GRAZING VERSUS GRASS-FEEDING INDOORS OF DAIRY COWS: EFFECTS ON HEPATIC AND PLASMA PARAMETERS

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Grazing dairy cows were compared with cows fed grass indoors for mRNA expression of hepatic genes encoding enzymes and nuclear receptors, and for plasma concentrations of metabolites and hormones. The hypothesis to be tested was that metabolism of grazed vs. zero-grazed dairy cows is differently regulated due to an expected higher energy expenditure of cows on pasture.

The study consisted of 3 experimental periods (spring, summer, autumn) of 14 d each, involving 18 lactating Holstein cows. Cows were allocated randomly to the treatment grazing from pasture (PAST, n=9) or to the treatment having ad libitum access to grass cut from the same paddock in a free-stall barn (STALL, n=9). Throughout the study period, cows were supplemented with concentrate to meet the calculated extra energy requirement for milk production. Blood and liver samples were collected at the end of each experimental period when the cows were 66, 115 and 192 DIM. Blood plasma was assayed for concentrations of metabolites and hormones. Liver samples were measured for mRNA abundance by real time RT-PCR of 15 target genes encoding enzymes and nuclear receptors involved in gluconeogenesis, fatty acid beta-oxidation, fatty acid and triglyceride synthesis, ketogenesis, citric acid cycle, cholesterol synthesis, and the urea cycle.

The higher T3 plasma concentrations in PAST cows compared to STALL cows across seasons (P < 0.05) may imply a higher energy expenditure of PAST vs. STALL cows, although glucose concentrations were similar between groups. The likely higher physical activity in PAST cows may have resulted in increased oxidation of fatty acids, which explains the lower NEFA concentrations compared to STALL cows, especially in springtime (P < 0.05). The lower NEFA concentrations in PAST cows may furthermore explain the lower mRNA abundance of glycerol-3-phosphate acyltransferase (GPAM) and liver X receptor α (LXRA) across seasons compared to STALL cows, as both hepatic parameters play roles in hepatic lipid metabolism involving the uptake of fatty acids in the liver for biosynthesis of triglycerides. In conclusion, the observed differences in liver and plasma parameters confirm our hypothesis that metabolism is different between STALL and PAST cows. Additionally, the results show that these differences are related to lipid metabolism.