

Comparison between Types of Feeding on Goat Milk Composition

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Abstract

Twenty lactating Carpatina goats were randomly allocated to four treatment groups with different levels of concentrates on composition of Carpatina goat milk. Goats in group A were confined and fed alfalfa hay with 1.32 kg/day of concentrate mixture. Group B, C and D were rotationally grazed and received 1.32, 0.66 and 0 Kg/day of concentrate supplementation, respectively. The results obtained from this experiment indicated that goats fed with high concentrate level and pasture grazing (Group B and C) produced milk with significantly higher contents of fat, protein, lactose and total solids than goats kept on pasture alone (Group D) or under a confined feeding system with concentrate and hays (Group A). Grazing significantly increased the concentration of saturated and polyunsaturated fatty acids, such as α -linolenic acid 0.49% (recorded from Group B). The milk from Group A (alfalfa hay and high concentrate) had an α -linolenic acid content of 0.38%.

Keywords: feeding system, goat milk composition.

1. Introduction

Goat milk and its products are an alternative to cow milk and its products [1]. In many developed countries it became a delicate speciality food, such France and Italy.

In what concerns the fatty acids, the goat milk is richer in oleic, palmitic, caproic, capric, caprylic acids than the cow milk. The results of the research concluded that between the goat and cow milk appear some differences in what concerns the distribution and the quantity of fat, protein, lactose and total solids [2,3]. The characteristic smell of goat milk is given by the higher quantity of capric, caprylic and caproic acids. Researchers mention that due to excessive moisture the smell disappears. Excessive feeding with concentrate supplementation to lactating goats is a major

method of improving the milk composition, but only if it is accompanied with intensive grazing.

2. Materials and methods

Intensive grazing may be an alternative to reduce acquisition costs of the concentrate supplementation. Some diets were conceived in order to increase milk production and its content. The goat's paddocks contain a mixture of wheat, clover, rye, chicory, Sudan grass. The forage of the goat was herbage mass (*Festuca arundinacea*, *Dactylis glomerata* and *Lolium perenne*, *Medicago sativa*), alfalfa hay and concentrates. Sample of herbage mass was collected to estimate the dry matter, protein and the organic matter digestibility, as shown in table 1.

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Table 1. Chemical composition (%) of pasture, hay and concentrate

Variable	Pasture	Alfalfa hay	Concentrate
Dry matter	92.8	93.3	89.0
Protein	11.2	15.9	12
Organic matter digestibility	84.7	70.9	95.2

The concentrate composition was: 75% corn, 15% soybean, 3% sodium bicarbonate, 7% mineral and vitamin salts. The concentrate and forages were measured to maintain a minimum quantity of 2-4 kg/day/goat. The goat milk samples were collected at 5 days interval and it was analysed in order to estimate the chemical composition, such as: fat, protein, lactose and total solids.

This study was made on 20 goats (four groups). Group A were fed with alfalfa hay and 1.32 kg per day concentrate supplementation.

Groups B, C, D were fed with vegetative forages and concentrate supplementation as follows:

Group B received vegetative forage and 1.32 kg/day concentrate supplementation. These goats were let to graze.

Group C received vegetative forage and 0.66 kg/day concentrated supplementation, lower than groups A and B and were let to graze, too. Group D did not receive concentrate supplementation, but they were kept on pasture to graze.

Milk samples were collected daily from each group for the analysis of chemical composition. Sample collection started in April and ended in October.

No.	Group	Forage	Concentrate (kg/day)
1	A	Alfalfa hay	1.32
2	B	Grazing	1.32
3	C	Grazing	0.66
4	D	Grazing	0.00

Chemical analysis of goat milk

Fat, protein, lactose and total solids of goat milk were determined using the Ekomilk Total located at the Center for Research in Biotechnology and Microbiology of the University „Lucian Blaga” of Sibiu. This milk analyzer was calibrated monthly using goat milk standards. Fatty acids determination from goat milk was made using a reversed-phase HPLC with spectrophotometric detection at 254 nm. For fat extraction it was used 10 ml of goat milk. Fatty acid methyl esters were prepared by saponification using KOH (0.68M in methanol) followed by transesterification with 20%

boron trifluoride in methanol and analysis by HPLC. The column (900 x 6.4 mm) was Bondapack C-18 and was eluted with acetonitrile-water, at a flow rate of 2ml/min.

The mobile phase was methanol containing some bonds in the same manner and it seems that separations of fatty acid derivatives are less affected by the nature of the gradient when this is used.

These solvents are transparent to UV light at 205 to 210 nm, so UV detection at such wavelengths can be employed. Identification of the peaks was made on the basis of the retention time of standard methyl esters of individual fatty acids.

The final concentration of fatty acids was expressed in µg/ml of milk [4, 5].

3. Results and discussion

It is well known that the composition of goat milk is affected by many factors, such as diet, breed, stage of lactation. The effect of feeding treatments on fat, protein, lactose, total solids and total fatty acids content is presented in table 2.

Table 2. The overall means and standard deviations for goat milk composition (n=20)

Variables	Mean	Standard deviation
Fat %	4.59	±0.04
Protein	3.95	±0.03
Lactose %	4.39	±0.02
Total solids%	12.93	±0.05
Total fatty acids (%)		
SFA	73,58	±1.04
MUFA	22,17	±1.22
PUFA	4,25	±1.29

SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids.

The chemical composition of Carpatina goat milk was significantly different in all four groups: group A (alfalfa hay and high concentrate), group B (high concentrate plus pasture grazing), group C (low concentrate and pasture grazing) and group D (no concentrate, only grazing).

The analyses of the goat milk lead us to the following values presented in the table 3.

Statistical analysis

Data were analyzed using the ANOVA Test (F - test).

Table 3. Effect of different types of feeding on chemical composition of goat milk (average content)

Indices	Goat milk				Standard deviation
	Group A ^a	Group ^b	Group C ^c	Group D ^d	
Fat %	4.18	4.60	4.43	4.21	±0.04
Protein	3.85	4.14	3.87	3.73	±0.03
Lactose %	4.36	4.39	4.42	4.27	±0.02
Total solids%	12.41	13.15	12.76	12.25	±0.05
Total fatty acids (%)					
SFA	72.60*	74.81*	73.69*	73.22*	±1.04
MUFA	24.56*	19.89*	21.41*	22.8*	±1.22
PUFA	2.84**	5.30**	4.90**	3.98**	±1.29

According to F. Pajor et al., 2009, G.F.W. Haelein, 2008

a – confined and fed alfalfa hay and high level of concentrate supplementation; b – grazed with high concentrate supplementation; c - grazed with low concentrate supplementation; d - grazed without concentrate supplementation; *- non significantly difference; **-p<0.01; SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids.

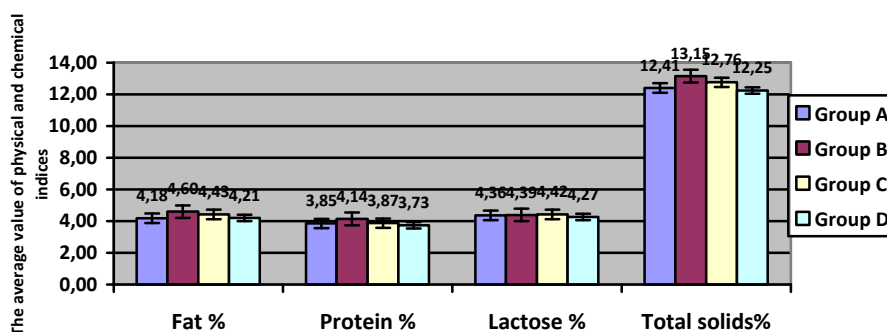


Figure 1. Effect of different type of feeding on chemical composition of goat milk

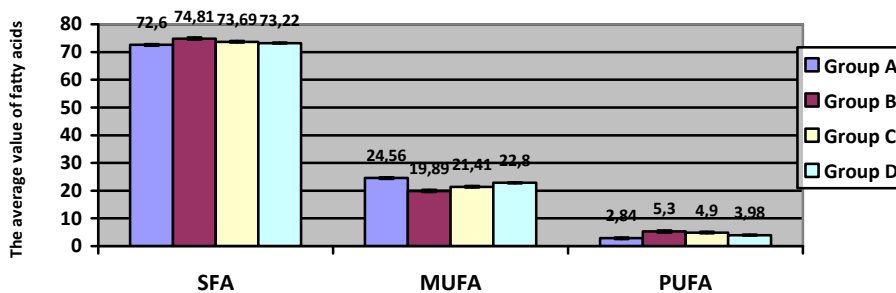


Figure 2. Fatty acids composition of goat milk

Milk from goats in Group B (kept on pasture and received a high level of concentrate supplementation) had significantly higher fat, protein, lactose and total solids contents than other three groups (p<0.05).

The protein content of milk was significantly lower (3.73%) in group D than in other groups. Bernacka et al. (2007) reported similar results; the protein content was 3.26% [6].

In this study, fat content of goat milk showed a higher value at the beginning of lactation (April and May) in group B and C compared to Groups

A and D. This was expected since group B and C were kept on higher nutritional level, while goats in group A were confined and in group D depended only on forage grazing.

The total solids content of goat milk from group B and C followed the trend of fat and protein contents. The lowest value were registered at mid-lactation and it increase to the maximum values at the end of lactation. Guo et al. (2001) reported similar results of decreased total solids content in early lactation, reaching a minimum in mid-lactation [7].

Lactose content registered the highest value at the beginning of lactation. It decreased in June and at the end of lactation.

In group D, where the goats were kept on pasture without concentrate supplementation, lactose content recorded the lowest value at the end of lactation.

These results agreed with what other authors presented that chemical composition of goat milk is determined by the nutritional diet [8].

The fatty acids profiles in our study are similar to the findings of other authors in milk studies [9].

Grazing significantly increased the concentration of saturated and polyunsaturated fatty acids, such as α -linolenic acid 0.49% (recorded from Group B). The milk from Group A (alfalfa hay and high concentrate) had an α -linolenic acid content of 0.38%. Sampelayo et al. in 1998 found the α -linolenic acid content to be 0.3% in goat milk when the animals were fed with alfalfa hay [10].

The monounsaturated fatty acids content in milk from goats fed with alfalfa hay and concentrate supplementation (Group A) recorded the highest percentage (24.56%), but it was less at the other groups B, C and D (19.89%, 21.41%, 22.80%), shown in figure 2.

4. Conclusions

The results of this experiment lead us to the conclusion that the presence of a high level of concentrate supplementation in diets followed by intensive grazing produces significant changes in the goat's milk chemical composition. Groups B and C fed with high concentrate level with pasture grazing recorded significantly higher contents of fat, protein, lactose and total solids. The chemical composition of Carpatina goat milk varied during lactation, with high values in the early and the late lactations.

The effort to increase and change the fatty acids profile in milk dietary manipulation may provide functional food for human consumption. Although the fatty acids content in dairy products is affected by many factors, animal feeding strategies and specific diets with high supplements of PUFA can be affective in the enriching milk of dairy breed [11].

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