BEHAVIOURAL PATTERN OF DAIRY COWS UNDER DIFFERENT THERMAL STRESS MANAGEMENT SYSTEMS IN SUMMER *

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Received : 16.06.2017
Accepted : 21.06.2017

Abstract

Diurnal behaviour of dairy cows was assessed in different thermal stress management system during summer period. Three different thermal stress alleviating measures were compared with control animals. Wetting and forced ventilation (T1), early morning and late evening concentrate feeding (T2), Vitamin E supplementation (T3) and control (T4)were the treatments.Time remained in standing position was more in control animals. Animals in T1 spent more time in lying position forrumination than other treatments. Animals in T1 which were subjected to wetting and forced ventilation experienced less thermal stress and stayed significantly more time in lying position than control. It was concluded that wetting and forced ventilation was better option to reduce thermal stress in dairy cattle.

Keywords: Dairy cattle, Thermal stress, temperature humidity index, behaviour

In tropical humid climate exposure to summer weather affects both the physiology and behaviour of farm animals.They try to adjust with stressors using behavioural and physiological stress responses inorder to restore homeostasis.When these responses are thwarted, typical behavioural and physiological symptoms of chronic stress begin.Behaviour is a direct measure to evaluate the welfare state of animals either in loose housing system or confined system.Standing and lying period can be considered as important indicators for cow welfare (Kooij *et al.*, 2012;Vasseur*et al*., 2012). This study was an attempt to understand the behavioural responses of crossbred dairy cattle

* *Part of PhD thesis submitted by the first author to the Kerala Veterinary and Animal Sciences University, Pookode, Wayanad, Kerala*

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in tie stall to different thermal stress alleviating measures for optimizing animal welfare and minimizing losses in product yield and quality.

Materials and Methods

The study was conducted at Cattle Breeding Farm under Kerala Veterinary and Animal Sciences University located at Thumburmuzhy, Thrissur district in Kerala state. Farm is located at10° 29' 54'' N and 76° 25' 58'' E at an altitude of 40 m MSL.Three different thermal stress alleviating measures were tested along with a control group in 24 crossbred dairy cows. Six animals each were randomly allotted to three treatments and control viz.Wetting and forced ventilation (sprinkler and fan) (T1), early morning (4.00 am) and late evening (7.00 pm) concentrate feeding (T2), Vitamin E supplementation (1000 IU/animal/day) (T3) and control without any thermal stress ameliorative measures(T4). The period of study was from February to May, 2016 during which a high THI (LPHSI, 1990) of 82.35 ± 0.35 was recorded. A simple ethogram including diurnal behavioural patterns such as lying, standing, feeding and rumination was prepared with the help of continuous surveillance camera footage.Twenty four hour video footage was recorded once in every week for each treatment for the entire study period. Behaviour was visually monitored and the duration of activities was recorded in minutes for 24 h period. A particular group activity was counted only if at least fournumber of animals in a group of six were involved in that activity. Vaginal temperature was taken as core body temperature and diurnal recording was taken every hour using electronic digital loggers (Thermochron *i*Button (DS1921G), Maxim Integrated, USA). The logger was attached to a Controlled Internal Drug Release device (CIDR) and kept in the vaginal cavity for 10-12 days and repeated the procedure after giving a gap of one week each time.

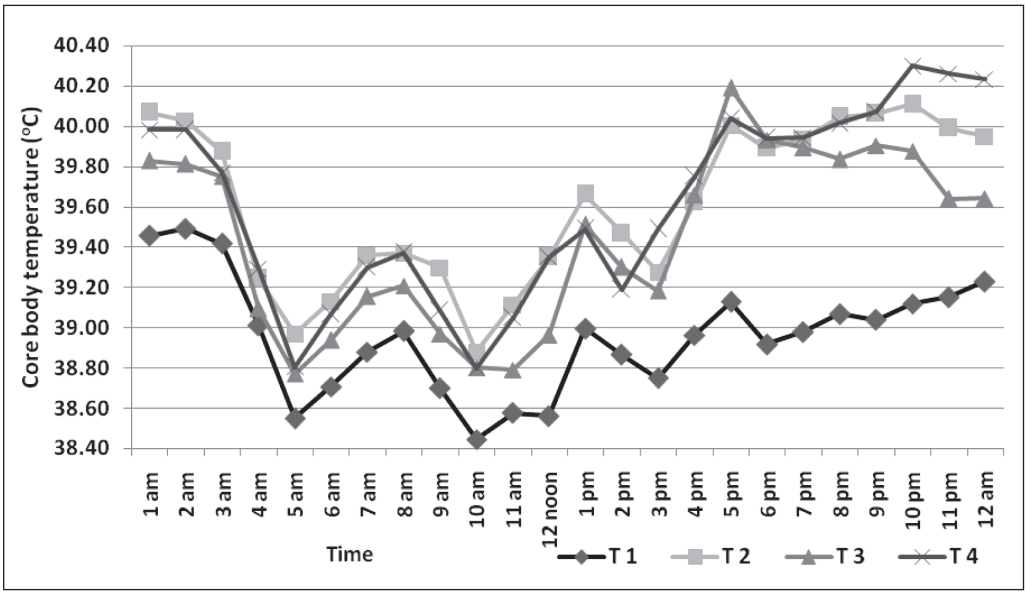
The data obtained were statistically analysed as per the method of Snedecor and Cochran (1994) using one way analysis of variance (ANOVA).

Results and discussion

Core body temperature (°C)

Significantly lower ($p<0.05$) diurnal core body temperature was observed in T1 animals compared to other treatments and control (Fig 1). Whilst,T2 and T3 did not vary much from control group.Animals under treatment T1 distinctly recorded less than 39°C in core body temperature compared to others.

Fig. 1. Diurnal core body temperature of different treatments during summer



Animals under group T1, which were subjected to wetting and forced ventilation recorded significantly lower temperature with respect to all other treatments and control. Gaughan*et al.*(2008)reported that mean rectal temperature was lowered by cooling cattle after reaching peak ambient temperature.Present study was in accordance with the findings of Mena *et al.* (1993); Nickerson (2014); Prasad (2014). Anderson (2013) observed that flip fans were better than fan and mister system in reducing rectal temperature in cattle. But the presentobservation did not agree with Holt *et al.* (2004) who suggested that afternoon feeding at 4.00pm would be beneficial in alleviating heat stress. Animals supplemented with Vitamin E showed relatively lower body temperature with respect to control.Lallawmkimi*et al*. (2013) and Sejian*et al*. (2014)obtained positive response to Vitamin E supplementation. The direct and immediate effect of wetting and forced ventilation was the reason for the relatively lower core body temperature in T1 animals.

Behaviour

Behavioural pattern was observed and duration was measured in minutes for 24 h period. Posture, feeding and rumination behavioural details are given in Table 1. Animals in treatment T1,which were subjected to wetting and forced ventilation spent significantly more ($p<0.05$) time in lying position compared to other treatments and control. The duration of standing posture was significantly lower ($p<0.05$) in T1with respect to others. Effect of treatments in feeding concentrate feed was not observed in any of the treatments. But animals in T1 and T2 spent significantly more($p<0.05$) time for feeding fodder grass compared to T3 and control animals. Posture of animals at the time of rumination was recorded during the period. A significantly higher ($p<0.05$) duration was observed in T1 animals for ruminating in lying position. Animals in T2 and T3 treatments and control took significantly more ($p<0.05$) time for rumination in standing posture compared to T1. Over all the time spent for rumination was higher in T1 animals followed by T2, T3 and control.

Animals in treatment T1 spent more time in lying posture and less time in standing compared to other treatments. Wetting and forced ventilation significantly reduced thermal stress in T1 and they spent more time in lying posture (Tucker *et al*., 2008;Schulz *et al.,*2010;Goble, 2012).According to Allen *et al.* (2013) core body temperature was correlated with standing behaviour as it was evident from the present study. Animals under stress remain standing to increase the evaporative cooling as it increases the area of skin in contact with air. But when the concretefloor whichwas heated during daytime, it was found that high producing animals tried to reduce body temperature by standing instead of lying (Tapki and Sahin, 2006). As suggested by Kooij*et al*. (2012) increased lying period and reduced standing period was a good indicator of reduction of

Table. 1. Duration of diurnal behaviour in fourtreatmentsin summer(mean ± SE), min

Treatments		Time spent for posture (min)		Time spent for feeding (min)		Time spent for rumination (min)	
		Lying	Standing	Concentrate	Fodder	Lying	Standing
T1	Wetting and fan	725.18 ± 6.06 ^{a}	640.17 ± 3.43 ^{b}	35.64 ± 0.38	268.41 ± 5.92^{a}	444.49 ± 5.9^{a}	100.65 ± 5.36^{b}
T2	Early and late feeding	647.46 ± 5.57 ^{b}	686.39 ± 5.85^{a}	34.22 ± 0.35	267.91 ± 5.69^{a}	389.14 ± 7.31^{b}	138.39 ± 6.97^{a}
T3	Vit. E supplementation	664.65 ± 5.40 ^{b}	683.22 ± 5.62 ^{a}	35.27 ± 0.35	248.95 ± 5.71^{b}	384.78 ± 9.14^{b}	129.66 ± 5.17^{a}
T4	Control	657.29 ± 6.75 ^{b}	693.23 ± 4.90 ^{a}	37.25 ± 0.41	248.28 ± 7.01^{b}	376.56 ± 5.26^{b}	128.32 ± 3.84^{a}

Means with different superscripts differ significantly in a column ($p<0.05$)

stress level in dairy cattle. The effect of thermal stress relief was evident in treatment T1which was very well reflected in their behaviour.

Time taken for feeding concentrate was more or less same in all the treatments. As two times feeding of concentrate was practiced, all the animals completed the feed within short period of time, irrespective of the level of thermal stress. While considering the fodder feeding time, T1 and T2 animals spent more time compared to T3 and control. This was in accordance with the observation of Brscic*et al*.(2007) and Tapki and Sahin (2006). Reduced level of heat stress in T1 and T2 animals allowed them to eat more without increasing the body temperature further.

Rumination in lying position was significantly more ($p<0.05$) in animals (T1) which were subjected to wetting and forced ventilation. The duration of rumination in standing posture was less in T1 compared to control. Brscic*et al*. (2007) reported that cows in heat stress resorted to rumination in standing posture as an attempt to dissipate body heat.

Behaviour of dairy cow is a directly observable indicator of welfare. It has to be continuously observed and critically analysed to evaluate the thermal stress alleviating measures adopted.

Acknowledgements

The authors duly acknowledge the College of Veterinary and Animal Sciences, Mannuthy and Cattle Breeding Farm, Thumburmuzhy for the facilities provided.

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