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## Effect of microclimate alteration devices and feed additive on stress hormones in Murrah buffaloes

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### Abstract

The present study was carried out on twenty four lactating Murrah buffaloes housed in four different groups (six in each group) viz. foggers (T1), fans (T2), fans and feed additive (T3) and control group (C) in LRS, Mamnoon. The stress hormones estimated by the influence of microclimatic alteration devices and feed additive on Murrah buffaloes were Triiodothyronine (T3), Thyroxin (T4) and Cortisol. The serum total T3 levels were higher in C group followed by T3, T2 and T1 groups while total T4 levels were higher in C group followed by T2, T1 and T3 groups. The serum cortisol levels were higher in C group followed by T2, T3 and least in T1 group of Murrah buffaloes.

**Keywords:** buffaloes, cortisol, fans, feed additive, foggers, triiodothyronine, thyroxin

### 1. Introduction

Global warming has been increasing and to this changing climate, homeotherms generally adapt compensatory (thermoregulatory) mechanisms directed at maintaining or restoring thermal balance (West, 1999) [24] and this adaptability results in changes in physiological, haematological, biochemical, hormonal, behavioural, production and reproduction aspects. Heat is lost from the body by radiation, conduction, convection, evaporation of water from skin and respiratory passages and excretion of faeces and urine. Respiratory cooling and evaporation from body surface are negatively correlated with the temperature and relative humidity in the air. Buffaloes are more prone to heat stress because of poor heat tolerance capacity when compared to other domestic ruminants (Moran, 1973) [12] due to scarcely distributed sweat glands, dark body colour and sparse hair on body surface which reduce the capacity of cutaneous evaporation.

Heat stress led to decreased thyroid activity in various species (Dwaraknath *et al.* 1984, Habeeb *et al.* 2000 and Rasooli *et al.* 2004) [5, 8, 17]. Longterm heat stress resulted in reduced serum cortisol in cattle (Rhynes and Ewing, 1973 and Dantzer and Mormede, 1983) [18, 4] while acute heat exposure to buffalo calves and Friesian calves induced significant increase in plasma cortisol concentration (Nessim 2004 and Habeeb *et al.* 2001) [14, 7], respectively.

### 2. Materials and Methods

A study was conducted for estimation of stress hormones under the effect of microclimatic alteration devices and feed additive in twenty four lactating Murrah buffaloes available at Livestock Research Station, Mamnoon, Warangal district, Telangana. The average temperature ranges from 15-46°C. All the buffaloes were maintained under standard feeding and managerial conditions. The buffaloes were housed in four different groups (six in each group) viz. foggers (T1) operated from 12.00 noon to 3.00 pm, fans (T2), fans and feed additive in the form of Chromium supplement and yeast culture as an anti-stress agent @ 500g/tonne of feed (T3) and control group of buffaloes were housed under loose housing system (C). Feeding and vaccination were accordingly with the farm schedule.

For estimation of stress hormones i.e. T3, T4 and Cortisol, blood samples (5 ml) were collected from the jugular vein of the experimental animals, randomly into a clean, dry, sterilized test tube without adding anti-coagulant prior to the morning feeding, during the study period. Serum was separated by centrifugation at 2000 xg for 15 min. and stored at -20°C till use. These were analyzed for T3, T4 using CLISA kits (Cat # 9001-16 and Cat # 9003-16, respectively), DIAGNOSTIC AUTOMATION, INC. and serum cortisol hormone was analysed using AccuDiag™ Cortisol ELISA Kit (Cat# 6101-15). The data was analyzed

by using completely Randomized Design (CRD).

additive in response to heat stress on hormonal profile of Murrah buffaloes has been presented in Table 1.

### 3. Results and Discussion

The effect of microclimate alteration devices and feed

**Table 1:** Effect of microclimate alteration devices and feed additive on hormonal profile in Murrah buffaloes during the study period

Experimental groups	Tag no.	Total T3 (ng/dl)	Total T4 (µg/dl)	Serum cortisol (µg/dl)
Control (C)	249	70.8	2.8	1.1
	452	69.2	2.6	1.0
	539	67.6	2.5	0.9
	541	71.2	2.7	0.9
	561	69.8	2.6	1.0
	557	70.6	2.7	0.9
Mean		69.87 <sup>c</sup>	2.65 <sup>c</sup>	0.97 <sup>b</sup>
± SE		0.54	0.04	0.03
Foggers (T1)	579	54.5	2.5	0.7
	580	57.5	2.7	0.9
	581	58.5	2.3	0.6
	582	56.2	2.4	0.7
	583	57.1	2.6	0.9
	584	58.4	2.5	0.6
Mean		57.03 <sup>a</sup>	2.50 <sup>b</sup>	0.73 <sup>a</sup>
± SE		0.62	0.06	0.06
Fans (T2)	460	63.9	2.6	0.8
	461	60.8	2.5	1.0
	462	66.2	2.7	0.9
	463	63.6	2.6	1.0
	464	62.9	2.7	0.9
	471	65.1	2.5	0.8
Mean		63.75 <sup>b</sup>	2.60 <sup>ab</sup>	0.90 <sup>b</sup>
± SE		0.76	0.04	0.04
Fans + Feed additive (T3)	465	60.5	2.3	0.6
	466	69.3	2.0	1.0
	467	68.7	2.1	0.9
	468	66.5	2.0	1.0
	469	64.3	2.2	0.6
	470	68.1	2.0	0.9
Mean		66.23 <sup>b</sup>	2.10 <sup>a</sup>	0.83 <sup>ab</sup>
± SE		1.36	0.05	0.08

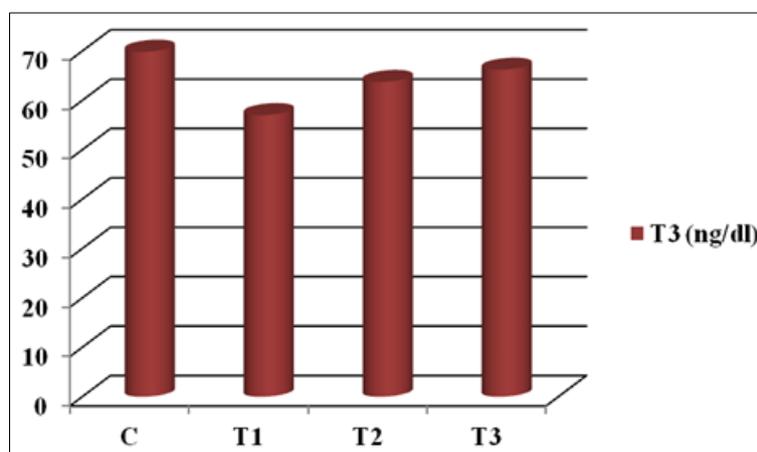
a, b, c means with different superscripts within column differ significantly ( $P < 0.01$ )

#### 3.1 Effect on Triiodothyronine (T3)

Present study revealed that the mean values of serum total T3 in C, T1, T2 and T3 groups of buffaloes were  $69.87 \pm 0.54$ ,  $57.03 \pm 0.62$ ,  $63.75 \pm 0.76$  and  $66.23 \pm 1.36$  (ng/dl), respectively and differed significantly ( $P < 0.01$ ). Among all the four groups, total T3 levels were higher in C group followed by

T3, T2 and T1 groups (Graph 1).

Similar result was found by Chaiyabutr *et al.* (2008) [13]. This might be due to animals tried to restore the thermal balance without restricting DMI. Also, feed additive had no significant effect on triiodothyronine and the same was given by Muneendra *et al.* (2015) [13].

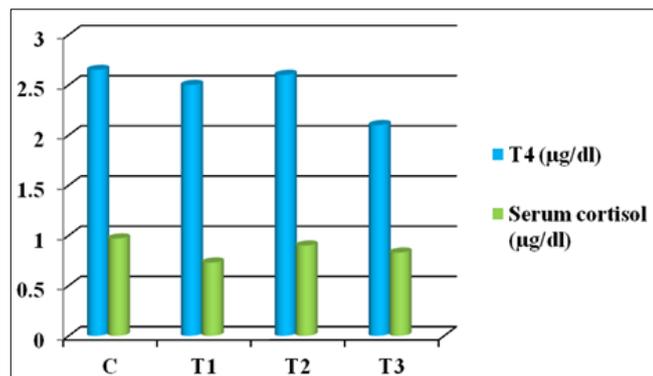


**Graph 1:** T3 (ng/dl) in Murrah buffaloes among the experimental groups

### 3.2 Effect on Thyroxin (T4)

Present study revealed that the mean values of serum total T4 levels were  $2.65 \pm 0.04$ ,  $2.50 \pm 0.06$ ,  $2.60 \pm 0.04$  and  $2.10 \pm 0.05$  ( $\mu\text{g/dl}$ ) in C, T1, T2 and T3 groups of Murrah buffaloes, respectively and were significantly ( $P < 0.01$ ) different. Total T4 levels were higher in C group followed by T2, T1 and T3 groups (Graph 2).

This suggested that heat acclimation did not depress thyroid gland activity and involve adjustments in peripheral monodeiodinative pathways of thyroid hormones (Aceves *et al.* 1987) [1] or due to lower utilization of T4 at cellular level (Wankar, 2012) [22] or due to metabolic adjustments made by animals in response to thermal stress.



**Graph 2:** T4 ( $\mu\text{g/dl}$ ) and Serum cortisol ( $\mu\text{g/dl}$ ) in Murrah buffaloes among the experimental groups

### 3.3 Effect on serum cortisol

The mean values of serum cortisol during the present study in C, T1, T2 and T3 groups were  $0.97 \pm 0.03$ ,  $0.73 \pm 0.06$ ,  $0.90 \pm 0.04$  and  $0.83 \pm 0.08$  ( $\mu\text{g/dl}$ ), respectively and differed significantly ( $P < 0.05$ ). The perusal of Graph 2 showed that the serum cortisol levels were higher in C group followed by T2, T3 and least in T1 group of Murrah buffaloes.

This might be due to activation of hypothalamo-pituitary adrenal cortical axis (HPA) in response to heat stress resulting in increased cortisol levels (Silanikove, 2000) [18]. These results were in accordance to the findings of Wise *et al.* (1988) [24]; Habeeb *et al.* (2001) [7]; Nessim *et al.* (2003) [15]; Nessim (2004) [14]; Starling *et al.* (2005) [20]; Sunil *et al.* (2010) [21]; Khongdee *et al.* (2011) [10]; Wankar (2012) [22] and Silva *et al.* (2014) [19].

T3 group of buffaloes exhibited lower serum cortisol levels when compared to C group because of effect of feed additive in response to heat stress. Similar results were given by Jeanne (1995) [9]; Kumar *et al.* (2013) [11] and Muneendra *et al.* (2015) [13].

T1 group exhibited the least serum cortisol levels when compared to C group because of effect of foggers in response to heat stress providing comfort to Murrah buffaloes. These results were consistent with those found by Brijesh *et al.* (2016) [2].

### 4. Conclusion

The inclusion of microclimate alteration devices and feed additive were beneficial for providing comfort to the Murrah buffaloes in adapting to the changing climate.

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