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THE EFFECT OF TEMPERATURE IN STABLE ON THE NUMBER OF DAIRY COWS LYING IN CUBICLES DURING THE RESTING PERIOD OF SUMMER DAY

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Abstract

The effects of stable temperature was investigated on the number of cows lying in cubicles during the resting period of the day. The experiment took place on the University Enterprise (49.011598N, 16.602572E) in Žabčice during August 2017. The 143 cows of Holstein cattle undertook the experiment in total. The number of cows lying, relative humidity and ambient temperature were recorded. The temperature was expressed by the environmental cooling rate that was calculated. The temperature-humidity index (THI) was calculated and correlation was computed with the number of cows that were lying in the cubicles. A moderate positive correlation was found between the number of lying cows and environmental cooling rate (r=0.50). The relationship between THI and the number of cows that were lying in the cubicles was negative (-0.25). The temperature showed a stronger negative correlation (r = -0.598) to number of cows lying in cubicles than THI. These results can be used for breeders to optimize their breeding environment.

INTRODUCTION

According to *West* (2003) the one of the greatest challenges for cows is the heat stress. *Trnka et al*. (2011) claims, that the global temperature will rise of 5°C between 2030 and 2050. This is a serious issue that cattle husbandry will need to deal with. Meteorological factors have a large impact on the behaviour of animals. The behaviour changes with temperature, humidity and other climatic factors. This is called the etological adaptation to the surrounding environment. During warm episodes in summer, the goal is to minimize the impact of thermal load by influencing the exchange of heat between the animals' body and the surrounding environment (*Zejdová*, 2012). A large amout of heat is produced by feeding, digestion or moving (*Doležal*, 2010). *Cooppock et al*. (1982) found that milk production is 52.9% of all heat production of body.

Heat stressed cows are seeking ways to cool down herselves (wind, shade, damp places) (*Chase*, 2006; *West*, 2003). According to *Dolejš et al*. (2004) the number of cows that are standing is increasing as well as their activity.

Doležal (2010) claims, that the cows during the heat waves lay down in the excrement coridors, trying to increase the exchange of heat between body and moist enviromnemt. *Doležal*

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(2010) also mentioned that endeavor to moisten the body surface with saliva and nasal secrects, the time of rumination in lying is decreased with 55% and cows were lying down in the normal posture, but with the legs stretched. This is mainly because of the endeavor to increase the surface of their body and therefore increase the evaporation surface.

This paper is aimed to asses the effect of ambient temperature on the number of cows that are lying in the cubicles. This is important for the rumination and therefore production of milk as well as welfare of animals.

MATERIALS AND METHODS

Experiment for this paper took place in Žabčice University Enterprise (49.011598N, 16.602572E) and lasted over one month (August) in 2017 summer. In total, 143 Holstein cows (two sections) were used for the experiment. The feed ration and the milk yield of cows was same (high production cows). The feed ration included the corn silage, alfalfa hay and silage, sugar beet pulp and grinded limestone. Water was available all times.

The temperature was recorded as well as the number of cows that were lying in the cubicles during the resting period of the day (11:00 AM). Data were collected on daily bases. Temperature data were collected by a data logger placed in the middle of the two observed sections. Temperature was later represented by an environmental cooling rate (ECR).

The ECR was measured as follows: the water that had 38°C was poured in the special Hill's thermometer and the time of cool down between 38°C and 35°C was measured in seconds. Later the ECR was calculated by following formula:

$K=F/t$

t= time of cooling

F= factor of the Hill's thermomether

Temperature and humidity were also obtained by data logger. The temperature/humidity index (THI) was calculated as follows:

$THI = 0.8tdb + ((Tdb – 14.4) * RH)/100 + 46.4$

T_{db}= air temperature (dry bulb temperature)

RH= relative humidity

The data about a number of cows that lied in cubicles was obtained by counting the cows every day during the resting period.

RESULTS AND DISSCUSION

The relationship between temperature and the number of cows lying in the cubicles is presented in *Figure 1*. The results show a strong negative correlation (r = -0.598) between the temperature and number of lying cows. This supports the statement of *Ito et al*. (2009) and *Vaculíková et al*. (2017) that both claim, that at higher temperatures, cows tend to stand more than in low temperatures.

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***Figure 1*: The relationship between temperature in stable and number of cows lying in the cubicles**

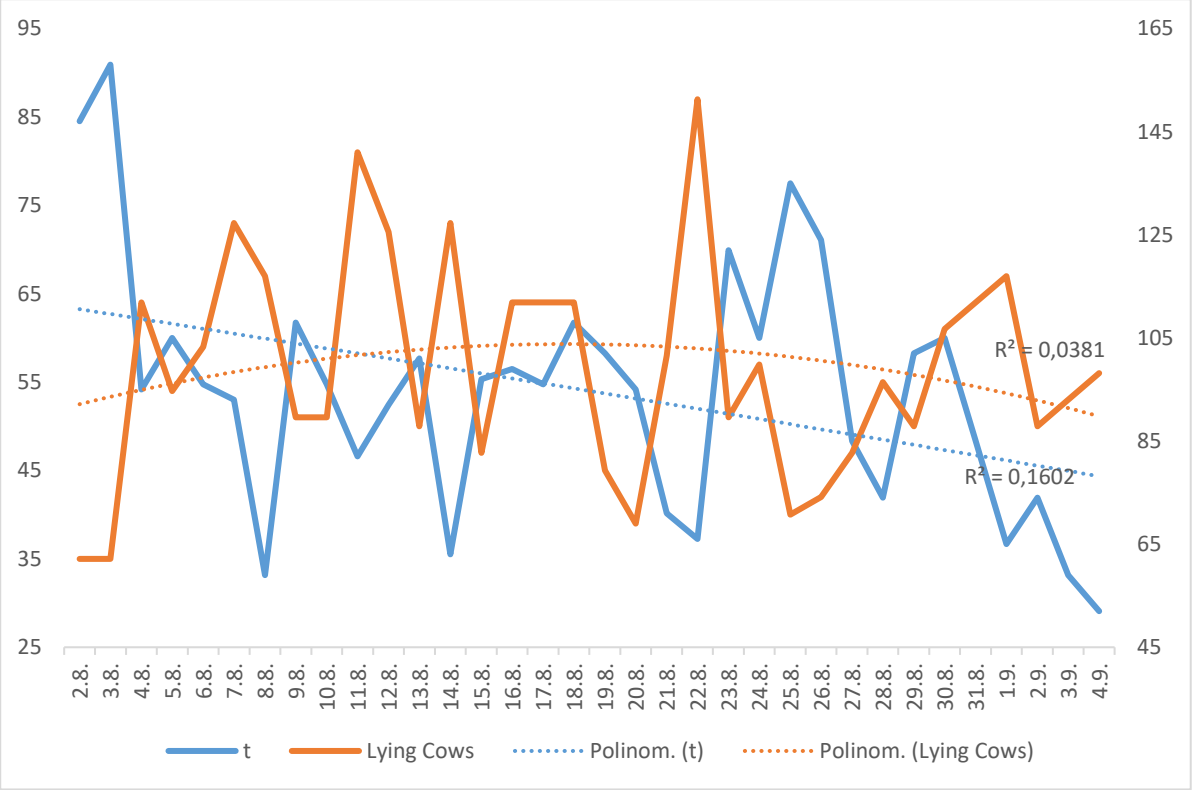

Figure 2 represents a relationship between number of lying cows and the THI. Here, results show weaker negative relationship (r = -0.25). It can also be observed from the *Figure 2*, that the THI did not alter the number of cows lying in cubicles that much as a temperature in *Figure 1*. This supports the statement of *Zejdová et al.* (2014) that claims, that THI is not suitable for assessing the heat stress due to high correlation between temperature and THI (r = 0.998) in Czech Republic. This is caused by no sudden changes in weather. Our results are in contrary to the findings of *Provolo and Riva* (2009) who claim, that higher THI values have stronger correlation with cattle lying behaviour. *Armstrong* (1994) showed that THI over 72 is critical. In *Figure 2*, values exceeding 73 can be observed and yet, the correlation is very weak.

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Figure 2: **Relationship between THI and cows lying in cubicles**

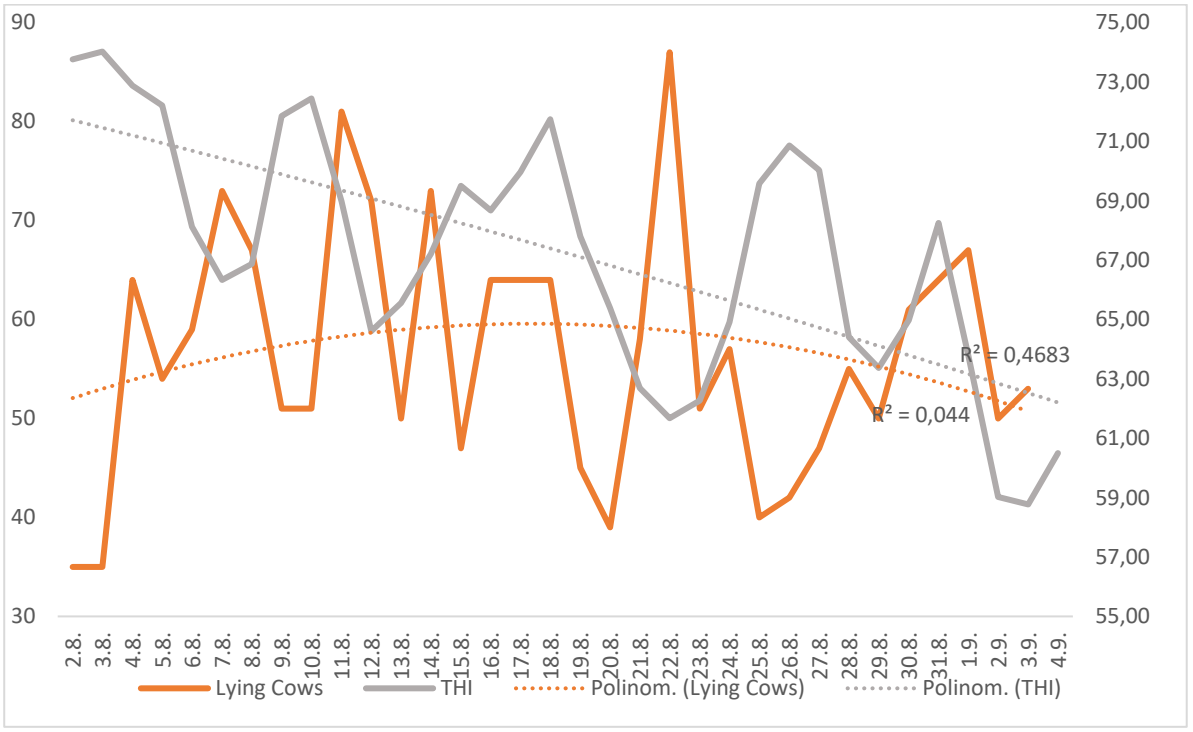

Figure 3. shows the relationship between the ECR (environmental cooling rate) and the number of cows lying in the cubicles. Results shows a moderate positive correlation (r = 0.50). This is surprising, because according to *Louda et al*. (1999) along with THI, ECR reflects on the microclimate of the barn environment the most and therefore, the number of lying cows should be larger. Only possible explanation of our findings could be the lethargic behavior expressed by cows during the heat periods (*van Devender*, 2006).

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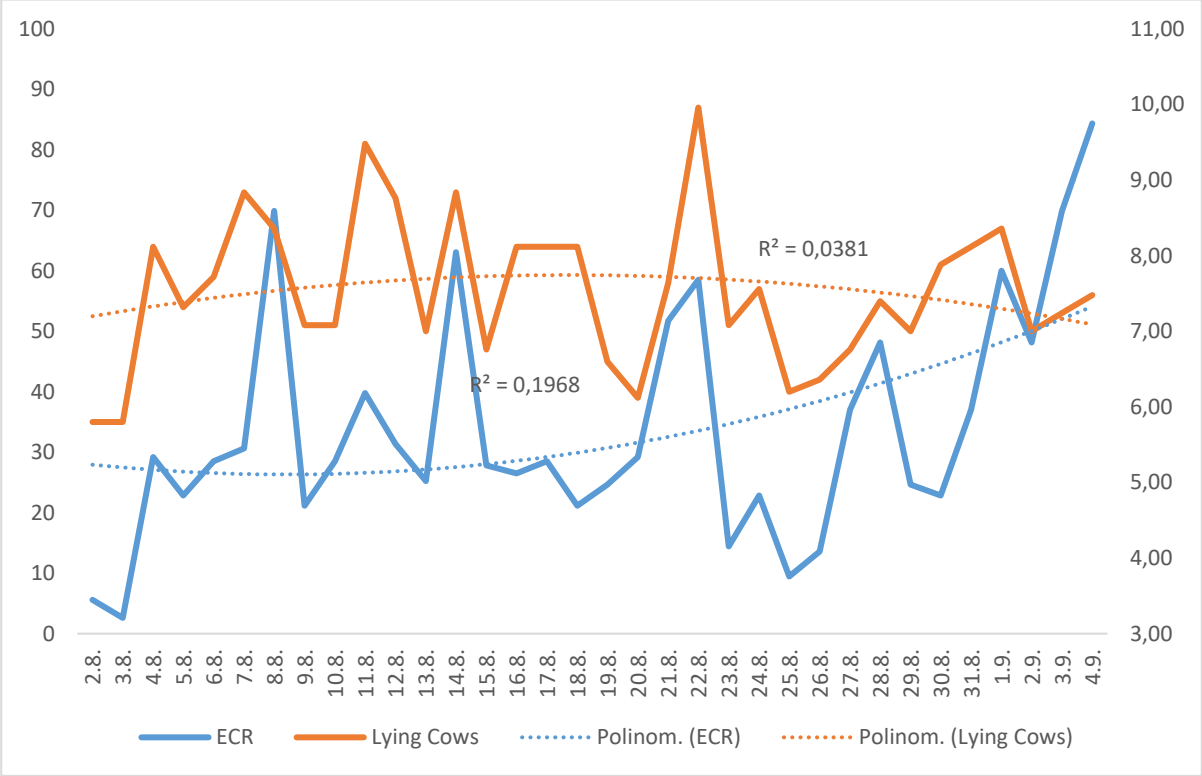
Figure 3: **Relationship between enviromnemtal cooling rate and cows lying in cubicles**



CONCLUSION

Our results showed that THI had a weak relationship (r = -0.25) with number of lying cows in cubicles. Temperature had a stronger negative correlation (r = -0.598) with the number of lying cows in the cubicles. The ECR had a moderate positive correlation (r = 0.50) to number of cows lying in cubicles. The results of this study might be used for farmers to optimize thermal environment around the animals.

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REFERENCES

Armstrong D.V. (1994): Heat Stress Interaction with Shade and Cooling, Journal of Dairy Science, 77. 7. 2044-2050.
Chase, L.E. (2006): Climate change impacts on dairy cattle. Department of animal science.
Doležal, O. (2010): Metody eliminace tepelného stresu-významná chovatelská rezerva. Praha. 41 p.

Ito, K., Weary, D.M., von Keyserlingk, M.A.G. (2009): Lying behavior: Assessing within- and between-herd variation in free-stall-housed dairy cows. Journal of Dairy Science, 92. 9. 4412-20.

Louda, F. (1999): Chov skotu: přednášky. 1. vyd. Praha: Česká zemědělská univerzita v Praze, 186.

Provolo, G., Riva, E. (2009): One year study of lying and standing behaviour of dairy cows in a frestall barn in Italy. Journal of Agricultural Engineering, 40. 2. 27-34

Trnka, M., Olesen, J.E., Kersebaum, K.C., Skjelvåg, A.O., Eitzinger, J., Seguin, B., Dubrovský, M. (2011): Agroclimatic conditions in Europe under climate change. Global Change Biology, 17. 7. 2298-2318.

Vaculíková, M., Komzáková, I., Chládek, G. (2017): The Effect of Low Air Temperature on Behaviour and Milk Production in Holstein Dairy Cows. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 65. 5. 1623-1627.

West. J.W. (2003): Effects of Heat-Stress on Production In dairy Cattle. Journal of Diary Science, 86. 6. 2131-2144.

Zejdová, P., Chládek, G., Falta, D. (2014): Vliv stájového prostředí na chování a mléčnou užitkovost dojnic. Brno: Mendelova univerzita v Brně.

10.17205/SZIE.AWETH.2017.2.101