderate climate change. Temperature humidity index is used as an indicator of thermal stress in animals.

Kerala is a tropical state having hot and humid climate, where the weather is unpredictable. So the current study was undertaken to study the haematological responses of Murrah buffalo calves to varying temperature humidity index in the central midlands of Kerala.

2. Materials and Methods

Six castrated male buffalo calves between four to seven months of age were selected for the study from the University Livestock Farm and Fodder Research and Development Scheme, KVASU, Mannuthy. The period of experiment was for one year. Daily ambient temperature and relative humidity were recorded at hourly intervals, inside and outside the shed using HOBO data logger. Temperature humidity indexwas calculated using the equation, THI = db^{o}F - (0.55 – 0.55 x RH) x (dboF – 58), where db^{o}F is the dry bulb temperature in Fahrenheit and RH is the relative humidity (RH%)/100 (LPHSI, 1990).

Rectal temperature was recorded daily at 09:00 am and 15:00 pm. Whole blood was collected from jugular vein using vacutainers containing anticoagulant on zero day of experiment and at fortnightly intervals till the end of experiment. The blood was used for analysis of haematological parameters like total erythrocyte count, haemoglobin concentration and haematocrit using haematological analyzer. Plasma volume was determined by the method of Kennedy and Millikan (1938) by injecting Evan's blue dye.

The data obtained on various parameters were statistically analyzed as per the method of Snedecor and Cochran (1994) using Pearson's correlation**.** The whole data was analyzed using computerized software programme SPSS Ver. 20.0.

3. Results and Discussion

The THI varied from 76.5 to 82.0 throughout the year. The lowest THI of 76.5 ± 0.20 was recorded in the second half of December, while the highest THI of 82 ± 0.36 was observed in the month of March (Table 1).

The body temperature remained consistent throughout the experiment. There was no significant correlation between temperature humidity index and rectal temperature (Table 3). This was in agreement with the study conducted by Zecchini *et al.* (2003) and Alam *et al.* (2011). This invariable maintenance of rectal temperature in varying temperature humidity index in the current study might be due to the fact that animals had high level of heat tolerance.

A negative correlation was observed between temperature humidity index and total erythrocyte count in buffalo calves at < 0.01 level (Table 3) which in agreement with the findings of Mirzadeh *et al.* (2013) and Omran *et al.* (2012). In contrast to these report, Naik*et al.* (2013) and Bhan *et al.* (2012) recorded increase in total erythrocyte count with increase in temperature humidity index.

Haemoglobin concentration significantly decreased with increase in THI in buffalo at P<0.01 level which was in accordance with the findings of Omran *et al.* (2012) who observed a reduction in the haemoglobin concentration of buffalo calves exposed to artificial hot conditions. However, Naik *et al*. (2013) observed significantly higher concentration of haemoglobin in cattle during summer than in winter and rainy season.

Haematocrit values exhibited a significantly negative correlation with temperature humidity index (Table 3) which is comparable with the result of Mazzullo *et. al.* (2011). Temperature humidity index was positively correlated with the plasma volume of buffalo calves which is similar to the findings of El-Sherif *et al.* (1996) and Abdel Fatha (2014).

The increase in plasma volume with increase in THI in the present study might be due to shifting of water from other compartments into the circulatory system for effective evaporative cooling in order to maintain thermal balance. Thus reduction in total erythrocyte count, haemoglobin concentration and haematocrit with increase in temperature humidity index might be due to haemodilution.

Thus we can conclude that the Murrah buffalo calves were adapted to temperature humidity index from 76.5 to 80.0 in the central midlands of Kerala.

Period	THI	Parameter		
		Rectal Temperature (^{0}F)	Total erythrocyte count (10^6/µL)	Haemoglobin concentration (g/dL)
1st half of January	77.5 ± 0.34	102.0 ± 0.01	6.26 ± 0.19	8.90 ± 0.37
2nd half of January	78.5 ± 0.64	102.1 ± 0.01	6.37 ± 0.05	8.78 ± 0.35
1st half of February	78.5 ± 0.57	102.1 ± 0.03	6.16 ± 0.32	9.00 ± 0.47
2nd half of February	77.5 ± 0.63	101.9 ± 0.03	6.23 ± 0.27	9.03 ± 0.29
1st half of March	80.0 ± 0.39	102.1 ± 0.01	5.32 ± 0.22	7.38 ± 0.31
2nd half of March	82.0 ± 0.44	102.0 ± 0.04	4.79 ± 0.20	6.92 ± 0.24
1st half of April	82.0 ± 0.36	102.0 ± 0.03	4.45 ± 0.12	6.81 ± 0.26
2nd half of April	80.0 ± 0.45	102.0 ± 0.03	4.92 ± 0.09	7.13 ± 0.18
1st half of May	81.0 ± 0.23	102.2 ± 0.02	4.56 ± 0.10	6.98 ± 0.18
2nd half of May	81.0 ± 0.39	102.1 ± 0.02	4.58 ± 0.09	7.06 ± 0.05
1st half of June	80.0 ± 0.39	102.1 ± 0.04	4.99 ± 0.10	7.06 ± 0.58
2nd half of June	79.0 ± 0.22	101.9 ± 0.01	4.70 ± 0.08	8.00 ± 0.23
1st half of July	79.5 ± 0.40	102.1 ± 0.01	5.10 ± 0.09	7.90 ± 0.24
2nd half of July	77.5 ± 0.45	101.9 ± 0.02	5.23 ± 0.12	8.13 ± 0.27
1st half of August	78.0 ± 0.20	102.0 ± 0.02	5.38 ± 0.13	8.26 ± 0.23
2nd half of August	79.0 ± 0.34	102.0 ± 0.04	5.39 ± 0.14	8.16 ± 0.19
1st half of September	79.5 ± 0.32	102.1 ± 0.04	5.42 ± 0.11	8.15 ± 0.49
2nd half of September	80.0 ± 0.34	102.2 ± 0.04	5.32 ± 0.22	8.10 ± 0.42
1st half of October	79.4 ± 0.30	102.1 ± 0.01	5.44 ± 0.11	8.21 ± 0.67
2nd half of October	80.5 ± 0.60	102.0 ± 0.01	5.32 ± 0.22	8.13 ± 0.26
1st half of November	78.5 ± 0.36	102.0 ± 0.01	6.14 ± 0.22	8.78 ± 0.50
2nd half of November	78.5 ± 0.40	102.1 ± 0.05	6.25 ± 0.19	8.76 ± 0.35
1st half of December	78.5 ± 0.36	102.0 ± 0.02	6.26 ± 0.19	8.98 ± 0.38
2nd half of December	76.5 ± 0.20	101.9 ± 0.02	6.31 ± 0.11	9.08 ± 0.37

Table 1: Haematological parameters and rectal temperature of Murrah buffalo calvesin varying THI

Parameters	Cattle
Rectal temperature	0.409
Total erythrocyte count	-0.835**
Haemoglobin concentration	-0.902**
Haemotocrit	-0.855**
Plasma volume	0.914**

*Table 2: Pearson's correlation coefficients (r) of haematological parameters and rectal temperature of Murrah buffalo calves with varying THI ** Correlation is significant at 0.01 level (2-tailed)*

Period	THI	Parameter	
		Haematocrit (%)	Plasma Volume (mL/Kg)
1st half of January	77.5 ± 0.34	33.03 ±1.08	41.27 ± 0.82
2nd half of January	78.5 ± 0.64	32.31 ±0.74	41.75 ± 0.75
1st half of February	78.5 ± 0.57	34.03 ±1.29	41.63 ± 1.13
2nd half of February	77.5 ± 0.63	34.75 ±1.12	41.38 ± 0.59
1st half of March	80.0 ± 0.39	28.76 ±1.26	43.81 ± 0.67
2nd half of March	82.0 ± 0.44	21.38 ±1.06	47.62 ± 0.29
1st half of April	82.0 ± 0.36	19.96 ±1.65	47.51 ± 1.05
2nd half of April	80.0 ± 0.45	23.23 ±1.26	44.29 ± 0.37
1st half of May	81.0 ± 0.23	23.90 ±1.54	46.78 ± 0.60
2nd half of May	81.0 ± 0.39	24.15 ±0.77	46.39 ± 1.42
1st half of June	80.0 ± 0.39	24.15 ±2.59	43.63 ± 0.82
2nd half of June	79.0 ± 0.22	29.53 ±2.06	42.50 ± 0.57
1st half of July	79.5 ± 0.40	29.93 ±1.73	42.71 ± 0.64
2nd half of July	77.5 ± 0.45	32.05 ±1.06	41.13 ± 1.09
1st half of August	78.0 ± 0.20	32.10 ±0.64	41.22 ± 0.75
2nd half of August	79.0 ± 0.34	31.01 ±0.45	41.72 ± 0.34
1st half of September	79.5 ± 0.32	32.08 ±1.78	41.83 ± 0.95
2nd half of September	80.0 ± 0.34	31.50 ±1.23	43.08 ± 0.38
1st half of October	79.4 ± 0.30	32.53 ±1.11	41.97 ± 1.14
2nd half of October	80.5 ± 0.60	30.10 ±1.14	43.88 ± 1.76
1st half of November	78.5 ± 0.36	32.20 ±0.69	41.35 ± 0.61
2nd half of November	78.5 ± 0.40	33.41 ±0.93	41.03 ± 0.77
1st half of December	78.5 ± 0.36	33.83 ±0.25	40.78 ± 0.63
2nd half of December	76.5 ± 0.20	34.10 ±0.94	40.53 ± 0.29

Table 3: Haematocrit and plasma volume of Murrah buffalo calvesin varying THI

4. References

i. Abdel Fattah, M. S. (2014). Changes in body fluid and plasma electrolytes (Na and K) concentration of Balady and Damascus goats exposed to heat stress in Desert of Sinai, Egypt. World Applied Sciences Journa,. 30(5), 534-542.

ii. Alam, M. M., Hashem, A., Rahmam, M. M., Hossain, M. M., Haque, M. R., Sobham, Z. and Islam, M. S. (2011). Effect of heat stress on behavior, physiological and blood parameters of goat. Progress Agric,.22 (1&2), 37-45.

iii. Bhan, C., Singh, S. V., Hooda, O. K., Upadhyay, R. C., Beenam and Mangesh V. (2012). Influence of temperature variability on physiological, haematological and biochemical profile of growing and adult Sahiwal cattle. J. Environ. Res. Develop,.7, 986-994.

iv. El-Sherif, M. A., Azamel, A. A. and El-Sayed, N. A. (1996). Effect of natural shading on some adaptive traits of hydrated and dehydrated ewes during breeding under semi-arid conditions. Proceeding of 4th scientific congress "Veterinary Medicine and Human health"3-5th April 1996. Faculty of veterinary medicine, Cairo University, Egypt.

v. LPHSI. (1990). Livestock and poultry heat stress indices. The livestock and poultry heat stress indices foe cattle, sheep and goats. Cited in the agriculture engineering technology guide, Clemson University, Clemson, SC, USA.

vi. Mirzadeh, K. H., Tabatabeei, S., Bojaipur, M. and Mamoei, M. (2010). Comparative study of haematological parametrs according to strain, age, sex, physiological status and season in Iranian cattle. J. Anim. Vat. Adv.,9 (16), 2123-2127.

vii. Naik, A. V. N., Kumar, A. S., Bramhaiah, K. V. R. and Chakravarthi, V. P. (2013). Effect of seasons on physiological and haematological values in Punganur cattle. Int. J. Pharm. Bio. Sci.,4(4), 40-49.

viii. Omran, F. I., Ashour,G., Youssef, M.M. and Shafie, M. M. (2012). Responses of haematology, blood metabolites, mineral ions and hormonal profile to heat stress of Egyptian buffalo calves. Egypt J. Agric. Res.,89(3), 1129-1140.

ix. Snedecor, G. W. and Cochran, W. G. (1994). Statistical Methods. (8th Ed.). Oxford and IBH publishing corporation, Calcutta.

x. Zecchini, M., Barbieri, S., Boureima, K. and Crimeila, C. (2003). Heat stress parameters in Azawak cattle (Bos indicus): four seasons of data collection. Ital. J. Anim Sci.,2, 142-144.