EFFECTS OF LIVE YEASTS ON THE FATTY ACIDS BIOHYDROGENATION BY RUMINAL BACTERIA

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Ruminants only absorb a little part of dietary unsaturated fatty acids, because rumen microorganisms hydrolyse the dietary triacylglycerols and then hydrogenate the unsaturated fatty acids. Ruminal biohydrogenation (BH) of linoleic acid (C18:2) comprises three steps: isomerisation to conjugated linoleic acids (CLA), mainly cis9,trans11 (CLAc9t11) and trans10,cis12 (CLAt10c12) isomers; hydrogenation of CLA to trans monoenoic acids (C18:1t), mainly trans11 and trans10 isomers; and finally hydrogenation of C18:1t to stearic acid (C18:0) (Figure 1). Unsaturated fatty acids, and some intermediates of BH like CLA could have beneficial dietetic properties for consumer.

Addition of live yeasts in high concentrate diets for ruminants has proved to maintain the ruminal pH above 6, this pH favouring BH. Moreover, yeasts improve the growth of the Megaspera elsdenii population in the rumen, which is able to isomerise C18:2 to CLAt10c12, and so favour trans10 isomers.

The objective of this study was to examine the effects of live yeasts on ruminal BH in dairy cows receiving a low fibre diet without added fat.

Materials and methods: Three ruminally fistulated dairy cows were given three diets based on maize silage (control diet, control diet + 0.5g/d or control diet + 5.0g/d of Saccharomyces cerevisiae NCYC SC47), according to a Latin Square design. Ruminal contents were sampled and liquid and solid phases were separated through a 0.25mm sieve. Fatty acids profiles were obtained by gas chromatography. Proportions of fatty acids (% of total fatty acids) in the rumen contents were statistically analysed with analysis of variance. Effects included diet, period, cow, and ruminal phase. Contrasts between control and both yeast diets, and between the two yeast diets were computed. Differences were considered significant at $P < 0.10$, and as a tendency when $0.10 < P < 0.15$.

Results: The addition of yeasts led to a greater pH than control diet, and maintained pH above 5.5 and 5.9 respectively for 0.5g and 5.0g added yeasts (Figure 2). With the added yeast diets, there was a significant decrease of the proportions of some saturated fatty acids: C14:0 (myristic acid), C15:0, C17:0, C18:0 (stearic acid), and C18:1c11 and C18:1t16 (Table 1). On the other hand the proportions of C18:2 and C18:1c9 (oleic acid) significantly increased (respectively by 32 % and 16 %), and that of CLAc9t11 tended to increase. No difference was observed between the two doses of yeasts.

Discussion: Contrarily to what could be expected due to a higher pH and a possible increase of Megaspera elsdenii activity, the addition of yeasts did not increase the extent of BH nor favour trans10 isomers: the increase of C18:2 and C18:1c9 and the decrease of C18:0 (respectively by 32 % and 16 %) was found. Possible explanations are:

1. The diet used in this experiment did not provide enough long fibre to improve the growth of cellulolytic bacteria, which produce BH enzymes, so that the extent of BH was limited even if the pH was maintained near 6.
2. The trans10 isomers BH pathway needs both a competent Megaspera elsdenii population and a low pH in the rumen or/and a high starch supply.

Conclusions: The addition of live yeasts in the ration of dairy cows can increase the proportion of unsaturated fatty acids in the rumen content by lowering the extent of fatty acids BH. This could be a way to increase their proportions in milk, without increasing trans10 isomers. However, more investigations are necessary to confirm this point and the effects on milk fat composition.