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Abstract

Metabolic Adaptations to Dynamic Energy Requirements during Lactation and Pregnancy in Dairy Cows with Varying Proportions of Holstein and Simmental Breed †

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Abstract: Depending on the breed or crossbreed line, cows have to cope with a more or less severe negative energy balance during the period of high milk yields in early lactation, which can be detected by beta-hydroxybutyrate (BHBA) and non-esterified fatty acids (NEFAs) in blood. Preventing cows from undergoing a severe negative energy balance by breeding and/or feeding measures is likely to be supported by the public and may help to improve the sustainability of milk production. The aim was to compare BHBA and NEFA concentrations in the blood of Holstein and Simmental cows and their crosses during the prepartum period until the end of lactation. In total, 164 cows formed five genetic groups according to their theoretic proportion of Holstein and Simmental genes as follows: Holstein (100% Holstein; n = 9), R1-Hol (51–99% Holstein; n = 30), F1 crossbreds (50% Holstein, 50% Simmental; n = 17), R1-Sim (1–49% Holstein; n = 81) and Simmental (100% Simmental; n = 27). NEFA and BHBA were evaluated once a week between April 2018 and August 2019. A mixed model analysis with fixed effects breed, week (relative to calving), the interaction of breed and week, parity, calving year, calving season, milking season, and the repeated measure effect on cows was used. Holstein cows had higher NEFAs (0.196 ± 0.013 mmol/L), and Simmental cows had the lowest NEFA concentrations (0.147 ± 0.008 mmol/L, p = 0.03). R1-Sim, F1 and R1-Hol cows had intermediate values (0.166 ± 0.005, 0.165 ± 0.010, 0.162 ± 0.008 mmol/L; respectively). The highest NEFA value was found in the first week after calving (0.49 ± 0.013 mmol/L). BHBA did not differ among genetic groups (p = 0.1007). There was, however, an interaction between the genetic group and week (p = 0.03). While Simmental, R1-Sim and F1 cows had the highest BHBA value, the second week after calving (0.92 ± 0.07 and 1.05 ± 0.04, and 1.10 ± 0.10 mmol/L, respectively), R1-Hol and Holstein cows showed the BHBA peak at the fourth week after calving (1.16 ± 0.07 and 1.36 ± 0.12 mmol/L, respectively). Unexpectedly, Holstein cows had a high BHBA peak again at week 34 after calving (1.68 ± 0.21 mmol/L). The genetic composition of the cows affects NEFA and BHBA. Simmental and R1-Sim cows mobilize fewer body reserves after calving. Therefore, dairy cows with higher degrees of Simmental origin might be more sustainable in comparison with Holstein genetics in the present study.

Keywords: sustainable animal health

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