Effect of dietary lipids in dairy cow diets: A nutrigenomic approach

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Introduction: In the last decade, there has been an increase in the consumer demand for milk with higher proportions of healthy fatty acids (FA) such as unsaturated FA (e. g., C18:1t11 and C18:2 c9, t11). Manipulating the diet of the dairy cow is one practical way to alter the FA profile of milk fat. The different chemical structure of dietary lipids may result in different intermediates of biohydrogenation, which may affect differently, the pathways of lipid metabolism partly through changes in lipogenic gene expression (in adipose and mammary tissue).

Objectives: The first objective of this study is to determine the effects of degree of saturation of dietary lipids on the mRNA abundance of 32 genes involved in lipid synthesis and secretion in mid-lactating dairy cows. This objective will be achieved by supplementing dairy cows with residual olive oil (unsaturated FA source) or hydrogenated palm oil (saturated FA source) for 63 d. The second objective is to determine the effects of the number of double bonds of dietary lipids on the mRNA abundance of 32 genes involved in lipid synthesis and secretion in mid-lactating dairy cows. This objective will be achieved by supplementing dairy cows with fish oil (high in EPA and DHA) or soybean oil (high in C18:2n6) for 63 d.

Preliminary results: Fifteen cows averaging 189 ± 28 days in milk (average ± SD) at the beginning of the study were randomly assigned to treatment groups. During 63 d animals were fed a control diet with no added lipid (n = 5 cows; basal diet), and fat-supplemented diets containing OO (n = 5 cows; 30 g/kg DM) and HVO (n = 5 cows; 30 g/kg DM). Adipose tissue (AT) was obtained from the tail-head area at the onset of the study and after 63 d of supplementation. Compared with control and HVO, OO increased ($P < 0.05$) milk yield, and reduced ($P < 0.05$) milk fat yield and milk somatic cell counts. Relative expression was determined using P0 as a reference condition. OO upregulated ($P < 0.05$) the expression of ACACA, PLIN2, THRSP, DGAT1, LPL and FABP4. HVO upregulated ($P < 0.05$) the expression of SLC27A6. Overall, OO upregulated some genes related to FA metabolism in adipose tissue whereas HVO induced upregulation on a gene related to FA import.

Conclusions: Until now, our results suggest that unsaturated lipid sources may have stronger lipogenic effects in bovine AT than saturated sources in long-term supplementation. This study provides further knowledge on FA metabolism in AT and data can be used to develop new strategies for a better nutritional management in dairy cows.

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