CONTINUOUS MEASUREMENT OF CORE BODY TEMPERATURE OF DAIRY COWS IN WINTER AND SUMMER USING THERMO-CHRONIBUTTONS*

S. Harikumar[1], K.S. Anil[2], Joseph Mathew[3], A. Prasad[4], K.A. Mercey[5], K. Ally[6] and K. Raji[7]
Department of Livestock Production Management
College of Veterinary and Animal Sciences,
Mannuthy, Kerala-680651, India

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Abstract

Continuous recording of core body temperature is the major requisite to study thermodynamics of the body in detail. Information on dynamic diurnal core body temperature helps to formulate suitable thermal stress alleviating measures in livestock production. There are several electronic loggers available to record body temperature continuously. In this study a small and convenient Thermochronibutton was used to record vaginal temperature of dairy cattle subjected to thermal stress alleviating measures in winter and summer. It provided accurate and continuous data to analyse the effect of stress relieving measures and season on core body temperature of dairy cows.

Keywords: *Dairy cattle, core body temperature, temperature logger, Thermochronibutton*

In cattle several attempts were made to measure the body temperature at various locations, including the rectum, vagina, ear, udder, intra peritoneal cavity, reticulo-rumen and skin. Continuous recording of core body temperature is the inevitable component in assessing thermal stress in dairy cattle (Leufcort and Adams, 1998). Vaginal temperature can be considered as core body temperature as there is greater blood flow in the vagina compared to the rectum, and so vagina is more sensitive to changes in core body temperature compared to the rectum (Emmanuel *et al*., 2000). Suthar*et al.* (2011) have reported negligible differences between vaginal temperature and rectal temperature in dairy cowshoused in a tie stall barns.Thermochron *i*button (DS1921G), Maxim Integrated, USA), is the smallest available data logger, weighing3g with a sensitivity range of 15 °C to 46 °C and temperature resolution of 0.125 °C. Thermochron*i*buttons are powered by a lithium battery that can be operated at least 10 years without maintenance. A 10min sampling

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1. *PhD scholar and corresponding author: email: harikumar@kvasu.ac.in Ph. 9447386770*
2. *Professor and Head, Department of Livestock Production Management*
3. *Registrar, Kerala Veterinary and Animal Sciences University*
4. *Assistant Professor and Head, Cattle Breeding Farm, Thumburmuzhy*
5. *Professor and Head, Department of Statistics*
6. *Professor, Department of Animal Nutrition*
7. *Assistant Professor, Department of Veterinary Physiology*

interval is sufficient for most of the applications and allows for two weeks recording. It can be inserted into the groove of CIDR and can be placed into the vaginal cavity (Davidson *et al*., 2003 and Hansen, 2012). In this study Thermochron*i*buttons were used to record core body temperature in two groups of dairy cows in different heat stress alleviating measures in two seasons.

Materials and methods

Twelve crossbred dairy cows were selected for the study at Cattle Breeding Farm under Kerala Veterinary and Animal Sciences University located at Thumburmuzhy, Thrissur District in Kerala. They were divided into two groups of six animals each. One group (T1) was subjected to wetting and forced ventilation by means of sprinkler and fan to reduce thermal stress and other group was kept as control without any intervention for thermal stress relief. The study was conducted during winter (December 03-February 10) and summer months (February 11-May 26). Ambient temperature was recorded by HOBO logger. Vaginal temperature was taken as core body temperature and it was continuously recorded by Thermochron*i*button (Fig 1). CIDRwas used to hold the*i*button in position (Fig 2) and it was introduced in to vaginal cavity by means of an applicator.It was retained there for 10-12 days and later withdrew to download the data. The procedure was continued after givingan interval of one week each time. Care was taken to

Fig 1. Thermochron*i*button (size 1.5cm)

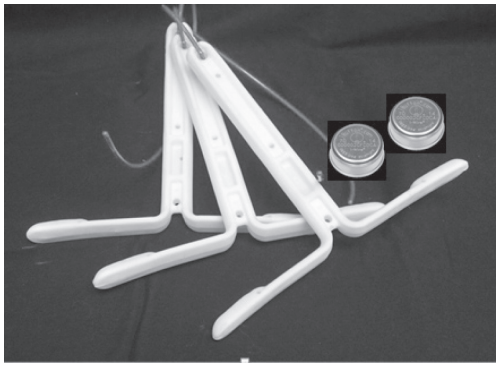

Fig 2. Thermochron*i*buttons and CIDR

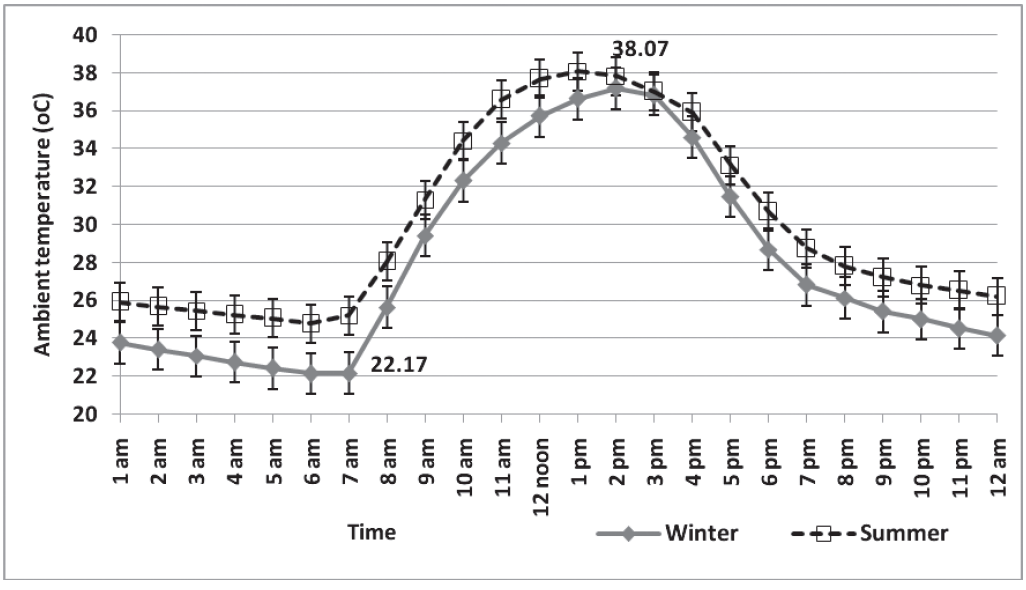

Fig 3. Mean diurnal ambient temperature in winter and summer, °C

maintain aseptic conditions.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

Ambient temperature

The diurnal ambient temperature was recorded in winter and summer (Fig 3). The mean temperature during winter was 28.11 ± 1.09 °C and during summer was 30.05 ± 1.00°C. The highest value of ambient temperature was recorded during summer (March,39.86°C) and the lowest during winter (January,21.58°C). In both winter and summer lowest temperature was observed at 7.00 am and highest at 1.00 pm in summer and 2.00 pm in winter. THI (LPHSI, 1990)was calculated in both seasons as 77.73 ± 0.53 in winter and 82.35 ± 0.35 in summer.

Tej (2015) recorded the maximum ambient temperature during pre monsoon (May) in Kerala but it was March in the present study. The temperature recorded by Zarina (2016) was lower than that of present study.

Core body temperature

Table 1. Mean core body temperature in winter and summer, °C

Treatments		Core body temperature, °C (mean ± SE)	
		Winter	Summer
T1	Automatic wetting and fan	38.74 ± 0.04 ^{bB}	38.95 ± 0.06 ^{aB}
T2	Control	39.27 ± 0.05 ^{bA}	39.62 ± 0.10 ^{aA}
Mean ± SE		39.00 ±0.03	39.28 ±0.04

Means with different superscripts (a, b in rows, A,B in columns) differ significantly (p<0.05)

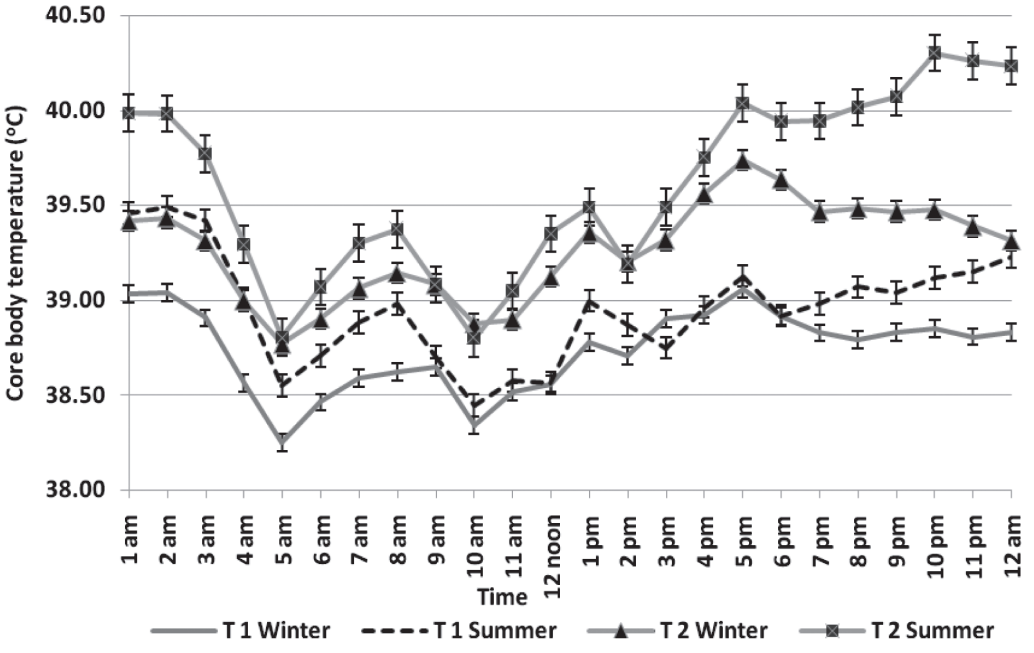

Fig 4. Mean core body temperature in summer and winter, °C

The data downloaded from Thermochron*i*button was analysed to understand the diurnal fluctuation in core body temperature of animals in two groups. In general lowest core body temperature was recorded at 5.00 am in all animals irrespective of season and treatment. Sharp depressions in body temperature during day time were associated withroutine cleaning of animals with water and feeding concentrate feed. During summer a gradual increase in temperature was observed in both T1 and T2 from 6.00 pm to 12.00 midnight.In winter diurnal fluctuation observed was in accordance with Schutz and Bewley (2009) who noticed a distinct circadian rhythm within a range of 0.2 to 0.9°C. But in summer diurnal variation was up to 1.5°C.

In winter treatment T1showed significantly lower ($p<0.05$) core body temperature compared to control. Similarly in summer also significant reduction in temperature was noticed in T1. The effect of wetting and forced ventilation considerably reduced thermal stressin comparison with control where no ameliorative measure was provided. Mena *et al.* (1993), Nickerson (2014) and Prasad (2014) observed similar response with wetting and forced ventilation.Gaughan*et al.*, (2008) reported that loweredmean rectal temperature and respiration rate wereobtained by cooling cattle after reaching peak ambient temperature in early evening. Anderson (2013) observed lower rectal temperature using flip fans compared to fan and mister system.Wetting and fan accelerated evaporative cooling from skin and reduced core body temperature.

Continuous recording of core body temperature by means of Thermochron*i*button provided descriptive information of thermodynamics of animal body.

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