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Effect of chestnut tannin in the diet of lactating ewes on milk and cheese quality

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ABSTRACT: A commercial product consisting of pure soluble tannins extracted from chestnut wood was introduced into the diet of lactating ewes at pasture, at the level of 20 g / head / day in the concentrate mixed feed. The supplementation with tannins did not exert any influence on milk yield and on lactose and fat content of milk, but induced an increase in milk protein yield, apparently in heat coagulable proteins. This is maybe due to an increase of the rumen undegradable fraction of dietary proteins. The somatic cells count and the bacterial load of milk were not affected as well. Further studies are needed to confirm these important results, in order to optimize the nitrogen metabolic balance of ruminant animals, among the other advantages.

Key words: Chestnut tannin, Sheep milk, Sheep cheese.

INTRODUCTION – One of the major problems linked to the most adequate feeding of dairy ruminants (cows, ewes and goats) is represented by the dietary undegradable protein fraction, escaping the microbial rumen degradation, which is often too small (Jones *et al.*, 1994; Narijsse *et al.*, 1995; Bhatta *et al.*, 2005; Min *et al.*, 2005). Aim of the present experiment, whose results are the first preliminary ones, was to study the effect of the supplementation to the diet of lactating Massese ewes with a commercial tannin product (commercial name “Saviotan Feed”), extracted from chestnut wood, on the quality of both milk and related cheese.

MATERIAL AND METHODS – Sixteen lactating ewes, at their second lambing, were randomly allotted to 2 groups of 8 animals each, homogeneous for body weight (47 ± 1 kg) and stage of lactation. The feeding regimen was based on natural pasture, grazed *ad libitum*, mixed natural hay (850 g / head / day) and a concentrate feed (400 g / head / day, table 2). The botanical composition of pasture was made up of about 50% graminæ and 10% legumes. The rest was represented by Caryophyllaceae, Ranunculaceae, Rosaceae, Rubiaceae, Geraniaceae (25%), Compositae, Cyperaceae, Linaceae (9%) and Scrophulariaceae, Umbrelliferae, Convulvaceae (6%). The tannin product was added to the mixed feed administered to the “experimental group”, at the level of 5% of the same mixed feed, to be compared with the other group, the “control” one, with no addition. The commercial product is a light brown powder extracted from chestnut wood and almost entirely composed of soluble tannins (table 1). Each week, for a period of 3 weeks, individual samples of milk were collected to be analyzed for fat, proteins, lactose, somatic cells and bacterial load. Since the goal of the experiment was the comparison of milk and cheese samples of treated animals with the samples of untreated ones, the differences were statistically analysed by the “t” test of Student between two sample means (SAS, 2001). Even though the figures in the table are expressed as real counts, they have been transformed into logarithms for the adequate statistical comparison.

RESULTS AND CONCLUSION – The preliminary results are gathered in table 3. The presence of the chestnut tannin product in the diet fed to the treated ewes had no influence on milk yield and on the concentrations of fat and lactose in milk, as it was expected, but had a marked positive effect on the level of milk proteins, which were augmented up to 5.39 %, with a statistically significant increment of about 5 g per kg milk (about 10% increase). The experiment was carried out on a private farm, where it has been impossible to perform scientifically acceptable measures of milk yield. According to the shepherd, there was no difference in milk yield and cheese yield between the two treatments (about 900 g/d, on average).

This is the reason why the significance of differences was statistically analysed for fat, proteins and lactose only. The increased amount of milk protein resulted in an increased amount of cottage cheese (ricotta), essentially. This observation makes us think that lactalbumins were the protein fraction principally affected by the dietary treatment. The tannin treatment did not have any significant effect on somatic cells and bacterial load.

But the ordinary cheese itself was affected by the tannin treatment (table 4). In fact, both the protein and fat content, on the dry matter basis, of the cheese samples obtained from the milk of the ewes treated with tannin in their diet were higher ($P < 0.01$).

That means a richer cheese both in protein and fat, on the dry matter basis.

Table 1. Chemical composition of the tannin product.

Dry matter, %	92
Tannins, % (minimum)	75
pH	3.2
Water insoluble fraction, % (maximum)	1
Ash, %	3.5
Crude fibre, %	1.0
NDF, %	2.5
ADF, %	1.5
ADL, %	1.0
Total sugars, %	2
Crude protein, % (maximum)	4
Calcium, ppm	800
Phosphorus, ppm	50
Magnesium, ppm	200
Potassium, ppm	120
Sodium, ppm	40
Copper, ppm	10
Zinc, ppm	20
Manganese, ppm	280

Table 2. Ingredient composition of concentrate mixed feed (kg / 100 kg feed).

maize grain	40
wheat bran	30
soy bean meal 48	15
sunflower cake 48	10
Calcium di-phosphate	2
Calcium carbonate	2
Mineral vitamin supplement	0.50
Sodium chloride	0.25
Choline HCl	0.25

It may be thought, as a scientific hypothesis, that the tannin product induced an increase of the amount of the undegradable fraction of dietary proteins, capable of escaping the proteolytic activity of rumen bacteria. The scientific literature on the subject fortifies such a hypothesis, which needs further investigations to be confirmed.

The product did not appear to have exerted any effect both on the somatic cells count and on the bacterial load of milk. A parallel experiment, conducted on lactating dairy cows, while confirming the effect of the product on the

milk protein concentration, seems to have beneficially influenced the somatic cells count of milk. Again, another aspect waiting for an experimental confirmation.

In conclusion, even though this is a provisional conclusion, the supplementation of chestnut tannin at the level of 20 g / head / day, as adopted in the present experiment, appears a recommendable feeding habit to increase the protein content of milk, in this case of sheep milk, most probably by enhancing the heat coagulable proteins, so increasing the yield of total amount of cheese which may be produced.

Table 3. Major chemical traits, somatic cells and bacterial load of milk samples.

	fat, %	proteins, %	lactose, %	SC/ml	BL/ml
control group	7.24±0.35	4.91±0.38 ^a	4.71±0.18	774,600	2,984,600
treated group	6.61±1.78	5.39±0.24 ^b	4.47±0.28	1,370,670	2,742,830
difference	- 0.63	+ 0.48	- 0.24	+ 596,070	- 241,770

^{a,b} = $P < 0.05$ in the same column.

Table 4. Protein and fat content of cheese samples, on the dry matter basis (means ± SD).

	fat, %	proteins, %
control group	34.39 ± 0.65 ^A	40.70 ± 0.46 ^A
treated group	36.99 ± 0.55 ^B	43.73 ± 0.06 ^B
difference	+ 2.60	+ 2.03

^{A,B} = $P < 0.01$ in the same column.

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