Chapter 8
Effect of Evaporative Cooling System on Behavior, Milk Yield, and Milk Quality of Holstein Cows in a Tropical Climate

Cristiane Gonçalves Titto
São Paulo University, Brazil

Evaldo Antonio Lencioni Titto
São Paulo University, Brazil

Rafael Martins Titto
São Paulo University, Brazil

Alfredo Manuel Franco Pereira
https://orcid.org/0000-0001-9430-9399
Universidade de Évora, Portugal

Messy Hannear de Andrade Pantoja
São Paulo University, Brazil

João Alberto Negrão
São Paulo University, Brazil

EXECUTIVE SUMMARY

In a tropical climate, air temperature can be stressful for Holstein cows throughout the year. This chapter's objective was to determine how the use of ventilation and fogging on a freestall barn can positively change the behavior, milk production, and milk quality of Holstein cows in all seasons. Twenty-eight lactating cows were divided into two groups: cooling group (CG) and non-cooled group (NCG). For different weather patterns throughout the year, behaviors (position, posture, and activity) were observed every 30 min during the day. Milk production was measured and milk samples were collected for analysis of protein, fat, lactose, total solids, and somatic cell count. All animals spent most of the day standing in the shade eating,

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ruminating, and idling regardless of the season (P<0.05). Also, animals under cooling system showed greater milk production, fat content, and higher somatic cell count (P<0.01). Provision of cooling system during the warmer months of the year proved to be efficiently increasing the feeding time, milk production, and milk quality of lactating cows.

BACKGROUND

Milk production can be negatively affected by heat, especially in animals of high genetic merit (Ahmed et al., 2022), and heat stress can have negative effects on the welfare (Lacetera, 2019), which can be rated by physiological and behavioral responses. Climatic factors, such as temperature, relative humidity, and solar radiation, may cause increase in rectal temperature and respiratory rate (Li et al., 2020) and reduction in daily activities (Hut et al 2022) and dry matter intake (Chang-Fung-Martel et al., 2021).

Decrease in lying and eating behavior are the first changes on daily activities when the air temperature rises (; Chang-Fung-Martel et al., 2021; Tullo et al., 2019; DelCurto-Wyffels et al., 2021). Besides the decline in milk production, heat stress may also reduce milk quality: somatic cells increase (Zeinhom et al., 2016) and protein and fat contents become smaller (Bernabucci et al., 2015). Animals under heat stress reduced milk yield from 34.3 kg/day to 22.5 kg/day when compared to thermoneutral conditions (Fontoura et al., 2022), in addition, findings by Bertocchi et al. (2014) showed higher somatic cell scores in heat (4.613) compared to cold (4.287).

However, there is evidence that providing shade or other cooling methods is beneficial for cattle, based on changes in respiratory rate and body temperature (Schütz et al., 2011; Brown-Brand, 2018), diurnal feeding (Portugal et al., 2000), and plasmatic cortisol and IGF-I (Chaiyabutr et al., 2008; Brown-Brandl et al 2017).In freestall barns, cows stay inside during the hottest hours of the day to obtain shelter from intense solar radiation; however, the barn itself can cause heat stress if not well ventilated or has high roofing. Environmental modification on dairy barn has demonstrated improvement in microclimate and a positive effect on cow's performance with forced ventilation (Marumo et al., 2022), ventilation with misting (Titto et al., 2013), and ventilation with sprinkling (Román et al., 2019). Studies that investigate animal behavior to show animal preferences is important to increase welfare (Arnott et al., 2017).