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Effect of seasonal variations and different housing systems on physiological responses and hematological parameters of buffaloes

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ABSTRACT

An experiment was conducted to study the effect of 2 housing systems and seasonal variations on physiological responses and haematological parameters of buffaloes. Twelve buffaloes were selected and randomly divided into 2 equal groups. Animals of group A were housed in shade with net and animals of group B in shade without net. The experiment was conducted for 2 seasons i.e. monsoon and winter. The physiological responses were recorded weekly. Blood samples were aseptically collected fortnightly and were analyzed for hematological studies. All the parameters of physiological responses viz. respiration rate, rectal temperature, heart rate, and pulse rate were non significantly higher in group B as compared to group A in monsoon and winter seasons. Highly significant increase in mean values of Hb, TEC, TLC and PCV was observed in group A than the group B values in monsoon and winter seasons. Significantly higher values of lymphocytes and neutrophils was observed in group A during monsoon and non-significantly lower values in group B during winter season. Eosinophils and monocytes were non significantly higher in group B during monsoon and winter season as compared to group A. The temperature humidity index (THI) showed significantly lower in group A as compared to group B in both the seasons.

Key words: Buffaloes, Cattle, Haematological parameters, Housing systems, Physiological responses.

The climate of Marathwada region in wet monsoon (weeks 23 - 44, 4th June - 4th Nov.) period alternate with long rain free cold winter (weeks 45 - 9, 5th Nov.- 4th March). The (12–18°C) minimum temperature and (40–45°C) maximum temperature is observed during summer (weeks 10–22, 5th March - 3rd June). The temperature may be dropped in first week of June. About 80% cattle population of the world is affected by various arthropods, causing enormous economic losses. These losses are associated to bite causing mechanical injury, anemia and leading to loss of condition. Ectoparasites such as ticks, lice and flies not only keep animals restless but also transmit blood protozoa causing diseases like trypanosomiasis, babesiasis, theileriasis and anaplasmosis (Raut *et al.* 2008). To protect buffaloes from infestation of pests, a new housing system covered with net is emerging. Weather this system will affect on physiological study was undertaken and results are reported. Most of the ectoparasites causes harm to the animals in monsoon and winter seasons, therefore, only 2 seasons are taken into consideration in the present study, to know the effect of net shade on hematological and physiological responses.

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MATERIALS AND METHODS

The trial was conducted during monsoon and winter season in the year 2013 on 12 adult she buffaloes maintained at Buffalo Breeding Farm, College of Veterinary and Animal Sciences, Parbhani. The animals were divided into 2 equal groups viz. Group A and Group B. The buffaloes reared in net shade (is a concept that shade is totally covered with 40 mm mesh to protect animals from bites of flies and is provided with a hurricane type of ventilator) were designated as group A and buffaloes reared in shade without net (conventional shade uncovered with net and not provided with hurricane ventilator) were designated as group B. All the buffaloes selected in this study were apparently healthy and free of any parasitic infestations and other disease conditions. The physiological responses viz. respiration rate, rectal temperature, heart rate, and pulse rate were recorded weekly as per the procedures suggested by Kelly (1984).

Blood samples were collected between 07:00 to 08:00 hours at fortnightly intervals from both the groups by passing 18 gauge hypodermic needle in jugular vein, 3 to 4 ml of blood was collected in a vial containing EDTA for

haematological parameters such as Hb, TEC, TLC, PCV and DLC by using haematology analyzer.

Management and feeding of animals: The animals of both the groups were let loosed for grazing between 8 AM to 4 PM and then they were stall-fed as per the schedule for the rest of period of a day (24 h). The feed composed of concentrate mixture, green and *jowar*, *kadbi* as per their maintenance and production requirement. The animals of both the groups were having free access to drinking water. They were vaccinated against haemorrhagic septicemia, black quarter and rinderpest, and were also dewormed regularly. Animals of both the groups were treated with same food, water and other managemental practices except difference in shed used for their maintenance.

Meteorological observation: Dry and wet bulb temperatures were recorded daily at 07:30 AM and 02:30 PM in the shade with net and shade without net. The temperature humidity index was calculated by using the formula of McDowell (1972).

$$THI = 0.72 (DBT + WBT) + 40.6$$

Analysis of data was carried out by using standard statistical procedure and interpretations by applying student 't' test (Snedecor and Cochran 1967).

RESULTS AND DISCUSSION

The values of physiological responses for buffaloes in 2 different housing systems are presented in Table 1. In the present study, all the parameters of physiological responses differ non significantly, the rectal temperature was non significantly higher in group B as compared to group A in monsoon and in winter season. However, there was a slight rise in rectal temperature at afternoon, which might be due to feed intake and higher environmental temperature at afternoon time, which increased the rectal temperature of buffalo, which is similar to the findings reported by Rahman and Nagpaul (2013). Temperature is not the only environmental factor that affects the intensity of heat stress. The temperature humidity index (THI) measures the combined effects of ambient temperature and relative humidity (RH) to ascertain heat load intensity. The pulse rate was found to be nonsignificantly higher in group B in both the seasons as compared to group A, which is comparable to the findings reported by Pennisi *et al.* (2010). They further stated that effect of time is most important while taking observations, the pulse rate increases as the temperature increases significantly. The respiration rate was non-significantly lower in group A in monsoon and winter as compared to group B, which supports the findings of Rahman and Nagpaul (2013) stated respiration rate was significantly affected by shelter type during both morning and afternoon times. They observed higher respiration rate in goat during afternoon time than morning time in both groups. The heart rate was also higher in group B in monsoon and winter. Gangwar *et al.* (1988) reported that the environmental temperature has significant relation with variation in heart rate. These findings are similar to the present study. Temperature is not the only environmental factor that affects the intensity of heat stress. The temperature humidity index (THI) measures the combined effects of ambient temperature and relative humidity (RH) to ascertain heat load intensity (Berry *et al*. 1964).

It is observed from Table 2 that, the mean value of hemoglobin concentration, total erythrocyte count, packed cell volume and total leucocytes count was significantly higher in group A in monsoon and winter season, as compared to group B. Abdelatif *et al*. (2009) also found higher values in winter as compared to the other seasons of the year, they further stated that it might be due to depression of thyroid secretion which is associated with decreased erythropoiesis, which supports the findings of present investigations. An increasing trend is seen in the present study of Hb, TEC, TLC and PCV in group A in winter as compared to monsoon in group B, which is similar to the findings reported by Jabbar *et al.* (2012). They further stated that, season of the year or age of buffalo heifers had no effect on hemoglobin concentration. The season caused the significant difference in the values of leukocytes. Lower total leukocyte count was observed in autumn, while higher count was found during spring. Lower Hb, TEC and marked leucocytosis are might be due to anemia because of blood sucking ability of parasites and hemorrhage. Lymphocyte and neutrophil count was significantly higher in group A

Table 1. Effect of 2 housing systems and seasonal changes on physiological responses in buffaloes

Parameters	Monsoon				Winter			
	Group A		Group B		Group A		Group B	
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
Rectal Temperature (^{0}F)	99.83±0.15	100.13±0.36	99.92±0.44	100.56±0.16	99.04±0.95	100.05±0.45	100.44±0.56	100.83±49
Pulse rate (per min)	53.42±1.12	54.14±0.99	53.33±0.61	54.18±0.59	52.13±0.80	52.73±0.66	50.23±1.24	51.51±1.08
Respiration rate (per min)	23.65±0.33	24.01±0.23	23.15±1.08	23.49±1.27	21.58±0.42	22.01±0.33	20.63±0.8	22.80±0.70
Heart rate (per min)	53.89±0.26	54.11±0.22	53.85±1.85	54.03±0.95	53.34±1.08	53.45±0.32	51.58±1.56	52.68±1.24

Table 2. Effect of 2 housing systems and seasonal changes on haematological parameters in buffaloes

Parameters	Monsoon		Winter	
	Group A	Group B	Group A	Group B
Haemoglobin gm%	12.8±0.16**	9.52±0. 78	13.10±0.1**	9.40±0.67
TEC (10^6/cmm)	6.40±0.32*	5.80±0.55	7.23±0.19**	5.98±1.37
TLC(10^3/cmm)	12.68±.55**	10.42±1.05	13.14±0.64*	11.13±1.29
PCV %	36.13±.23**	32.53±0.89	38.26±1.23**	28.05±1.16
Lymphocyte (%)	57.62±0.44	61.37±0.56**	55.23±0.61	$55.56±0.66^{NS}$
Neutrophil (%)	37.12±0.76**	32.95±0.39	40.99±0.95	$39.96±0.41^{NS}$
Eosinophil (%)	2.5±0.72	$3.02±0.86^{NS}$	2.32±0.44	$3.19±0.16^{NS}$
Monocyte (%)	2.16±0.45	$2.47±1.26^{NS}$	1.69±2.15	$2.03±0.25^{NS}$

*P<0.05; **P<0.01; NS, non-significant.

Table 3. Meteorological observations of the two housing systems in different seasons**.**

Monsoon				Winter			
Group A		Group B		Group A		Group B	
THI of Morning	THI of Afternoon	THI of Morning	THI of Afternoon	THI of Morning	THI of Afternoon	THI of Morning	THI of Afternoon
67.90±0.45	73.34±0.56*	60.08±0.05	77.41±0.26**	65.12±0.49	74.038±1.16**	66.56±0.92	80.08±1.52**

** P<0.01 and *P<0.05.

during monsoon and non-significantly lower in group B during winter. The average mean values of the present study were in agreement with Serdaru *et al.* (2011). They studied on seasonal variation of some hematological parameters of the buffaloes during winter period. It is noticed that the neutrophil count was not affected by temperature throughout study in both the groups. Eosinophil and monocyte count in Group B was non-significantly higher in monsoon and winter seasons as compared to group B. The increasing trend of temperature does not affect the eosinophil count in the present study. Increased eosinophil count may suggest the increased infestation and biting of pests to these animals. The higher values in group B might be due to cortisol secretion (Abdelatif *et al*. 2009). They further stated that monocytes respond to elevation in blood corticosteroid concentration, but species differences are seen with the type of response and mechanism of monocytosis which occurs in some species is not known. No basophils were observed in present study. However, all the average mean values were within normal physiological limits (Schalm's *et al*. 2000).

Meteorological data: Meteorological variables are presented in Table 3. Temperature humidity index (THI) has been widely used as a heat stress index in buffaloes with values below 72 considered to be comfortable, 72–78 as mild, 78–88 as moderate and above 88 as extremely stressful (Bouraoui *et al.* 2002). It is observed that THI of group A was 67.90±0.45 and 73.34±0.56 at morning and afternoon respectively. Whereas, 60.08±0.05 and 77.41±0.26 of group B at morning and afternoon, respectively during monsoon season. However, during winter season, the THI of group A was 65.12±0.49 and 74.038±1.16, at morning and afternoon, respectively, whereas, 66.56±0.92 and 80.08±1.5 of group B at morning and afternoon, respectively. THI at morning of group A indicated that shed with net house was in normal physiological range which did not exhibit any discomfort to animals. While group B showed mild stress during winter season, which might be due to shifting of winter to summer season.

The estimation of haematological parameters and THI in 2 sheds (A and B) showed marginal variation, indicating that netting of the shade does not adversely affect these parameters during monsoon and winter season. Further, THI calculated in net shade was in the normal comfortable zone i.e. below 72, which indicated the comfort to the animals in both the seasons throughout experimental period. The shade without net showed mild stress to the animals but did not affect significantly on physiological responses. Certain haematological parameters are significantly higher in shade with net, which indicates that the shade with net can protect the animals from infestation of pests/ ectoparasites and infections which may cause harm to the animals.

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