Journal of Animal Research: v.3 n.2 p.167-171. December, 2013

Comparative Study of Seasonal Variations on Hematological Profile in Sahiwal Cows (*Bos Indicus*) and Murrah Buffalo (*Bubalus Bubalis*)

Mehtab Singh Parmar[1]*, A.K. Madan[2], S.K. Rastogi[3] and Ruokuobeinuo Huozha[4]

[1]*Division of Physiology and Climatology, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh, INDIA*
[2]*Department of Physiology, College of Veterinary and Animal Husbandry, DUVAS, Mathura, Uttar Pradesh, INDIA*
[3]*Department of Physiology and Biochemistry, College of Veterinary Science and Animal Science, Pantnagar, Uttarakhand, INDIA*
[4]*Department of Physiology and Biochemistry, College of Veterinary Science and Animal Science, Pantnagar, Uttarakhand, INDIA*

**Corresponding Author: M S Parmar; Email: mehtab.parmar@gmail.com*

Received: 03 April 2013; Accepted: 28 September 2013

ABSTRACT

Six apparently healthy, non-lactating and non-pregnant Sahiwal cows and Murrah buffalo each above two years of age were selected to evaluate the effect of seasonal variations on hematological parameters. Blood samples were collected aseptically by jugular vein puncture during peak winter and peak summer seasons. The present investigation revealed the mean values of Hb, PCV, TEC, neutrophils, MCH, MCHC were significantly higher ($P<0.05$) in Murrah buffalo during summer season as compared to their winter season. On the other hand, in Sahiwal cows except PCV ($P<0.05$) other hematological parameters were found to be statistically non-significant ($P>0.05$). The neutrophils/lymphocyte ratio was significantly higher ($P<0.05$) during summer as against the winter season in case of Murrah buffalo, whereas no significant alternation was registered in case of Sahiwal cows. These findings suggested that Murrah buffalo are more prone to stress due to seasonal variations in comparison to Sahiwal cows.

Keywords: Hematology, Sahiwal cows, Murrah buffalo

Stress is a complex phenomenon that produces measurable effects on normal physiological equilibrium of animals. It is revealed by inability of animal to cope with its environment, a phenomenon that is often reflected in the failure to achieve genetic potential for production traits (Dobson and Smith, 2000). Stressors could be physical, chemical, physiological, psychological and environmental. Heat stress

is caused primarily by high air temperature which is further intensified by high humidity, thermal radiation and low air movement (Morrison, 1983). Blood examination is performed as a screening procedure to evaluate the general health (Peinado *et al*., 1999). Hematological values are used as indicators of stress. Physiological variations in the blood parameters is of great significance for clinical hematology and animal production as blood constituents are indicative of heat tolerance and environmental stress in cows and buffalo of tropical regions (Blincoe and Brody, 1951). Sahiwal is well known for its milking abilities. Due to their heat tolerance character and high milk production they are among most useful animals in India. On the other hand, Murrah buffalo is the finest genetic material of milk producing buffalo in the world. This breed has beaten the best dairy cows of the world in performance. Since, it has been known that a portion of the metabolizable energy used for production is diverted to assure thermal balance under uncomfortable environmental conditions, particularly beyond an animal's thermo-neutral zone. Therefore, under environmental stress, productivity is reduced. Heat and cold stress both affect the productivity in cows as well as in buffalo, but very little information is available about physiological response of these animals to extreme seasonal conditions. The present in vivo study attempts to compile the variation in hematological profile in Sahiwal cows and Murrah buffalo on exposure to different seasons.

MATERIALS AND METHODS

Present investigation was undertaken at Instructional Dairy Farm, Nagla of G.B. Pant University of Agriculture and Technology, Pantnagar. Six apparently healthy, non-lactating and non-pregnant Sahiwal cows and Murrah buffalo each above two years of age were selected for the study. These animals were under same managemental and nutritional regimen at the time of sampling. Blood samples were collected aseptically using anticoagulant ethylenediamine tetraacetic acid (EDTA) at a concentration of 1-2 mg/ml by jugular vein puncture under sterile conditions during peak winter (temperature range 6.7°C to 9.4°C, RH=91%, THI<72) and peak summer (temperature range 38.3°C to 41.5°C, RH= 63%, THI>72). The THI recorded on the day of sampling during winter season was 55.72 (W°C=10.2, D°C=10.8) and in summer was 88.1 (W°C=26.5, D°C=39.5). THI was calculated as per THI = 0.72(W°C+D°C) + 40.6 (Kadzere *et al*., 2002), where W°C and D°C are wet and dry bulb temperature. In order to reduce the variation associated with diurnal rhythms in blood, samples were taken from cows and buffalo at the same hours (8.00-10.00 AM). All tubes were placed immediately on ice and were transferred to the laboratory. Hemoglobin concentration was measured by Acid hematin method. The packed cell volume was determined using capillary method. The erythrocyte number (RBC) was counted in Neubauer's hemocytometer after diluting (1:200) the sample in Grower's fluid. Total leukocyte count (TLC) was determined by Neubauer's hemocytometer after diluting (1:20) the blood sample in Thomas's fluid. For Differential Leukocyte Count (DLC) the smears were fixed

with methanol and stained with Giemsa solution. Mean corpuscular volume (MCV=hematocrit x 10/ RBC), mean corpuscular hemoglobin (MCH=hemoglobin x 10/ RBC), Mean corpuscular volume (MCV=hematocrit x 10/ RBC), and mean corpuscular hemoglobin concentration (MCHC=hemoglobin x 100/ hematocrit) were calculated. The data are presented as mean ± standard error (SE) in SI units. The paired student "t" test was performed in graph prism version 5. The mean hematological parameters were compared between winter and summer season of Murrah buffalo and Sahiwal cows separately.

RESULTS AND DISCUSSION

Table 1: Comparisons of hematological values of Sahiwal cows and Murrah buffalo under two different seasons

	Sahiwal		Murrah	
Parameters	Winter	Summer	Winter	Summer
RBC($X10^6$cell/µl)	7.06±0.21	7.22±0.20	7.29±0.18[a]	7.85±0.25[b]
Hb (g/dl)	12.1±0.3	12.42±0.34	10.67±0.37[a]	13.13±0.33[b]
PCV (%)	31.5±4.46[x]	33.17±0.50[y]	30.8±0.72[a]	38.17±1.07[b]
MCV (fl)	44.8±1.81	46.19±1.65	42.43±1.25	48.94±2.08
MCH (pg)	17.14±0.42	17.31±0.72	14.67±0.57[a]	16.81±0.65[b]
MCHC (%)	38.45±1.08	37.56±1.32	34.53±0.41[a]	34.43±.21[b]
TWBC ($X10^3$cell/µl)	8.33±0.33	9.06±0.35	10.66±0.47	10.87±0.43
Neutrophil (%)	26±1.25	27.83±0.44	28.83±1.26[a]	32.50±1.10[b]
Lymphocyte (%)	66.83±0.98	64.67±0.81	61.0±0.82	58.50±1.15
Monocyte (%)	3.16±0.37	2.0±0.33	2.67±0.45	2.33±0.38
Eosinophil (%)	4.0±0.62	4.33±0.30	6.17±0.50	6.0±0.62
Basophil (%)	0.33±0.19	0.50±0.20	1.0±0.41	0.67±0.38
N/L ratio	0.39±0.02	0.43±0.01	0.47±0.03[a]	0.55±0.03[b]

RBC=red blood cell; Hb=hemoglobin concentration; PCV=packed cell volume; MCV=mean corpuscular volume; MCH=mean corpuscular hemoglobin; MCHC= mean corpuscular hemoglobin concentration; TWBC=total white blood cell count.Mean superscript a with b and x with y differ significantly (Pℜ0.05) from each other.

The cows and buffalo are homeotherms and have the ability to maintain their body temperature within a relatively narrow range and both physiological and behavioural responses help in thermoregulation. Under stressful conditions, physiological, biochemical and behavioral responses vary with respect to the animal's genetic make-up and environmental conditions. Seasons exert a negative impact on the productivity of the animal as a greater portion of energy is dissipated in maintaining homeostasis. This also results in altered hematological, biochemical as well as plasma hormone levels. The mean values of Hb, PCV, TEC, neutrophils, MCH, MCHC were significantly higher ($P<0.05$) in Murrah buffalo during summer season as compared to winter season. Statistically, there was no significant difference in mean values of TLC, lymphocytes, monocytes, esosinophils and MCV in response to

different seasonal variation in Murrah buffalo. However, the ratio of neutrophils to lymphocyte was significantly higher ($P<0.05$) during summer as against the winter season in buffalo. This neutrophils/lymphocyte ratio is indicator of thermal stress on animals (Stanger *et al*., 2005). As it is evident that increase in glucocorticoid secretion is one of the most common responses during stress. So stress-induced reductions in circulating lymphocyte numbers can be attributed to glucocorticoid-induced alterations in the redistribution of lymphocytes from the blood to other body compartments (Dhabhar, 2002). At the same time, glucocorticoids escalates an influx of neutrophils into the blood from bone marrow and also decreases migration of neutrophils from the blood to other compartments (Bishop *et al*., 1968). Our result clearly suggested that buffalo are more prone to heat stress during summer season. The buffalo are poor in heat tolerance abilities in comparison to other domestic ruminants (Moran, 1973) and are more prone to heat stress due to scarcely distributed sweat glands, dark body colour and sparse hair on body surface (Das *et al.*, 1999). In case of Sahiwal cows, mean PCV value was significantly high ($P<0.05$) during summer season than winter. There were no significant differences of mean values of Hb, PCV, TEC, TLC, neutrophils, lymphocytes, monocytes, basophiles, neutrophil to lymphocyte ratio, MCV, MCH and MCHC during winter and summer season in Sahiwal cows. Our findings are similar with the previous reports on cows by Koubkova (2002). No significant difference was observed in neutrophils/lymphocyte ratio in Sahiwal cows between their summer and winter season. This indicated that Sahiwal cows have better tolerance to heat and cold stress than Murrah buffalo. Murrah buffalo exhibit signs of great distress when exposed to direct solar radiation or when working in the sun during hot weather. This is due to the fact that buffalo bodies absorb a great deal of solar radiation because of their dark skin and sparse coat or hair, and in addition to that they possess a less efficient evaporative cooling system due to their rather poor sweating ability. The rise in hematological parameters in buffalo may be an adaptive physiological mechanism of body to produce more number of RBCs either due to spleenic contraction or increased erythropoisis with similar rise in hemoglobin/ cell. It may be because of the fact that blood vessels in the skin vasodilate during endurable hot weather in summer, primarily, to bring body heat to the skin for dissipation by radiation and convection (Bianca, 1968). Rise in hemoglobin and RBCs concentration may provide better opportunity to carry the heat from inner body towards the skin surface and to dissipate it off.

REFERENCES

Ashour, G. and Shafie, M.M. 1993. Water balance in Riverine buffaloes. I–Mobilization of body fluids under heat and dehydration stress. International symposium on Prospects of in buffalo production in the Mediterranean and the Middle East. EAAP Publication No **62**: 194–197

Bianca, W. 1968. Thermoregulation. In: Adaptation of Domestic animals. E Hafez, E.S.Ed. Lea and Febiger, Philadelphia, 97-118.

Bishop, C.R., Athens, J.W., Boggs, D.R., Warner, H.R., Cartwrig, Ge and Wintrobe, M.M. 1968. Leukokinetic Studies 13. A non-steady-state kinetic evaluation of mechanism of cortisone-induced granulocytosis. *Journal of Clinical Investigation*, **47**: 249–260.

Blincoe, C. and S. Brody. 1951. The influence of temperature on blood composition of cattle. *Research Bulletin of the Missouri Agricultural Experiment Station*. No. 488.

Das, S.K., Upadhyaya, R.C. and Madan, M.L. 1999. Heat stress in murrah buffalo calves. *Livestock Production Science*, **61**: 71-78.

Dhabhar, F.S. 2002. A hassle a day may keep the doctor away: stress and the augmentation of immune function. *Integrative and Comparative Biology*, **42**: 556–564.

Dobson, P. and Smith, R.F. 2000. What is stress and how does it affect reproduction. *Animal Reproduction Science*, **60**: 743-752.

Kadzere, C.T., Murphy, M.R, Silanikove, N. and Maltz, E. 2002. Heat stress in lactating dairy cows: a review. *Livestock Production Science*, **77**: 59-91.

Koubkova, M., Knizkova, I., Kunc, P., Hartlova, H., Flusser, J. and Dolezal, O. 2002. Influence of high environmental temperatures and evaporative cooling on some physiological, hematological and biochemical parameters in high-yielding dairy cows. *Czech Journal of Animal Science*, **47**: 309-318.

Lipid portion of lipopreotein; metabolic activities like gyconeogenesis, deamination of amino acids, and detoxification of noxious substances (Akiyoshi and Inoue, 2004).

Moran, J.B. 1973. Heat tolerance of Brahman cross, buffalo, bauteng and shorthorn steers during exposure to sun and as a result of exercise. *Australian Journal of Agricultural Research*, **24**:775-782

Morrison, S.R. 1983. Ruminants heat stress: effects on production and means of alleviation. *Journal of Animal Science*, **57**:1594-1600.

Peinado, V.I., Celdran, J.F. and Palomeque, J. 1999. Basic hematological values in some wild ruminants in captivity. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, **124**:199-203.

Stanger, K.J., Ketheesan, N., Parker, A.J, Coleman, C.J., Lazzaroni, S.M. and Fitzpatrick L.A. 2005. The effect of transportation on the immune status of *Bos indicus* steers. *Journal of Animal Science*, **83**:2632-2636.