

## MECHANISMS OF LIVING ORGANISMS ADAPTATION TO EXTREME CONDITIONS

### CHANGES IN RESPIRATION RATE AND BEHAVIOUR OF LACTATING DAIRY COWS AS AN ADAPTION TO HEAT STRESS

**G. Hoffmann, J. Heinicke, T. Müschner-Siemens, T. Amon\***

Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB),  
Department of Engineering for Livestock Management, Potsdam, Germany

\*ATB and Freie Universität Berlin, Institute of Animal Hygiene and  
Environmental Health, Berlin, Germany  
ghoffmann@atb-potsdam.de

**S. Pinto**

Leipzig University, Faculty of Veterinary Medicine, Clinic for Ruminants and  
Swine, Leipzig, Germany

**R. Mylostyvyi**

Dnipro State Agrarian and Economic University, Dnipro, Ukraine

*У цьому дослідженні вивчено вплив кліматичних умов навколишнього середовища на частоту дихання та поведінку (активність, тривалість відпочинку та час жуйки) лактуючих корів. Зроблено висновок, що фізіологічні та поведінкові особливості підходять для оцінки теплового навантаження у великої рогатої худоби.*

Introduction. Studying changes in the behaviour and clinical condition of dairy cows during heat stress can be a useful tool in evaluating animal welfare. Understanding the mechanisms by which animals adapt to high temperatures should help to implement possible mitigation strategies in time. The purpose of this trial was to declare how high-yielding dairy cows adapt to heat stress conditions.

Methods. This study was carried out with 51 Holstein Friesian cows (1st to 8th lactation, daily milk yield:  $40.7 \pm 6.8$  kg) housed in a naturally ventilated barn in Brandenburg, Germany. Respiration rate (RR) was counted hourly, via counting visually the flank movements in 30 seconds and multiplied them by two (breath per minute, bpm) on 2-3 randomly chosen measurement days per week between 0700 h and 1500 h. Rumination time (RT) was recorded continuously with microphone-based acoustic sensors (Lely Qwes HR, Lely, Maassluis, Netherlands) at a collar around the neck, and activity behaviour (AB) by pedometers (IceTag3D™ activity

sensor, IceRobotics, Edinburgh, UK) attached to one hind leg of each cow measuring body posture (standing and lying) every second. Simultaneously, air temperature (in °C) and relative humidity (in %) in the barn were logged (EasyLog, Lascar Electronics Wiltshire, UK) to calculate the temperature-humidity index (THI). Data were analysed for differences between factor levels with a repeated measurements linear mixed model at an overall significance level of  $P < 0.05$ .

**Results.** RR: The RR of cows changed depending on THI and body posture. The values of RR in lying cows in  $THI < 68$ ,  $68 \leq THI < 72$  and  $72 \leq THI < 80$  categories (36, 46, and 54 bpm, respectively) were greater than in standing cows (30, 39 and 45 bpm, respectively). RT: Rumination time decreased above a THI value of 52. The biggest drop in RT (from 60min/2h to 30min/2h) was between 1600 and 2000h. AB: Dairy cows changed their activity and lying behaviour affected by daily heat load duration exceeding a heat load threshold (THI 68). An increase in the duration and intensity of heat load on the measurement day led to a decrease in the lying time (from 10.8 to 7.7h/day and cow) and to an increase in the number of steps (from 2062 to 2482 steps/day and cow, on days without and with heat load, respectively). The cows also spent more time in a standing posture and the standing bout duration increased (from 57.86 to 79.26 min /standing bout) on measurement days with heat load.

**Conclusion.** Lactating dairy cows show significant changes in RR, RT as well as in AB as a reaction to changed climatic environmental conditions in order to use their thermoregulatory mechanisms to lose heat. Physiological and behavioural characteristics are suitable to evaluate the heat load in cattle, but animal-specific differences in response to heat load are obvious.

**Keywords.** Heat stress, dairy cow, respiration, behaviour.

#### *How to Cite*

Hoffmann, G., Heinicke, J., Müschner-Siemens, T., Amon, T., Pinto, S., & Mylostyvyi, R. (2021). Changes in respiration rate and behaviour of lactating dairy cows as an adaptation to heat stress. Proceedings of the 2nd International Scientific and Practical Conference AWCGCC, April 21-22, 2021. Dnipro, 44–45.



## **TRANSAMINASES OF SERUM AND THEIR RELATIONSHIP WITH PHYSICOCHEMICAL PROPERTIES AND CHEMICAL COMPOSITION OF MUSCLE TISSUE OF YOUNG PIGS LARGE WHITE BREED**

**V. Khalak**

