Diets supplemented with various lipid sources differently affect selected milk metabolites concentrations in cows and goats

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Abstract

Previous research has shown that animal husbandry factors such as diet composition and intake can alter milk content of selected metabolites (Larsen *et al.*, 2016). Our objectives were to determine the effects of species (cow vs goat) and dietary lipid supplements known to largely impact milk fat content at least in cows, on selected metabolites and enzymes in milk. Twelve Holstein cows and 12 Alpine goats, all multiparous, nonpregnant and at 86 ± 24.9 and 61 ± 1.8 DIM respectively, were fed a basal diet (45% forage + 55% concentrate) not supplemented (CTL) or supplemented with corn oil plus wheat starch (COS; 5% diet dry matter (DM)), marine algae powder (MAP; 1.5% diet DM), or hydrogenated palm oil (HPO; 3% diet DM) in a replicated 4×4 Latin square design with 28-d experimental periods. Data on intake and milk production were reported in Fougere *et al.* (2018). B-hydroxybutyrate (BHBA), isocitrate, glucose, glucose-6-phosphate, glutamate, cholesterol, choline, free amino acid group, urea, alkaline phosphatase and lactate dehydrogenase were analysed (Larsen *et al.*, 2016, 2017) on morning milk samples collected on d24 of each experimental period.

Production data from this experiment is reported elsewhere (Fougère *et al.*, 2018). In cows, milk fat content was lowered by COS and MAP (-45% and -22% respectively; $p<0.001$) and increased by HPO (+13%; $p<0.001$) compared with CTL, whereas in goats only MAP decreased milk fat content (-15%; $p<0.001$) compared to CTL. Energy and protein balance were positive for all treatments in both species.

Regarding milk metabolites and enzymes, irrespective of diet, cow milk was richer in alkaline phosphatase and glucose compared to goats (16 and 3 times more respectively, $p < 0.01$), whereas goat milk contained more urea and glucose-6-phosphate compared to cows (1.9 and 5.3 times more respectively, $p < 0.01$). In cows, COS decreased BHBA and choline (- 25 and -24% respectively; $p < 0.001$) compared to CTL whereas no effects were observed in goats. COS and MAP increased milk isocitrate compared to CTL in cows, but decreased isocitrate concentrations in goat milk. In cows, milk choline was correlated with milk fat content ($r=0.693$, $p=0.001$), and lactate dehydrogenase was correlated with milk somatic cells count ($r=0.839$, $p=0.001$) but not in goats.

We provide evidence of different milk metabolite responses according to species and diets. Metabolites or enzymes secreted in milk may be indicators of specificities of lipid metabolism among ruminant species, and may contribute to a better understanding of mechanisms regarding milk fat secretion processes.

Fougère, H., C. Delavaud, and L. Bernard. 2018. Diets supplemented with starch and corn oil, marine algae, or hydrogenated palm oil differentially modulate milk fat secretion and composition in cows and goats: A comparative study. Journal of dairy science 101(9):8429-8445.

Larsen, T., L. Alstrup, and M. R. Weisbjerg. 2016. Minor milk constituents are affected by protein concentration and forage digestibility in the feed ration. Journal of Dairy Research 83(1):12-19.