Can condensed tannins from legumes affect milk and cheese quality?

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Introduction

Even when dietary lipids have a high proportion of polyunsaturated fatty acids (PUFA), their proportion in dairy products is low. By contrast, the proportion of saturated fatty acids (SFA), whereof some representatives are considered as unhealthy, is high (Livingstone et al., 2012). Through a large rate of biohydrogenation in the rumen, a major part of the dietary PUFA, especially linoleic acid (LA) and α-linolenic acid (ALA) are transformed to SFA by rumen microbes. It has been shown that condensed tannins (CT) have the potential to reduce fatty acid biohydrogenation (Buccioni et al., 2015). Thus, the objective of the present study was to evaluate to which extent diets containing different proportions of CT from forage legumes can improve milk and cheese quality through increasing the PUFA proportion without affecting their sensory properties.

Material and methods

A feeding experiment was conducted with 24 Holstein cows allocated to four treatments. The experiment was divided into two periods of 26 days each: a control period (CoP) and an experimental period (ExP). During CoP, all cows received a basal diet consisting of hay, maize silage, linseed, concentrate and dehydrated lucerne (LU) pellets (45:25:5:7:18). In ExP, LU was replaced by either sainfoin (SF; 19% CT) or one of two cultivars of birdsfoot trefoil (Polom, BP, 3% CT; Bull, BB, 5% CT) in three of the four groups. During the three last days of each period, milk was collected to analyse milk quality, fatty acid profile and to access milk odour by a trained panel. The same milk was used to fabricate Gruyère-type cheeses (three cheeses per treatment and period). After 8 months of ripening, fatty acid profiles of the cheeses were determined and the sensory quality was evaluated by a trained panel using a ranking scale (from 0 to 10). Data of milk and cheese data were analysed using the MIXED procedure of SAS. Two comparisons were of interest: 1) comparison of ExP vs CoP within a treatment and 2) comparison of the experimental treatments (LU, BB, SF, BP) in ExP. Least squares means were compared using the PDIFF statement with the Tukey adjustment. Probability levels of $P<0.05$ were considered significant. Data from the cheese appreciation were

analysed based on a non-parametric ANOVA-type test using the 'nparLD' package of the R software.

Results and discussion

Feeding CT via legumes had no impact ($P>0.10$) on feed intake or on milk yield. From CoP to ExP, milk urea concentration was reduced ($P<0.001$) by 23% with SF, remained unchanged with BP and tended to increase ($P< 0.10$) with LU and BB, even though crude protein intake was similar between the four groups. In addition, in ExP, cows fed SF had the lowest ($P< 0.001$) milk urea concentration compared to the three other groups. These results suggest that ruminal protein degradation was slowed down in cows fed SF, which is consistent with previous observations of Scharenberg et al. (2007). Switching to ExP resulted in a 17% increase in the proportion of ALA in the lipids of both the milk ($P=0.07$) and the cheese ($P<0.001$) of cows fed SF. In addition, a concomitant increase in the proportions of 20:5*n*-3 and 22:5*n*-3 ($P<0.10$) in the cheese produced from milk of SF cows was also observed. These findings corroborates results of previous studies on the effect of CT on the fatty acid profile of milk of ewes (Buccioni et al., 2015). The two birdsfoot trefoil cultivars had opposite effect on ALA proportion in the cheese. From CoP to ExP, ALA proportion in the cheese increased ($P=0.04$) by 3% for the BP whereas it tended to decrease ($P=0.07$) for the BB group respectively. The odour of the milk from the BB group was judged to be different ($P<0.05$) from the odour of the milk from the LU group in the ExP. Regarding the cheese appreciation, cheeses produced from milk of cows fed CT were harder ($P<0.05$) and tended to be less adhesive ($P=0.08$) on the palate compared to LU cheese.

Conclusion

Comparing the three plants containing CT, SF had the greatest impact manifested by increasing the level of some beneficial PUFA and reducing milk urea level without negatively affecting cheese quality. This was also the forage legume with the greatest CT content. Interestingly, despite similar CT contents, the two birdsfoot trefoil cultivars had opposite effects on milk urea and ALA deposition, probably due to a different structure of the CT.

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