Short Communication

EFFECT OF DIFFERENT HEAT AMELIORATING MEASURES ON PHYSIOLOGICAL RESPONSES OF MURRAH BUFFALOES DURING SUMMER IN THE CAUVERY DELTA REGION OF TAMIL NADU

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ABSTRACT

A study was conducted in Murrah buffaloes belonging to Livestock Farm Complex of Veterinary College and Research Institute, Orathanadu, located in cauvery delta region to document the effect of heat ameliorative measures on physiological responses during summer. Twenty four buffaloes were selected and divided into four treatment groups of 6 animals per group. All the animals were maintained under standard managemental conditions with wallowing facility. The treatment group (T_1) was control, animals in T_2 were provided with cooling jacket, animals in T_3 were supplemented with probiotics (*Saccharomyces cerevisiae*) and T_4 animals received probiotics (*Saccharomyces cerevisiae*) and were provided cooling jacket. Physiological parameters *viz.,* respiratory rate, pulse rate and rectal temperature were recorded during the summer season (March 2022 to May 2022) at weekly intervals in animals of all the treatment groups. Measurements were made when animals were at rest and after the exposure to sun light at 9 am and 2 pm respectively. From results it was concluded that the heat ameliorative measures given to the different groups of animals decreased the respiratory rate, pulse rate and rectal temperature during summer.

Key words: Heat stress, rectal temperature, respiratory rate.

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INTRODUCTION

Climate change associated heat stress was established to be the crucial factor, which negatively influences animal production. Animals have a number of adaptations that help them to survive in harsh environments, but doing so compromises their ability to perform in a productive manner. Physiological adaptability was thought to be one of the fundamental processes by which heat stressed animals survive the heat stress among the

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several mechanisms that serve to maintain homeostasis in animals.

The five fundamental physiological factors that help the stressed animals to maintain their homeostasis and thermal balance are respiration rate, pulse rate, rectal temperature, sweating rate and skin temperature. The intensity of heat stress in animals can therefore be efficiently determined using these characteristics.

Heat stress can harm animals' health, meat production, reproductive effectiveness, milk yield and its quality (Shaji *et al*., 2016). Environmental temperature appears to play a significant impact among all the meteorological variables in adversely affecting animal's production and reproduction performance (Reynolds *et al.,* 2010).

Physiological responses of heat ameliorative measures like wallowing, splashing of water, supplementation of yeast culture reduce the physiological responses (Aggarwal and Singh (2010), Das *et al.* (2011), Rahangdale *et al.* (2011), Das *et al.* (2014) and Kumar *et al.* (2018)). Although a large genetic diversity was found in these response mechanisms, these characteristics are still thought to be important in determining the impact of heat stress in animals.

Additionally, differences in physiological adaptation between native, mixed-breed, and pure-bred animals were noticed. It was predicted that native cattle breeds would have less physiological variability than their imported counterparts. These discussions clearly highlight the value of thoroughly examining the physiological mechanisms of adaptation in various farm animals, and these efforts can assist the farming community in identifying the most suitable livestock breeds for particular agroclimatic zones, which can go a long way toward ensuring climate-resilient livestock production.

Hence the present study was undertaken to document the effect of heat ameliorative measures on physiological responses during summer in the cauvery delta region.

MATERIALS AND METHODS

For the study, 24 buffaloes were selected and divided into four treatment groups of 6 animals in each group. The treatment group one (T_1) was acted as a control, whereas group two (T_2) were provided with cooling jacket, group three group three (T_3) were supplemented with probiotics (*Saccharomyces cerevisiae*) and group four (T_4) animals received supplements with probiotics (*Saccharomyces cerevisiae*) and cooling jacket. During the study period, all the experimental animals were fed with concentrate feed and roughage (CoFS 29 and paddy straw) according to their physiological stage. The animals in treatment group three (T_3) and four (T_4) were provided with extra feed supplement (*Saccharomyces cerevisiae)* mixed with concentrate feed and heat amelioration measures as listed in the experimental design below.

EXPERIMENTAL DESIGN

Treatment	Number of animals	Details of experiment
T_1	Six	Control group – Wallowing and fogging (2 hours period) only
T_2	Six	Wallowing and fogging (2 hours period) + cooling jackets (Body patches).
T_3	Six	Wallowing and fogging (2 hours period) + supplementation of probiotics (*Saccharomyces cerevisiae*– dry yeast @ 2.5 g per animal per day) (Maamouri *et al.,* 2014).
T_4	Six	Wallowing and fogging (2 hours period) + supplementation of probiotics (*Saccharomyces cerevisiae*- dry yeast @ 2.5 g per animal per day)+ cooling jackets (Body patches) (Verma *et al.,* 2016)

Physiological responses of the animals viz., rectal temperature, respiratory rate and pulse rate in all four treatment groups were recorded at weekly intervals in the morning at 9 am when the animals in rest and in the afternoon at 2 pm after exposure to sunlight. Temperature was measured using digital thermometer (OMRON) placed in contact with rectal mucosa for 2 min. Pulse rate was recorded from the coccygeal arteries manually for 1 min. Respiratory rate was measured by silently observing the movement of the thoraco abdominal region for each animal included in the study at particular time and date.

The data obtained on four treatment groups were statistically analyzed using the methods proposed by Snedecor and Cochran (1994). The experimental data were statistically analyzed with IBM SPSS Statistics Version 25.0 using the statistical tool one-way analysis of variance (ANOVA) with the General Linear Model Univariate Procedure.

RESULTS AND DISCUSSION

The physiological responses of Murrah buffaloes in different treatment groups is presented in Table 1. The statistical data of rectal temperature, respiratory rate and pulse rate of animals in different treatment groups were found to be highly significant ($P<0.01$) when compared to control. The reduced physiological responses viz., rectal temperature, respiratory rate and pulse rate with probiotic supplementation might be attributed to the fact that yeast culture improved the ruminal fermentation, digestibility, feed efficiency and minimised the heat stress. Moreover, a change in the microenvironment was due to cooling jacket.

Table 1. Physiological responses (Mean ± SE) of Murrah buffalo in different treatment groups (n= 72)

Physiological Parameters	Time	Control – T_1	T_2	T_3	T_4	Overall	F Value	P value
Rectal temperature (°C)	Morning	38.08 ± 0.94^a	37.50 ± 0.80^b	37.31 ± 0.10^b	37.01 ± 0.09^c	37.48 ± 0.05	25.139**	0.000
	Evening	38.40 ± 0.08^a	37.72 ± 0.88^b	37.43 ± 0.10^c	37.30 ± 0.10^c	37.71 ± 0.05	27.370**	0.000
Pulse rate (beats per min)	Morning	52.43 ± 0.32^a	48.58 ± 0.35^b	48.67 ± 0.36^b	47.36 ± 0.38^c	49.26 ± 0.21	38.226**	0.000
	Evening	53.56 ± 0.23^a	49.61 ± 0.33^b	49.85 ± 0.34^b	47.93 ± 0.35^c	50.23 ± 0.20	55.761**	0.000
Respiration rate (breaths per min)	Morning	22.01 ± 0.2^a	18.72 ± 0.26^b	18.43 ± 0.2^b	17.76 ± 0.16^c	19.23 ± 0.14	76.970**	0.000
	Evening	23.14 ± 0.18^a	19.85 ± 0.29^b	19.50 ± 0.22^{bc}	18.89 ± 0.19^c	20.34 ± 0.15	71.286**	0.000

** Highly significant; * Significant

The Mean values with different superscript in the same row (a, b, c and d) differ significantly (P<0.01)

Diurnal variation of physiological responses of Murrah buffalo was recorded before and after exposure of animals to sunlight in different treatment groups (n = 72) and is presented in the Table 2. The data revealed that the rectal temperature of T_3 animals had no significant difference, T_2 and T_4 group animals had significant difference (P<0.05) and control group (T_1) animals had highly significant (P<0.01) diurnal variation. Pulse rate of animals in T_4 group had significant difference (P<0.05), and pulse rate of animals in (T_1), (T_2) and (T_3) differed in a highly significant (P<0.01) manner.

The findings of the present study using heat ameliorative measures of supplementing yeast culture, providing cooling jacket and combining both was in accordance with the findings of Aggarwal and Singh (2010), Das *et al*. (2011), Rahangdale *et al*. (2011), Das *et al*. (2014) and Kumar *et al*. (2018). RR was found to be the major physiological heat stress indicator in the animals. Results of reduced RR observed in treatment groups T_2, T_3 and T_4 when compared to control group was found to be similar with that reported by Singh *et al*. (2014) and Mohanarao *et al*. (2014).

Table 2. Diurnal variation of physiological responses of Murrah buffalo recorded before and after exposure of animals to sunlight in different treatment groups (n = 72)

Physiological responses	Treatment	Time	Mean ± SE	T	Sig. (2-tailed)
Rectal temperature (°C)	**Control – T_1**	Morning	38.08 ± 0.94	-3.672**	0.000
		Evening	38.40 ± 0.08		
	T_2	Morning	37.50 ± 0.80	-2.033*	0.046
		Evening	37.72 ± 0.88		
	T_3	Morning	37.31 ± 0.10	-1.121	0.266
		Evening	37.43 ± 0.10		
	T_4	Morning	37.01 ± 0.09	-2.404*	0.019
		Evening	37.30 ± 0.10		
Pulse rate (beats per min)	**Control – T_1**	Morning	52.43 ± 0.32	-3.853**	0.000
		Evening	53.56 ± 0.23		
	T_2	Morning	48.58 ± 0.35	-3.577**	0.001
		Evening	49.61 ± 0.33		
	T_3	Morning	48.67 ± 0.36	-4.985**	0.000
		Evening	49.85 ± 0.34		
	T_4	Morning	47.36 ± 0.38	-2.270*	0.026
		Evening	47.93 ± 0.35		
Respiration rate (breaths per min)	**Control – T_1**	Morning	22.01 ± 0.21	-22.460**	0.000
		Evening	23.14 ± 0.18		
	T_2	Morning	18.72 ± 0.26	-27.937**	0.000
		Evening	19.85 ± 0.29		
	T_3	Morning	18.43 ± 0.21	-17.397**	0.000
		Evening	19.50 ± 0.22		
	T_4	Morning	17.76 ± 0.16	-26.683**	0.000
		Evening	18.89 ± 0.19		

** Highly significant; * Significant

CONCLUSION

From the present study it was concluded that heat ameliorative measures like yeast culture supplementation, providing cooling jackets and combined effect of both (yeast culture and cooling jacket) was found to be effective in reducing the heat stress and also physiological parameters like RR, RT and PR. Combined measures as in group (T_4) showed better responses in reducing heat stress and also the physiological parameters.

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