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Short communication

EFFECT OF SHEARING ON MILK COMPOSITION IN THE TSIGAI EWES

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The effect of shearing on milk yield and milk composition was studied in the Tsigai ewes. The sheep were kept indoor and shorn at the beginning of April. Ewes were milked twice daily and milk samples, from the morning yield only, were taken on the day before, and on days 2 and 14 post-shearing. Shearing had no effect on milk yield. The concentrations of milk fat and casein increased from 6.83 ± 0.44 and 3.81 ± 0.30 %, respectively, in unshorn sheep up to 7.81 ± 0.35 and 4.23 ± 0.33 % on the second post-shearing day, and continued to increase thereafter. The concentration of total solids in unshorn sheep averaged 18.26 ± 0,44 % but it increased up to 19.37 ± 0.25 % and 20.26 ± 0.66 %, respectively, on day 2 and on day 14 after shearing. There was no effect of shearing on the lactose concentrations. Renneting time progressively decreased, with changes in milk composition. The possible effects of different mechanisms involved in post-shearing adaptation on the observed changes in milk composition are discussed.

Key words: sheep; shearing; milk; composition

ЕФЕКТОТ НА СТРИЖЕЊЕ ВРЗ СОСТАВОТ НА МЛЕКОТО КАЈ ОВЦИТЕ ЦИГАЈА

Ефектот на стрижењето врз продукцијата и составот на млекото беше проучуван кај овците од расата цигаја. Овците беа чувани во штали и стрижени на почетокот на април. Молзени беа два пати дневно, а примероците на млеко само од утринското молзење беа земени ден пред стрижењето и 2-иот и 14-тиот ден по стрижењето. Стрижењето немаше ефект врз продукцијата на млеко. Концентрациите на млечната маст и казеинот порастаа од 6,83 ± 0,44 и 3,81 ± 0,30% кај нестрижените овци до 7,81 ± 0,35 и 4,23 ± 0,33% во вториот ден по стрижењето и продолжија да се зголемуваат понатаму. Концентрацијата на вкупните суви материи кај нестрижените овци во просек изнесуваше 18,26 ± 0,44 %, но порасна до 19,37 ± 0,25% и 20,26 ± 0.66% на 2-иот и 14-тиот ден по стрижењето. Стрижењето немаше ефекти врз концентрациите на лактоза. Времето на потсирување прогресивно опадна со промените во составот на млекото. Дискутирани се можните ефекти на различни механизми вклучени во постстрижбената адаптација на наблудуваните промени во составот на млекото.

Клучни зборови: овци; стрижење; состав на млеко

INTRODUCTION

Sheep of different breeds are kept for dairying in many countries all over the world. Sheep milking has been traditionally practiced for thousands of years in the Mediterranean and in the Balkan countries. Genetic and nutritional factors as well as management practices may affect to a different extent the composition of milk and hence the yield and quality of dairy products. Thermal environment may also appreciably influence milk yield (MY) and milk composition. Effect of cold exposure on milk yield and composition was evaluated in sheep predominantly in short-term laboratory studies. Thompson et al. (1981) stated a considerable reduction in milk secretion rate and increased milk total nitrogen in shorn sheep exposed to ambient temperature 1 °C. Conversely, McBride and Cristopherson (1984) found no effect of cold exposure (0 °C) of shorn sheep on daily milk yield whereas milk fat concentration significantly increased. Milk protein and lactose concen-

trations also showed a tendency to increase compared to the values in sheep kept at thermoneutrality. Indeed, newly shorn sheep are often exposed to temperatures below the zone of thermal indifference, which may affect both the MY and milk composition. The objective of this study was to evaluate the effect of early spring shearing on milk composition in the Tsigai ewes kept indoor.

MATERIAL AND METHODS

Experiment was carried out in five Tsigai ewes at similar age and stage of lactation kept in barn where lying area of approximately 3 m^2 per ewe was ensured. Sheep, in good body condition (average liveweight of 39.4 ± 1.19 kg), were shorn at the beginning of April. Concentrate (700 g/head daily commercial mix, containing 18% crude protein and 6.46% crude fibre) was offered twice daily, in the morning and in the afternoon, immediately before milking. Chopped hay (10.01% crude protein and 32.93% crude fibre) was administered *ad libitum.* Diet was calculated to meet the requirements for maintenance and lactation (NRC, 1981). The ewes had free access to water throughout the day. Sheep were hand milked twice daily at 8:00 and at 18:00 and the milk yield (MY) from each sheep was measured volumetrically. Milk samples, from the morning milk only, were taken on the day before, and on days 2 and 14 post-shearing. During the observation period air temperature and humidity, and air movement were recorded at sheep's height three times daily: at 7:00, 14:00 and 21:00. The daily water intake was also recorded. The results were presented as mean and standard error of the mean. Differences were assessed by the Student's *t*-test. Data were analyzed using software package "Statistica" (Exel 2003).

RESULTS AND DISCUSSION

During the post-shearing period minimum temperatures in the barn ranged from 1.6 to 6.7 °C, and maximum temperatures ranged from 10.7 to 17.9 °C, being most of the time well below the critical point for shorn ewes (NRC, 1981).

Changes in milk composition are presented in Table 1. Mean daily MY was not affected by shearing and did not change measurably throughout the observation period. There were appreciable increase in total solids and milk fat content on the second day after shearing and the increase persisted up to the end of observation. Total protein concentration also exhibited a tendency to increase apparently at the expense of casein. There were not detectable changes in lactose concentration resulting from shearing. Renneting time decreased with the increase in concentrations of other constituents, especially casein.

Table 1

Milk yield and composition before and after shearing

Items	Before shearing	2nd day post-shearing	14th day post-shearing
	$x \pm Sx$	$x \pm Sx$	$x \pm Sx$
Mean daily milk yield, ml	0.349 ± 4.2	0.353 ± 2.9	0.338 ± 3.5
Total solids, %	18.26 ± 0.44	19.37 ± 0.25	20.26 ± 0.66
Milk fat, %	6.83 ± 0.44	7.81 ± 0.35	8.07 ± 0.52
Total protein, %	6.12 ± 0.40	6.34 ± 0.30	6.71 ± 0.40
Lactose, %	4.71 ± 0.23	4.61 ± 0.32	4.89 ± 0.16
Casein, %	3.81 ± 0.30	4.23 ± 0.33	4.61 ± 0.35
Renneting time, s	235 ± 8	210 ± 6	200 ± 8

Numerous environmental and other factors influence milk yield and quality by means of changes in the over-all hormonal profile and metabolism resulting in changes in the concentrations of various metabolites in the blood flow. This results in changes in the rate of supply of nutrients to the mammary gland that ultimately affected the secretion of milk constituents (Thompson, 1985).

Shearing had the most substantial effect on milk fat concentration. Such sharp changes are usually associated with decrease of milk volume, but in this study mean daily MY was not measurably influenced by shearing. This suggests that the observed increase in milk fat concentrations may be due to the post-shearing metabolic adaptation associated with mobilization of body fat reserves and corresponding increase in free fatty acid and triglyceride concentrations in blood flow. Milk fat is composed of triglycerides containing short-, medium- and long-chain fatty acids which are used by the mammary gland for milk synthesis (Thomson and Snoswell, 1979). Maintenance of the thermal homeostasis in shorn ewes led to an increase in circulating substrates supporting milk fat secretion. Thereby, the increased availability of milk fat precursors in the bloodstream might be expected to increase milk fat content.

Milk protein yield is less dependent on environmental conditions than fat content. Although it is difficult to influence by nutritional manipulation, milk protein is positively related with the total energy supply. In our study shearing did not cause noticeable changes in feed intake that may account for the increase in milk protein concentration. There were several possible mechanisms underlying the improved amino acid supply to milk protein synthesis in shorn ewes. The increased rate of passage of digesta in shorn, cold exposed, sheep may increase the amount of undegraded protein reaching the abomasum (Ngongony et al., 1984). This post-ruminal protein supply may increase amino acid availability for milk protein synthesis. On the other hand, the increased rate of passage of digesta is usually associated with a decrease of bacterial protein yield in the rumen (Christopherson and Kennedy, 1983), reduction of protein supply to the post-ruminal parts of the digestive tract and, therefore, a decrease in the amino acids supply for milk protein synthesis.

Changes in the hormonal profile resulting from shearing apparently affected the homeorhetic capacity of ewes that led to the changes in nutrient partitioning to different tissues and organs. This appeared to be a key mechanism which may affect both the rate of milk fat and milk protein synthesis. Such a suggestion was confirmed by the equal level of feed intake during pre- and post-shearing period (Aleksiev, 2008). Symonds et al. (1990) pointed out that winter shearing caused changes in blood hormone concentrations resulting in improved ability to utilize body fat as an energy source and changes in the partition of nutrients to the mammary gland. The observed post-shearing dehydration of sheep, owing to the decrease in voluntary water intake (Aleksiev, 2008), may change the total body water content and plasma osmolality, and influence the concentration of milk constituents in shorn ewes.

The increased concentration of milk constituents during cold exposure may also be considered as an adaptive responses aimed at supporting the offspring with an adequate level of nutrients for survival. Knight et al. (1993) studied the shearing effect at different months of the year and stages of lactation on milk yield and composition. In all cases shearing was found to cause an increase in the concentrations of fat and protein with an accompanying increase in the concentration of the total solids.

The decrease in renneting time reflected increased concentrations of milk fat and proteins, particularly casein, which constitutes the main limiting factor of cheese to milk ratio (Diaz and Analla, 1999). In this respect shearing had a distinct positive effect on milk characteristics from the processing point of view.

CONCLUSION

Early spring shearing of the Tsigai sheep kept indoor had no effect on daily milk yield. Shearing caused an increase in milk fat and milk protein concentrations and a corresponding increase in the concentration of the total solids. These changes would be expected to improve the quality of milk for processing and increase the yield of cheese per liter of milk.

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