Technological Possibilities of Contactless Measuring the Body Surface Temperature

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Abstract
The regular measuring of the body surface temperature can help to evaluate health condition of animals and react immediately on the first symptoms of illness. There are many of technological possibilities of contactless measuring the body surface temperature. It is important to find the right part of the body which the temperature will show the first possible symptoms of illness. This experiment with dairy cows and heifers was realized at the farm in Petrovice. The body surface temperature and rectal temperature of animals were observed in dairy cows and heifers. It was rated 3 different groups of dairy cows and heifers in 2 stables. The body temperature was obtained by the thermocamera. The temperatures were shot from the 3 different parts of body of animals (the body core, the eyes and the udder). The relative humidity, temperature, cooling value environment and flow rate in stable were measured as further independent variables. The aim of this study was finding how body temperature correlate together with health of animals, reproduction, milk quality, vital signs and productivity of dairy cows and heifers.

Keywords: body surface temperature, dairy cows, heifers, thermocamera, welfare.

1. Introduction

The balance of chemical and physical thermoregulation is safeguarded with a rectal temperature, which is an indicative of the internal body temperature. The best indicator of the physiological response to stress is body temperature because it is under non-stressed conditions almost constant. On the basis of the changes of the rectal temperature can quickly deduce on the thermal load of the body and the involvement of an adaptive mechanisms [1]. Literature gives the range of the rectal temperature in cattle from 37.5 to 39.5 °C [2].
However Bukvaj [3] shows fluctuations in rectal temperature in dairy cows from 36.9 to 39.1 °C. The unity of the chemical and physical thermoregulation is achieved by the maintaining constant body temperature of animals. However there are many factors which may affect such as a daytime, an age of animals, a sexual activity, a physical performance, a food intake, psychological influences, the state cover the body, the impact of climate and microclimate etc. [4]. To evaluation of the health status of animals can help regular measurement of the body surface temperature of animals and so immediately respond to the first signs of illness. There are many methods of contactless measuring the body surface temperature. It is important to find the right part of the body whose temperature will point to the first potential signs of the disease. One objective of this experiment was to find how the body temperature is correlated with one of the microclimatic parameters. In this case it is with the cooling value of the environment.

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2. Materials and methods

This experiment was carried out at the stables with free boxing barns at the farm in Petrovice. Measurements were carried out right in the stable and cows were fixed in box. Three different groups of cows and heifers were evaluated in two sheds with different microclimate conditions. The temperatures were recorded with a thermographic camera Testo 875 from three different parts of the body (body core, the eyes and an udder). These temperatures were given in the correlation with one of the independent microclimatic value – the cooling value of the environment. That was obtained with the using of the psychrometer. The experiment was conducted during three month (February to April) at weekly intervals. 36 dairy cows and heifers were measured. They were divided by 12 pieces in three groups. Cows and heifers from the second day to two months after calving were in the first group. The second group was consisted of cows from fourth to fifth month after birth. The third group included cows from seventh to eight month after calving. Thermograms of body part measurements (body core, the eyes and an udder) were taken from a thermographic camera Testo 875 and recorded in the memory. The thermograms were then evaluated and put together in the tables. The average body parts temperatures of animals from each measurement were given in the correlation with the cooling value of the environment. It was obtained with the using of the psychrometer. The resulting values were processed into graphs put together a program Microsoft Excel.

3. Results and discussion

The results of correlation of the cooling value of the environment and average body parts temperature of animals (body core, the eyes and an udder) are shown in the Figures 1, 2, 3. It was found that the temperatures of the measured body parts of animals were noticeably affected by the ambient temperature.

The most significant fluctuations were in the third group of dairy cows and heifers. This group of cows occurred in the different stable than the first and second groups which were together in other stable. The third group was housed in another shed with the significantly different microclimate conditions.

The Figures also show greater fluctuations of the cooling values of the environment. That may be caused by structural building conditions of the stables (windows, open/close doors, etc.) But these variations did not significantly affect the resulting values of the measured body parts temperature of animals.

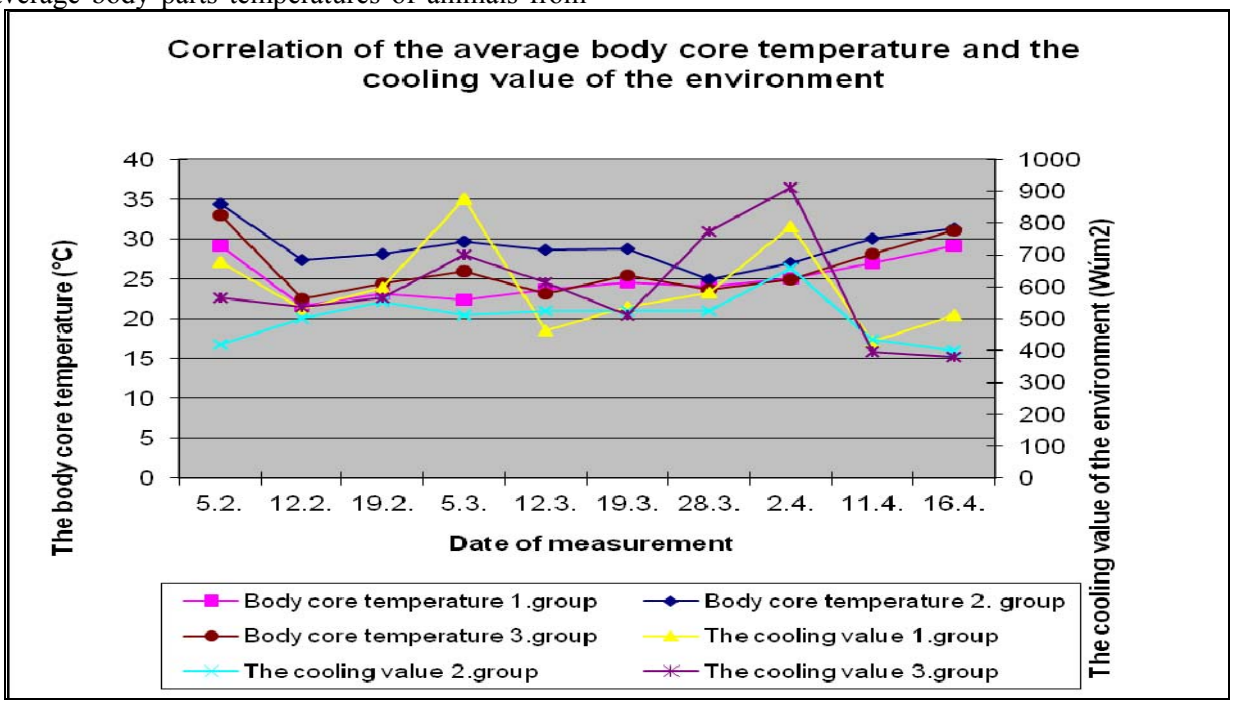

Figure 1. Correlation of the average body core temperature and the cooling value of the environment

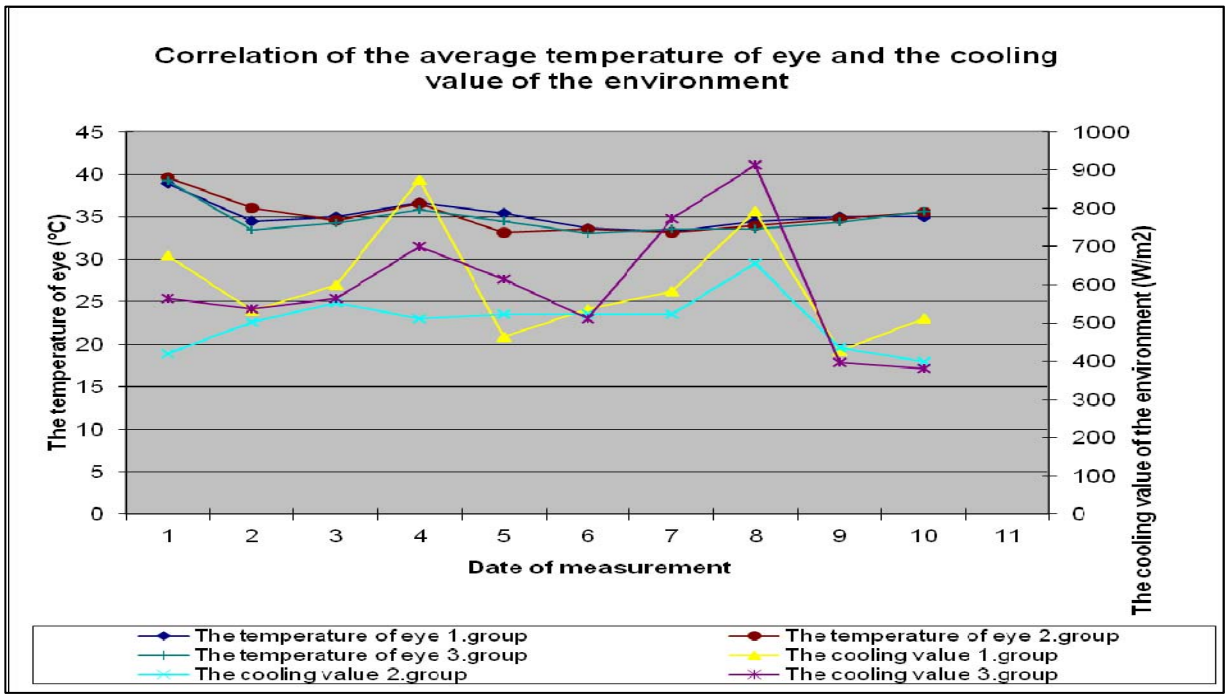

Figure 2. Correlation of the average temperature of eye and the cooling value of the environment

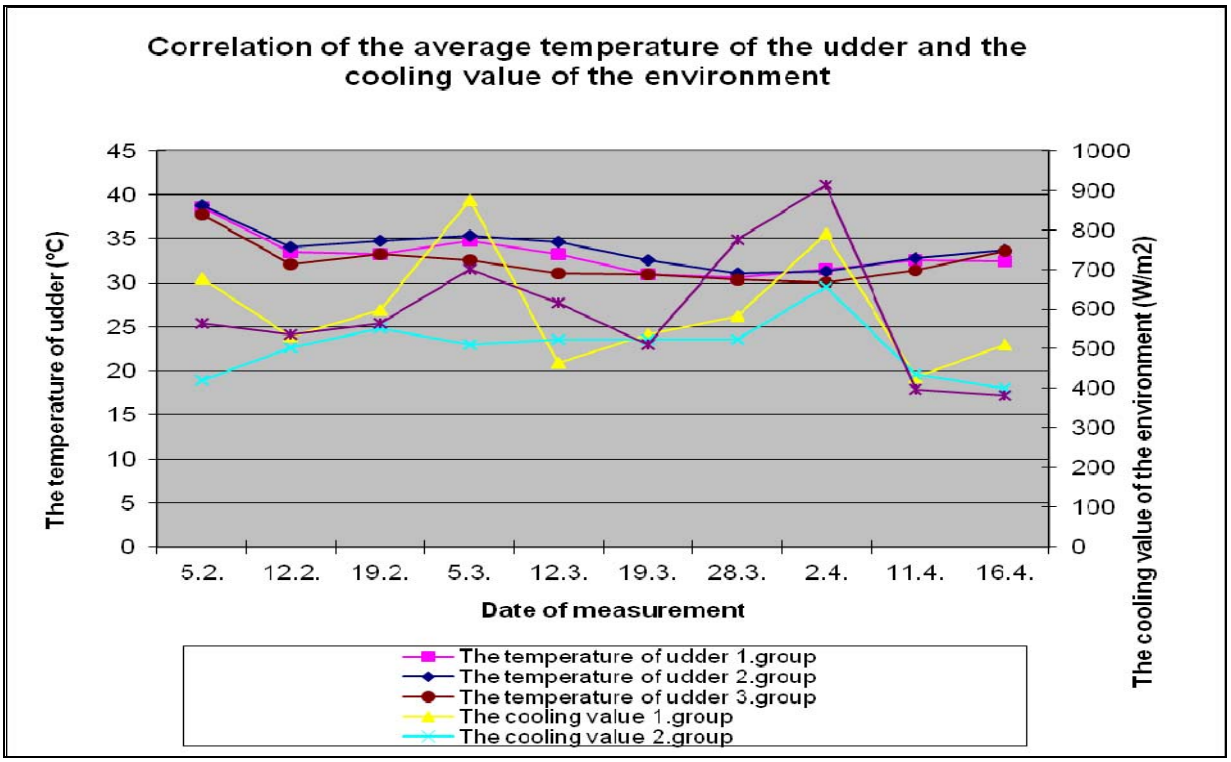

Figure 3. Correlation of the average temperature of the udder and the cooling value of the environment

The Figure 2 shows that at least impressionable parts of the body were an eye. The different factors, such as a length and density of coat, a colour or degree of muscularity, on which significantly depends the emissivity (the ability to emit infrared radiation), acted in the remaining two measured parts of the body (body core and an udder).

KURSA et al. [5] state the optimal cooling values of the environment for the adult animals 293 - 419 $W.m^{-2}$. The figures observe the cooling values of the environment much higher than the exceeding value above 502 $W.m^{-2}$. It should indicate the sense of cold for the animals. The increased cooling value of the environment like this negatively affects the health status of the animals.

4. Conclusions

The measurements in chosen groups of cows and heifers at the farm in Petrovice shows that the average body parts temperature of animals (body core, the eyes and an udder) was not significantly affected by the cooling value of the environment.

A main role played the emissivity and the setting of the thermographic camera. Different factors such as the nature coat or degree of muscular acted for each animal. These significantly affected the results. Dairy cows and heifers showed no negative effects of thermal comfort though the high measured value of the optimal cooling values of the environment.

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