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Periodic Research

Effect of water showering on hemato-biochemical parameters of cross-bred cows during peak summer season

Abstract

The primary objective was to find the effect of showering on haematological and bio-chemical parameters in cross-bred dairy cattle during heat stress. Fifteen crossbred dairy cows were randomly divided into three treatment groups (T_0, T_1 and T_2) of five animals each. Animals under treatment were showered either once in T_1 or twice in T_2 respectively, while control group (T_0) was without showering. The overall mean maximum and minimum temperatures recorded during the study were 38.80±2.08°C and 27.33±2.23°C respectively, while the overall mean relative humidity and THI recorded at 0600 hrs, 1400 hrs and 1900 hrs were 82.49±4.68%, 74.01±3.13, 50.16±4.10%, 87.60±3.63 and 60.73±3.93, 77.99±3.77 respectively. Approximately 10ml blood was collected from each animal once in a week immediately after showering to know its effect on haemoglobin, PCV, Blood glucose, serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT), and alkaline phosphatase . All the values were within the normal range but a significant (P<0.05) difference was seen in hematological and bio-chemical levels within the showered and un-showered groups. It was concluded that showering during extreme summer months can be effectively utilized as a simple management practice to curb heat stress in animals.

Keyword: Showering, Cross-bred dairy cows, Heat stress management.

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Introduction

Animal productivity is influenced by several factors like genetic potential, availability of feed resources, nutritional status, management practices and climatic conditions (Mudgal, 2003). Cattle are susceptible to heat stress, thus leading to lower growth rate in summer leading to economic losses (Marai et al. 1995). Heat stress disturbs metabolism and also suppress hematopoiesis. SGOT and SGPT are involved in amino acid metabolism and hence, protein turnover. Alkaline phosphates is involved in energy metabolism and is also an indicator of alkalosis and stress, while serum glucose is an indicator of energy turn over.

Heat stress in cattle occurs when the animal heat load is greater than its capacity to dissipate heat (Kumar *et*. al., 2010). The animal heat load is determined by its own body heat production plus environmental heat that includes air temperature and h-umidity, and both are combined into a temperature humidity index (THI). Ambient temperature within an animal's lower and upper critical temperature is regarded as the zone of thermo neutrality. Within this zone, minimal physiologic cost and maximum productivity normally are achieved. For dairy cows, this range is between -5°C and 24°C. The average temperature in Jammu during summer ranges from 35^0C to 47^0C during peak summers. Thus, this is probably a major constrain in the development of livestock.

One of the natural methods of heat dissipation is evaporation. Showering involves wetting the animal body surface by a shower. Showering method does not attempt to cool the air but instead uses a large droplet size to wet the hair coat to the skin of animal and then water evaporates and cools the hair and skin. However, most of the heat ameliorative studies have been carried out in lactating buffaloes, calves and in poultry respectively. There are only limited studies done in dairy cattle. Thus the objective of this study was to find the heat stress ameliorating effect of showering on hematological and bio-chemical parameters in cross bred dairy cattle.

Materials and Methods

The experiment was conducted at the Instructional Dairy Farm, Division of Livestock Production Management, Faculty of Veterinary Sciences and Animal Husbandry, R. S. Pura, SKUAST-J, Jammu, during the summer months (June, July and August). Fifteen crossbred cows were randomly put into three groups of five animals each viz., T_0 – without water showering (control), T_1 - showering for 20 minutes once daily between1100 - 1300 hours, T_2 showering for 20 minutes once between1100 -1300 hours and 20 minutes again between 1600-1800 hours totaling 40 minutes daily.

Microclimatic variables like maximum and minimum temperatures and relative humidity were recorded daily during the experimental periods at animal level to quantify the microenvironment prevalent around the animals. Dry and wet bulb temperatures were recorded during 0600, 1400 and 1900 hours on daily basis. Relative humidity in percentage was obtained from the dry bulb and wet bulb readings using psychometric table. Temperature Humidity Index (THI) was derived as per U.S. Weather Bureau equation, THI = 0.72 (dry bulb temp. °C + wet bulb temp °C) + 40.6).

Blood samples from individual animals were collected once in a week immediately after showering during the trial. About 10 ml of whole blood was collected from each animal aseptically by the jugular vein puncture using an 18 gauge needle. Samples vials were immediately placed in ice after collection. Hemato-biochemical parameters studied in experimental animals during the present study was Hb, PCV, Glucose, SGPT, SGOT and ALP. Haemoglobin was estimated by Sahli's method (Oser, 1965). The method is based on formation of acid haematin, which is compared with a standard, sealed in a glass tube. PCV was determined by microhaematocrit method. The serum ALP was measured spectro-photometrically by using ERBA diagnostic kit manufactured by TRANSASIA bio-medicals Ltd., Solan,(H.P) India. SGPT and SGOT were measured spectrophotometrically with blood chemistry analyzer using AUTOPAK diagnostic kits manufactured by SIEMENS healthcare diagnostic Ltd. Gujarat, India, as per manufacture protocol. Similarly plasma glucose was estimated spectrophotometrically by conventional method. The data recorded was analyzed as completely randomized design as per the procedure described by Snedecor and Cochran 1994.

Results and Discussion

Microclimatic variables

During the experimental period microclimatic variables recorded in the cattle shed are presented in Fig-1. The mean maximum temperature recorded was higher than the upper critical temperature (27^0C) and the minimum temperature recorded was higher than the comfort zone (18^0C) for cross breed cattle. The percent overall relative humidity recorded in the cattle shed was 82.49%, 50.16%and 60.73%per cent at 0600 hour, 1400 hour and 1900 hour respectively. In general, microclimate (ambient temperature and relative humidity) in the cattle shed was reported as stressful for dairy cattle. Temperature Humidity Index (THI) has been widely used as an heat stress indicator in dairy cattle with values below 72 considered to be comfortable; 72-78 as mild; 78-88 as moderate and above 88 as extremely stressful (Wiserma and Armstrong 1989). The observed THI recorded in the cattle shed at morning, afternoon and evening were 74.01, 87.60 and 77.99 and are considered stressful to dairy cattle.

Hemato-biochemical parameters

Haemoglobin

The overall mean haemoglobin level of cattle is presented in Table 1. In the present study, haemoglobin content of the showered groups (T_1 and T_2) were found to be significantly higher (P<0.05) than the control group (T_0). This indicates that heat stress lowered haemoglobin content in control group (T_0), which might be due to increased stress as excess heat load imposed upon animals mobilize the body energy reserves towards the physiological mechanism involved in heat dissipation and removes the energy sources from protein synthesis and thereby, suppress the haematopoiesis (Lee and Philips, 1948).

PCV

Table-1 shows that mean PCV of cattle in T_0, T_1, and T_2 groups were 30.02, 32.96 and 33.45 %, respectively. The value of PCV is within normal range of 24-46 % for cattle. Statistical analysis revealed a significant (P<0.05) increase in PCV value in showered groups (T_1 and T_2) than control group (T_0). This indicated that heat stress decreased the PCV in control cattle (T_0). The reduction in PCV value in control cattle might be due to the haemo-dilution effect and reduction in cellular oxygen requirements, so as to minimize metabolic heat load (Lee & Philips 1948; Bond *et al.*, 1991).

Glucose

The overall average plasma glucose value of the cattle in T_0, T_1 and T_2 treatments were 64.96, 66.10 and 68.54 mg/dl, respectively (Table-1). The result suggested that there was a significant (P<0.05) difference in the glucose value among the treatment groups. Lower level of glucose during heat stress may be due to glucose oxidation (Collier *et al*., 2008). Decreased gluconeogenesis and glycogenolysis were observed in cows during heat stress (Itoh *et al*., 1998).

ALP, SGPT and SGOT: The overall average plasma ALP value of cattle in T_0, T_1, and T_2 treatments were 30.31, 18.34 and 15.54 IU/litre, while the overall average plasma SGPT value of cattle in T_0, T_1 and T_2 treatments were 96.24, 76.31 and 64.40 IU/litre, respectively, and overall average plasma SGOT value of cattle in T_0, T_1 and T_2 treatments were 101.14, 82.10 and 78.21 IU/litre, respectively. Statistical analysis revealed a significant (P<0.05) difference in plasma ALP, ALT and AST values between different control and different treatments with lower values in showered groups (T_1 and T_2), while there was no significant difference in the plasma ALP, SGPT and SGOT values between T_1 and T_2 groups. Table-1 showed that plasma ALP, ALT and AST values increased under heat stress, but the values were within normal range. Similar finding was also obtained by Nazifi *et. al.,* (1999), who reported that the activities of ALP, ALT and AST were higher in summer ($P<0.05$) than in winter in camels.

Conclusion

The present study suggested that water showering as a simple management practice for crossbred cattle during hot hours of summer season to combat the heat stress by keeping the changes in hematological and biochemical parameters to minimum.

Refrences

1. Bond, E. R., Cris, W. L., Davis, D. R., Brum, E. W. and Ludwick, T. M. 1991. Forage composition and growth and physiological characteristics of cattle grazing several varieties of tall fescues during summer conditions. *Journal of Clinical Pathology,* **58**: 72-76.
2. Collier, R. J., Collier, J. L., Rhoads R. P. and Baumgard, L. H. 2008. Genes involved in the bovine heat stress response. *Journal of Dairy Sci*ence, **91**: 445-454.
3. Itoh, F., Yobara, H., Rose, M. T. and Fuse, H. 1998. Heat Tolerance on Plasma and Glucagon in response to secretagogues in non lactating dairy cows. *Domestic Animal Endocrinology,* **15**(6): 499-510
4. Kumar, S., Kumar, A. and Kataria, M. 2010. Effect of heat stress in tropical livestock and different strategies for its amelioration. *Journal of Stress Physiology and Biochemistry*, **7**(1): 45-54.
5. Lee, D. H. K. and Philips, R. W. 1948. Assessment of the adaptability of livestock to climatic stress. *Journal of Animal Science,* **7**: 391-401.
6. Mudgal, V. D., Singhal, K. K. and Sharma, D.D. 2003. *Advances in dairy animal production*, pp 447-458. International Book Distribution & Co, Delhi, India.
7. Marai, I. F. M., Habeeb, A. A., Daader, A. H. and Yousef, H. M. 1995. Effects of Egyptian subtropical summer conditions and the heat stress alleviation technique of water spray and a diaphoretic on the growth and physiological functions of Friesian cows. *Journal of Arid Environment*, **30**(2): 219-225.
8. Nazifi, S., Gheisari, H. R. and Poorabbas, H. 1999. The influence of thermal stress on serum biochemical parameters of Dromedary camels and their correlation with thyroid activity. *Comparative Haematology International*, **9**: 49-54.
9. Oser, B. L. (eds.). 1965. *Practical Physiological Chemistry*. McGraw-Hall Book Company, New York.
10. Snedecor, G. W. and Cochran, W. G. 1994. *Statistical methods*. 8th edition. Oxford and IBH publishing Co, New Delhi, India.
11. Wiersma, F. and Armstrong, D. V. 1989. Microclimatic modification to improve milk production in hot arid climate. *Dairy Science Abstract*, **52**(6): 3848.

Fig-1. Micro-climatic variables during the experiment

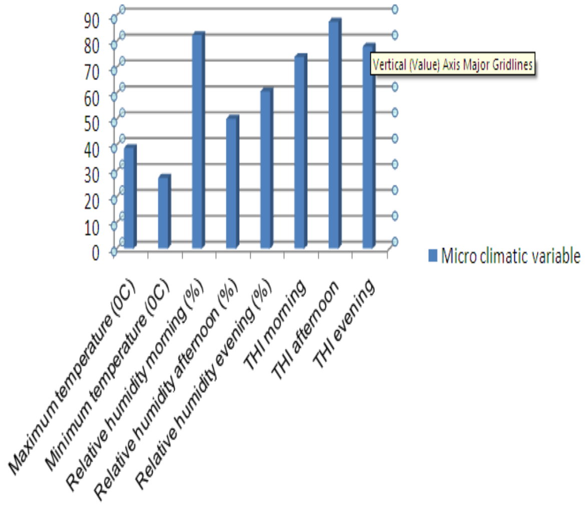

Table-1. Overall mean±S.E of hemato-biochemical parameters (mg/dl) of cattle under different treatments

Parameters	T_0	T_1	T_2
Haemoglobin, (g%)	8.60a±0.13	9.23b±0.13	9.31b±0.15
PCV (%)	30.02a±3.21	32.96b±2.41	33.45b±2.36
Blood glucose (mg/dl)	64.96a±1.06	66.10b±0.95	68.54b±0.80
ALP (IU/litre)	30.31a±3.32	18.34b±3.42	15.54b±2.32
SGPT (IU/litre)	96.24a ±6.24	76.31b ±7.52	64.40b±8.86
SGOT (IU/litre)	101.14a ±5.10	82.10b±4.16	78.21b±3.72

Means bearing different superscript (a, b, c) within a row differ significantly. Level of significance; * = $P<0.05$.

Micro-climatic variables	
Maximum temperature (^{0}C)	38.80
Minimum temperature (^{0}C)	27.33
Relative humidity morning (%)	82.49
Relative humidity afternoon (%)	50.16
Relative humidity evening (%)	60.73
THI morning	74.01
THI afternoon	87.60
THI evening	77.99