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EFFECT OF CERTAIN SUMMER MANAGEMENT PRACTICES ON CORTISOL AND PHYSIOLOGICAL RESPONSE OF CROSSBRED CALVES

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ABSTRACT
The presented study on certain summer management practices on performance on crossbred calves. To estimated heat stress in crossbred calves during the summer seasons at livestock research station Anand, Anand agricultural university. During experiment, 18 crossbred calves were divided into two groups: control (T1) and white painted roof with applied fogger (T2). The Meteorological data were recorded at 7:30 a.m. (morning), 2:30 p.m. (afternoon) and 7:30 p.m. (evening). Microclimate includes ambient temperatures, Relative humidity, air flow and light intensity. The found that ambient temperature at 2:30 p.m. was significantly lower in T2 Group as compared to control group. Relative humidity at 2:30 p.m. was significantly higher in T2 group as compared toT1 group. The average cortisol level of T1 and T2 group was 9.97 ± 1.285 and 8.43 ±0.389. Cortisol level and physiological responses found significantly lower in T2 group as compared to control group.

KEYWORD: Heat stress, Cortisol, Physiological, Fogger, summer.

INTRODUCTION
Heat stress is widely recognized as a stressful condition that affects hormonal responses of an animal. Animal responses to thermal challenges vary among different species. In dairy calves older than 3 weeks, the thermo-neutral zone is about 5–20°C, but this also varies among individual animals. In the temperature above the neutral zone, homeotherms maintain their body temperature within a relatively narrow range and both physiological and behavioral responses help in thermoregulation (Sanker *et al*., 2012). At temperatures above the Upper Critical Temperature, cattle sweat in an attempt to dispel the excess heat and the animal becomes heat stressed, which can lead to death of the animal. As cattle sweat at only 10% of the human rate, they are much more susceptible to heat stress (Leonel, 2012). Calves with elevated body temperature exhibit lower feed intake, high water intake and growth with less efficiency (Kendall *et al*., 2006), thus reducing profitability for dairy farms in hot, humid climates. For protection from direct solar radiation in open paddocks, different shade materials are used in mangers. The type of roof material generally decides the microclimate under the covered area (Kamal *et al*., 2014). The stress of high environmental temperatures may be severe enough that unless physiological changes are initiated, decreased productivity or death can occur. While animals do acclimatize by gradually adapting to such stressors within their natural environment (Kendall *et al*., 2006) the level of adaptation is not well documented in most situations.
The plasma cortisol level increases during acute heat stress and decreases during the chronic phase. The increase of plasma cortisol level during acute heat stress is attributed to the fact that glucocorticoid hormones have hyperglycemic action through the gluconeogenesis process, thus enhancing glucose formation in heat stressed animals (Abily *et al*., 1975). In this context, the objective of this study was to evaluate the effect of ambient temperature during summer seasons on cortisol and physiological responses, in crossbred calves under cooling condition

MATERIALS & METHODS
The present study was conducted at Livestock Research Station, Anand Agricultural University, Anand during hot dry period of summer Gujrat, India. The ambient temperature reaches highest 45°C in summer. To find out the effect of heat stress alleviation in crossbred calves during hot humid summer seasons, 18crossbred calves selected from LRS and were uniformly divided into 2 groups *i.e*. 9 in each based on their body weight and age. One group was considered as treatment (T2) and another as control (T1). In treatment (T2) Fogger with white painted roof improved quick dissipation of heat from animal's body through evaporative cooling. Increased frequency of feeding and that too in cooler part of the day and feed intake and distributed heat production throughout. Both experimental group animals were fed individually. The concentrate mixture, hybrid Napier and juwar straw was offered on basis of DCP and TDN to all experimental calves. The average ambient temperature within shed of T1 and T2 group were 36.66°C, and 35.01°C at 2:30 PM respectively, and 38°C, The average temperature humidity indexes (THI) of T1 and T2 group animal shed were recorded to be 84.11 and 83.12 2 PM, respectively.
Physiological responses: rectal temperature. The physiological responses *viz*., rectal temperature, heart rate and respiration rate of all the experimental animals were recorded by using doctor's thermometer, stethoscope and

hand method respectively (per minute) three days in a week in morning at 07:30 a.m., afternoon at 02.30p.m. and evening at 7:30p.m. during whole period of experimentation.

Blood collection and sampling*:* After proper restraining and humane handling, blood was collected from jugular vein. Blood was collected into 10 ml serum coagulated activator vacutainer tube containing active coagulant. Fortnightly collected samples during experiment period particularly when ambient temperature exceeded at afternoon were collected for analysis of serum cortisol level, Samples from both groups were collected between 2:30p.m. Average interval between 2 samplings was about 15 days from the beginning to the end of experiments. RIA cortisol kits were used to estimate serum cortisol

Statistical analysis

All data of control (T1) and treatment (T2) group during summer seasons are reported as means ±SEM. Data were analyzed by the method of analysis of two factorial completely randomized design procedures on analysis of variance The differences between treatment means were considered to be significant when P<0.05.

RESULTS AND DISCUSSION

Cortisol level

The serum cortisol concentrations of control and treatment group under hot dry seasons are presented in Table 1 Serum cortisol concentrations were significantly higher in control group calves than that in treatment group. The statistically significant difference between 2 groups was recorded. The blood samples were taken for hormone estimation in the afternoon hours when the microclimate was not comfortable. Acute stressors activates hypothalamus pituitary- adrenal axis, resulting in increased cortisol levels and involved in adaptation to short and long term heat stress (Beraidinell *et al.* 1992). During present study, the mean levels of cortisol were higher at higher temperature during summer. The overall mean values of cortisol of crossbred calves were 9.97± 1.285 and 8.43 ±0.389 *ng/ml*, in T1 and T2 groups, respectively.

TABLE 1. Serum cortisol concentration level of experimental animal

Parameter	Control (T_1)	Treatment (T_2)	Average	Test
Initial Cortisol Level(ng/ml)	$7.20^b \pm 0.953$	$9.61^a \pm 0.704$	8.41 ± 1.207	*
Overall Cortisol Level (ng/ml)	$9.97^a \pm 1.285$	$8.43^b \pm 0.389$	9.20 ± 0.678	*
CD value (5%)	1.290		3.649	

[a,b] Means within a row with different superscripts differ (P < 0.05)

Abily *et al.* (1975) observed that cortisol level decreased during prolonged heat exposure after a temporary increase at the beginning of heat stress. Decline in cortisol in heat stressed lactating buffaloes during July might be responsible for decline in milk components Haeeb *et al.* (2014) concluded that plasma cortisol level increases during acute heat stress and decreases during chronic phase. The former is attributed to the fact that glucocorticoid hormones have hyperglycemic action through the gluconeogenesis process resulting in more glucose formation in heat stressed animals. Whereas, the latter is attributed to the fact that cortisol is thermogenic in animals and the reduction of adrenocortical activity under thermal stress is a thermoregulatory protective mechanism preventing a rise in metabolic heat production in hot environment.

Similar finding was also reported in cow by Titto, *et al*. (2013) and DAS *et al.* (2014). Habeeb, *et al*. (2014) also found that Cortisol was significantly higher (P < 0.05) during summer by 31.74 and 27.30 % than those in winter in purebred and crossbred calves, respectively. Kamal *et al.,* (2015) presented that the cortisol level was significantly higher in control group than cooling modification groups in hot seasons, the overall THI at 2:00 PM was 80.72 ± 0.29, 79.68 ± 0.35, 82.86 ± 0.33 and 82.68 ±0.44, respectively. Over all initial cortisol level was 12.61 ± 0.67, 12.65 ± 0.77, 12.03 ±1.21 and 12.37 ± 0.92 and after 14 days 9.82 ±1.55, 7.39 ±0.75, 10.40 ± 1.04 and 9.70 ±1.11 in T1, T2, T3 and T4 respectively.

Physiological responses

Physiological responses presented in table 2 for treatment group and control group. The rectal temperature and respiration rate in the morning at 7:30 a.m., afternoon at 2:30 p.m. and evening at 7:30p.m. was significantly (P<0.05) low in T_2 (treatment) as compared to T_1(control). The lower respiration rate in fogger with white painted roof to lower ambient temperature prevailed as compared control group in which both environmental temperature and temperature humidity index were higher. The respiratory process helps the animals to get rid of heat load of body by increased pulmonary evaporative loss and such loss had been. The heart rate at 2:30p.m. found significance difference in treatment group as compared to control group. similar finding of present study in The results of the present study are in line with the findings of Mitlohner *et al.* (2001, 2002), Kendall *et al.* (2007), Marcillac – Embertson *et al.* (2009), Schutz *et al.* (2011), Das *et al.*(2014), Singh *et al.* (2014), Seerapu *et al* (2015) and Yadav *et al.* (2016) who reported that rectal temperature and respiration arte was significantly (P<0.05) higher in calves kept under the control compared to the calves kept under cooling modifications. Kamal *et al.* (2014) similarly found that the respiration rate was significantly higher (P<0.05) in control group in morning and afternoon as compared to treatments group.

TABLE 2. Physiological responses of experimental animal

Parameters	Duration	Control (T_1)	Treatments (T_2)	Cd $_{0.05}$
Rectal temperature (°F)	7:30 a.m.(Morning)	$101.0^a \pm 0.084$	$100.8^b \pm 0.090$	0.096 *
	2:30 p.m. (Afternoon)	$101.9^b \pm 0.157$	$101.3^a \pm 0.113$	0.069 *
	7:30 p.m. (Evening)	$101.2^a \pm 0.142$	$100.9^b \pm 0.118$	0.094 *
Respiration rate (breath/min)	7:30 a.m.(Morning)	$32^b \pm 0.968$	$30^a \pm 1.087$	0.634 *
	2:30 p.m. (Afternoon)	$42^a \pm 0.997$	$36^b \pm 2.179$	0.635 *
	7:30 p.m. (Evening)	$35^a \pm 0.956$	$33^b \pm 0.796$	0.679 *
Heart rate (beats/min)	7:30 a.m.(Morning)	83 ± 1.756	82 ± 2.479	NS
	2:30 p.m. (afternoon)	$96^a \pm 1.363$	$93^b \pm 1.742$	1.234 *
	7:30 p.m. (Evening)	94 ± 3.005	93 ± 1.765	NS

[a,b] Means within a row with different superscripts differ ($P < 0.05$)

CONCLUSION

Heat stress of crossbred calves can be alleviated by using fogger and white painted roof. The degree of improvement varies with the type of system provided, climate, and comfort level calves. Lower serum cortisol level and physiological responses as compared to calves of control group**.**

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