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Comparison of the thermoregulatory behaviours of low and high producing dairy cows in a hot environment

İbrahim Tapkı *, Ahmet Şahin

Department of Animal Science, Agriculture Faculty, Mustafa Kemal University, Hatay, Turkey

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Abstract

This study was carried out to compare the thermoregulatory behaviours of low and high producing dairy cows in a hot environment. Forty-one Holstein Friesian cows in their first lactation were allocated to two groups ($n = 21$ for group 1, $n = 20$ for group 2) on the basis of their milk production: low (<20 kg) and high (>25 kg). For a period of 4 weeks, and 2 days per week, the behaviour of each cow was registered every 10 min for 6 h (06:00–07:00 h, 10:00–11:00 h, 13:00–14:00 h, 16:00–17:00 h, 20:00–21:00 h and 23:00–00:00 h), recording the frequency of eating, drinking, ruminating, standing, resting and locomotion. When air temperature increased from 06:00 a.m. to 16:00 p.m., the frequencies of eating (31.7–17.4%) and ruminating (18.1–14.6%) decreased while standing (25.0–38.4%) and drinking (5.2–7.4%) increased in high producing dairy cow ($P < 0.001$). However, the changes the respective frequencies for low producing dairy cows were 21.5–15.7% for eating, 12.4–17.3% for ruminating, 23.1–33.8% for standing and 2.1–5.9% for drinking during the same times of day ($P < 0.001$).

However, the changes the respective frequencies for low producing dairy cows were 21.5–15.7% for eating, 12.4–17.3% for ruminating, 23.1–33.8% for standing and 2.1–5.9% for drinking during the same times of day ($P < 0.001$). Overall, low and high producing dairy cows showed 14.3% versus 18.5% eating, 2.8% versus 4.5% drinking, 21.0% versus 19.4% ruminating, 28.4% versus 30.1% standing, 26.0% versus 24.1% resting, 5.5% versus 1.7% locomotor and 2.1% versus 1.7% other activities, respectively ($P < 0.001$).

* Corresponding author. Tel.: +90 3262455845; fax: +90 3262455832.
E-mail address: itapki@mku.edu.tr (İ. Tapkı).

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In conclusion, high producing dairy cows were more sensitive than low producing dairy cows as shown by the former cows spending more time in standing but less time resting and in locomotor activity.

Keywords: Dairy cow; Behaviour; Milk production; Heat stress; Hot environment

1. Introduction

A hot thermal environment is a major factor that can negatively affect milk production of dairy cows, especially having a higher genetic merit (Kadzere et al., 2002) and heat stress can have negative effects on the welfare (Young, 1993; Jacobsen, 1996). In the subtropical-Mediterranean zone during the summer it is very hot and dry. The temperature rises up to 38 °C in this season (Strahler and Strahler, 1984). Therefore, animals are exposed to heat stress for 3–5 months annually (Habeeb et al., 1992; Silanikove, 1992, 2000).

High producing dairy cattle need environmental improvements such as comfort in internal and external housing conditions. Lactating dairy cows prefer ambient temperatures of between 5 and 25 °C, called ''thermoneutral'' zone (Roenfeldt, 1998), above which the cows can no longer cool themselves adequately and enters heat stress (Bligh, 1973). Milk production leads to metabolic heat production due to metabolism of large amount of nutrients, making the high producing cows more vulnerable to heat stress than lower yielding individuals (Kadzere et al., 2002). Consequently, in early lactation high producing dairy cows are quite sensitive to heat stress and their milk production declines significantly when exposed to hot environment (Igono and Johnson, 1990) because of homeostatic mechanisms aiming at cooling the body by lower feed consumption and increased water intake. In cold climate, animals increase their nutrient intake to generate heat which contributes to maintain body temperature. This homeostatic mechanism also runs with the changes in physiology of a cow, affecting milk production efficiency and, consequently, profitability of dairy enterprises (Kadzere et al., 2002) which consider their welfare, even though these high genetic potential cows are imported to either tropical or subtropical countries where their production capacity may be lowered because of the interaction of the dairy cow and its environment. Therefore, the aim of the present study was to determine the thermoregulatory behaviours of dairy cows, both low and high producing kept in a hot environment.

2. Material and methods

This study was carried out in Ceylanpınar State Farm in Turkey. Ceylanpınar is located at 36°51′ north latitude and 40°03′ east longitude in the Eastern Mediterranean region. In this location, animals are exposed to high temperatures for 3–5 months in summer annually. The recorded average temperature and humidity, respectively, for this location were 26.20 °C, 35.60% at 07:00; 40.17 °C, 15.94% at 14:00; 31.19 °C, 18.63% at 21:00 in