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Effects of soap supplies on goat milk production and composition

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SUMMARY – To determine the possibility of obtaining goat milk with a high dietetic quality, an experiment was carried out using two groups of goats. Animals were fed with either a diet supplemented (9%) or not supplemented (0%) with a protected fat rich in polyunsaturated fatty acids (PUFA). These diets were completed diets, pelletted and administered in this way together with a long fiber food, cereal straw. Feed intake was lower for goats fed the supplemented diet. Type of diet had no effect on milk production. However milk dry matter (DM) and fat contents were higher for goats fed the diet supplemented with the protected fat whereas protein content was lower. Type of diet affected fatty acid composition of the milk fat. Thus, the percentages of monounsaturated and polyunsaturated fatty acids in milk fat were higher for goats fed the diet supplemented with the fat. It is concluded that the use of protected fats rich in PUFA may be an appropriate strategy to improve the healthy quality of goat milk.

Key words: Goat feeding, protected fat, PUFA, milk composition, dietetic quality.

RESUME – *"Effets de l'apport de savons sur la production et la composition du lait de chèvre". Afin d'obtenir du lait de chèvre à une haute qualité diététique, on a réalisé un essai en utilisant deux lots des chèvres. Les animaux ont reçu deux régimes, contenant ou non 9% d'une matière grasse protégée (MGP), riche en acides gras polyinsaturés. Les régimes experimentaux étaient des rations complètes, granulées et distribuées en présence de paille de céréale. L'ingestion du régime avec MGP était la plus basse. Nous n'avons pas trouvé d'effet de la nature du régime sur la production du lait. Toutefois les teneurs en matière sèche et matière grasse du lait étaient plus élevées chez les chèvres qui consommaient le régime avec MGP ; en revanche, la teneur en matières azotées etait moins élevée avec ce régime. Le type du régime influencait la composition en acides gras. Les pourcentages en acides gras monoinsaturés et polyinsaturés de la matière grasse du lait étaient les plus élevés chez les chèvres qui consommaient le régime avec de la MGP. En conclusion, l'utilisation des matières grasses protégées et riches en acides gras polyinsaturés peut être une stratégie pour améliorer la qualité diététique du lait de chèvre.*

Mots-clés : *Chèvres, matière grasse protégée, acides gras polyinsaturés, composition du lait, qualité diététique.*

Introduction

The improvement of any milk quality by selection of animals involves a long time. However results can be obtained in a shorter time by the manipulating of the corresponding feeding (Murphy, 1995). In this sense the polyunsaturated fatty acids (PUFA) content of any milk fat is an important aspect establishing its dietetic quality. Changes in milk fat composition of rumen animals can be achieved using protected fats to annul the action of the rumen, on the basis being then absorbed at abomasal and intestinal level would determine milk fat composition (Boza, 1992). A first and positive results were obtained in this way (Pérez *et al.,* 1996), using Granadina goats fed with either a concentrate without supplementation or supplemented with different degrees of a protected fat, which was rich in PUFA. From the results obtained it was concluded that improvement of the healthy quality of goat milk fat is possible, being necessary the animal follow an adequate feeding behaviour with regard to the feed intake and to the established hay/concentrate ratio. In the present study results are presented from an experiment on Granadina goats that were fed with either a diet supplemented or not supplemented with a protected fat, calcium soap, rich in PUFA. With the aim of getting a constant composition of the corresponding intakes, hay and concentrate fractions of the diets were mixed and pelletted being administered in this way.

Material and methods

Experimental design and procedure

Forty goats of the Granadina breed, midway through second lactation were divided into two equal groups based on body-weight and milk production. Each animal received a daily ratio consisting of 1.0 kg of forage, good quality alfalfa hay, and 1.0 kg of concentrate. The concentrate ingredients were barley, corn gluten feed, faba beans and mineral complement being either not supplemented (diet 1) or supplemented (diet 2) with a 9.0 percent of a protected fat, calcium soap, rich in PUFA. Once chopped and mixed the forage fraction and the ingredients of each concentrate were pelletted to be thus administered. To observe in some of the animals fed with the diet supplemented with the fat an intestinal trouble, esteatorrhoea, it was considered also necessary to administer together with the ration, a long fibre food, cereal straw (500 g/animal per day), with which that trouble disappeared.

At the beginning of the experiment the animals were allocated in groups. Those fed with the diet supplemented with the protected fat received this progressively, over a period of at last one month. Once the diet was accepted, the animals were housed individually in metabolic boxes to carry out a balance and milk production trial. Once the animals were adapted to the new conditions, feed intake and milk production were recorded daily during the following five days, principal trial period. At 09.00 hours every day, the remainder of the previous day's feed was collected and the goats were milked by hand. Afterwards, ration was given together with water *ad libitum* for all animals.

Measurements and analysis

Aliquots of the milk produced during the principal trial period were stored at –30°C before analysis. Dry matter (DM), fat and N contents of these samples were determined in the fluid milk. All other analyses were determined by lyophilization and N by the Kjeldahl method, calculating the amount corresponding to protein by multiplying by 6.38. Fat contents were determined by the Gerber method and ash in an electric oven at 550°C. The amount of lactose in the different samples of milk was calculated by the difference between the corresponding DM and the sum of protein, fat and ash. To determine the fatty acid composition of the milk fat, the fatty acid methyl esters were separated on an Autosystem Gas Chromatograph (Perkin-Elmer Corp.) with a flame ionization detector. The temperature was programmed from 60 to 70°C at 2°C/min and from 70°C to 250°C at 20°C/min. Helium was the carrier gas (14 psi).

The results obtained were analysed statistically in accordance with the general linear model. The fatty acid composition of the milk fat was analysed using as a covariance factor the corresponding diet intakes.

Results and discussion

Table 1 shows the mean values for DM intake and those for milk production and composition in terms of DM, protein, fat and lactose as well as the effect of diet on these values. The type of diet affected DM intake ($P < 0.001$). This value was lower for goats fed the diet supplemented with the protected fat. This result is typical when using this type of supplementation (Morand-Fehr *et al.,* 1981) due probable to the higher energetic density of the diet. However type of diet induced changes in milk DM ($P < 0.01$), protein ($P < 0.001$) and fat content ($P < 0.001$). Thus milk DM and fat contents were higher for goats fed the diet supplemented with the fat whereas protein content was lower. When in the goat it is used diets supplemented with protected fats, the effect caused on the milk produced is not constant and a lower output (Morand-Fehr *et al.,* 1991; Guevara *et al.,* 1994) or an equal output (Guevara *et al.,* 1992) may be obtained. At the same time, the use in the goat of diets supplemented with fat has given variable results on milk composition, resulting in some cases in an increased lipid secretion associated with an increase in milk output, milk fat level, or both together with a decrease in milk protein level. This last result could be justified by physiological reasons (Morand-Fehr *et al*., 1991). In our case and in spite of the lower feed intake, the fat supplementation gave rise to a similar milk production together with a higher and a lower milk fat and protein concentration, respectively.

Table 1. Dry matter intake and milk production and composition. Effect of type of diet

Diet	1	2	Significance level
DM intake (g/day)	1995	1532	***
Milk production (g/day)	1978	1848	NS
Milk composition			
DM (%)	13.15	13.9	**
Protein (g/kg)	36.4	34.5	***
Fat (g/kg)	44.3	51.8	***
Lactose (g/kg)	42.9	44.7	NS

**P < 0.01, ***P < 0.001, NS = non significant.

Table 2 shows the fatty acid composition of the milk fat from goat fed the diet either supplemented or not supplement with the protected fat as well as the effect of the covariance factor and type of diet. Covariance factor and specially, type of diet had a significant effect (P < 0.05) on the majority of these values. The use of the protected fat in the ruminant diets is a strategy designed to improve the negative energy balance produced at the beginning of lactation. At the same time, the fatty acid composition of the milk fat may be affected by that of the fat used (Morand-Fehr *et al*., 1991) that were conformed by the results here obtained. According to the nature of the utilized fat, it was obtained a milk fat with a higher PUFA concentration together with a lower saturated/unsaturated fatty acids ratio.

Table 2. Fatty acid composition (%) of milk fat. Effect of covariance factor and type of diet

	Diet		Level of significance	
	1	2	Covariance	Diet
C4:0	2.2	2.6	NS	NS
C6:0	2.9	3.0	NS	NS
C8:0	3.7	3.6	NS	NS
C10:0	13.0	10.4	*	***
C12:0	7.0	4.7	NS	***
C14:0	12.2	10.3	*	***
C14:1	0.7	0.6	NS	NS
C16:0	27.1	27.2	NS	NS
C16:1	1.2	1.7	NS	***
C17:0	0.7	1.0	NS	***
C18:0	7.3	6.6	***	*
C18:1	17.5	21.1	NS	***
C18:2	3.6	3.2	NS	NS
C18:3	0.4	2.4	***	***
C20:0	0.3	0.5	***	***
C20:2	0.1	0.3	***	**
C20:3 + C20:4	0.2	0.9	***	***
Monounsaturated	19.3	23.4	NS	***
PUFA	3.9	6.7	**	***
Saturated/unsaturated	3.3	2.4	NS	***

*P < 0.05, **P < 0.01, ***P < 0.001, NS = non significant.

From the results obtained it is concluded the use of protected fats rich in PUFA may be an appropriated strategy to improve the dietetic quality of goat milk.

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