Comparison of sheep and goat colostrum fatty acids contents

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Abstract. The quality and content of colostrum is a very important factor for the health of the offspring. Colostrum is the first food that ensures the growth and development of offspring and their immunity against diseases. Colostrum composition is affected by many factors such as calving season, number of lactations, length of dry period, maternal diseases, age and breed. The animal material of the research consisted of Awassi sheep and Saanen goats raised in Adana province, where Mediterranean conditions prevail, and these animals were kept in semi-intensive conditions. In the study, fatty acids of sheep and goat colostrums were determined by gas chromatography device. As a result of the analysis, 26 fatty acids were detected in Awasi sheep and 27 fatty acids in Saanen goats. Erucic acid was not detected in Awasi sheep colostrum. The colostrum fatty acids with the highest percentage in both breeds wre oleic acid (Awassi sheep: 36.32%, Saanen goat: 25.68%) and palmitic acid (Awassi sheep: 28.15%, Saanen goat: 29.20%) was determined as. ∑SFA rates were found to be higher in Saanen goat colostrum, and ∑MUFA and ∑PUFA rates were found to be higher in Awassi sheep.

1 Introduction

The healthy and quality life of newborn ruminants is closely related to the colostrum they drink immediately after birth. Lambs and kids should definitely receive colostrum in appropriate amounts and for the appropriate period of time immediately after birth. Colostrum, secreted immediately after birth, is different in appearance and content from normal milk, has a thicker consistency than milk, and is yellowish in colour. It is very rich in terms of the nutrients it contains. Thus, it is an important nutrient for newborn lambs and goats, and it also contains biological active substances that are effective on certain functions [1].

The importance of colostrum in the nutrition of puppies is due to the fact that it contains protein, carbohydrates, fat, vitamins and minerals, as well as some biologically active molecules necessary for the body's immune and growth functions [2]. All components that make up colostrum make a great contribution to nutrition and health. One of these components is the fatty acids found in colostrum. The fatty acid content of colostrum plays a role in the regulation of many physiological events. Some of these events include changes in the gene expression of lipogenic and lipolytic enzymes and proteins regulation of energy metabolism and protection of the health of the offspring [3]. The concentration of the components that make up the colostrum varies according to many factors such as cubs' season, number of lactations, dry period length, mother diseases, colostrum volume produced, age and breed [4,5].

Animals use fatty acids (FAs) in their bodies to increase growth, structural health of the skin, a healthy lifespan and reproduction. Fatty acids have functions such as forming the structural components of cell membranes, prostaglandin synthesis and attaching proteins to cell membranes. Fatty acids are also stored as intracellular triacyl glycerides (TAG) within lipid droplets and provide a potent source of energy when the body needs it [6].

Since cells in mammals cannot synthesize some groups of fatty acids, they must be obtained externally through feed. Newborn lambs and goats use the fatty acids found in colostrum. Adequate maternal colostrum content is very important for offspring nutrition.

In this study, fatty acid changes in sheep and goat colostrum will be determined by gas chromatography device and colostrum contents will be examined. Because it is known how important colostrum is, both as a nutritious food substance and as it ensures the transfer of the mother's immune system to the newborn lambs and goats.

2 Material and method

In the study, 6 Saanen goats and 6 local Awassi sheep of the same age, healthy and with similar characteristics, located at the Research and Application Farm of Çukurova University Faculty of Agriculture, were selected. Colostrum samples were collected within 16 hours of birth. Before colostrum samples were collected, each animal's teat was washed several times with water and dried using paper towels. Colostrum samples were first poured into a container, mixed and transferred to clean and dry sterile tubes and stored under appropriate cooling conditions until analysed in the laboratory. The fatty acid profile of colostrum samples was analysed at the

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Aquaculture and Processing Technologies Laboratory of Çukurova University Faculty of Fisheries.

Lipid analysis was performed according to the method applied by Bligh and Dyer [7]. 15 g of homogenized sample is added to 120 ml of methanol/chloroform (1/2) and mixed in the homogenizer. Then, 20 ml of 0.4% CaCl2 solution was added to these samples and filtered through filter paper. After the samples were kept in the oven at 105°C for 1 hour, they were placed in a tared bottle. These balloons were closed in an airtight place and kept in a dark environment for 1 night, and the next day, the upper layer consisting of methanol-water was removed with the help of a separatory funnel. Chloroform was blown from the chloroform-lipid part remaining in the balloons
using an evaporator in a water bath at 60 °C. Then, the balloons were kept in the oven at 90°C for 1 hour, allowing all the chloroform inside to evaporate, and then cooled to room temperature in a desiccator and weighed on a scale with a precision of 0.1 mg.

Lipid samples were converted into their constituent fatty acid methyl esters using 2 M KOH in methanol and n-heptane using the method of Ichihara et al. [8]. Twenty mg of extracted oil was dissolved in 2 ml of n-heptane followed by 4 ml of 2 M methanolic KOH. The tube was then vortexed for 2 minutes at room temperature. After centrifugation at 4,000 rpm for 10 minutes, the n-heptane layer was taken for gas chromatography analyses.

2.1 Gas chromatography working principle

The text of your paper should be formatted as follows:
Fatty acid composition was determined using an autosampler (Perkin Elmer, Shelton, CT, USA) equipped with a flame ionization detector and a silica capillary SGE column (30 m3 0.32 mm ID 3 0.25 mm BP20 0.25 UM). Analyzed with GC Clarus 500. The oven temperature was held at 140°C for 5 minutes, increased to 200°C at a rate of 4°C/min and then to 220°C at a rate of 1°C/min, while the injector and detector temperatures were 220 and 280°C, respectively. is also set. The sample size was 1 ml and the carrier gas was controlled at 16 ps. The division used was 1:100.

2.2 Statistical analyse

Fatty acid analysis of all colostrum samples was carried out in three replicates due to the higher accuracy of gas chromatography results, and the results were reported as the mean and standard deviation of these measurements. The data of the two breeds were stated in tables and charts.

3 Results

In this study, the fatty acid contents and ratios of colostrum taken from Awassi sheep and Saanen goats after birth are detailed in Table 1.

Table 1. Colostrum fatty acid ratio of Awassi sheep and Sanen goats.

Name of fatty acids	Formula	Awassi sheep (%)	Saanen goat (%)
Butyric acid	C4:0	1.36±0.01	0.97±0.01
Caproic acid	C6:0	0.72±0.36	1.06±0.35
Caprylic acid	C8:0	0.64±0.07	1.58±0.54
Capric acid	C10:0	1.78±0.45	5.99±0.86
Myristic acid	C14:0	8.76±0.29	11.08±4.48
Myristoleic acid	C14:1	0.27±0.12	0.24±0.01
Pentadecanoic acid	C15:0	0.62±0.19	0.04±0.00
Methylpentadecanoate	C15:1	0.27±0.09	0.21±0.01
Palmitic acid	C16:0	28.15±0.76	29.20±4.86
Palmitoleic acid	C16:1	1.23±0.32	1.10±0.07
Margaric acid	C17:0	1.13±0.04	1.04±0.07
Heptadecenoic acid	C17:1	0.85±0.12	0.11±0.01
Stearic acid	C18:0	9.21±1.57	8.04±3.18
Oleic acid	C18:1n9	36.32±4.56	25.68±4.79
Vaccenic acid	C18:1n7	1.34±0.26	0.85±0.00
Linoleic acid	C18:2n6	2.78±0.45	2.45±0.16
Alfa Linolenic acid	C18.3n3	0.51±0.06	0.41±0.03
Gama Linolenic acid	C18:3n6	0.54±0.07	0.10±0.03
Arachidic acid	C20:0	1.02±0.09	0.59±0.15
Eicosanoic acid	C20:1n9	0.12±0.01	0.08±0.00
Eicosadienoic acid	C20:2n6	0.07±0.07	0.06±0.02
Erucic acid	C22:1n9		0.04±0.00
Behenic acid	C22:0	0.14±0.03	0.03±0.00
Docosahexaenoic acid	C22:6n3	0.12±0.02	0.08±0.01
Homo- γ –Linolenic acid	C20:3n6	0.08±0.01	0.08±0.00
Nervonic acid	C24:1n9	0.06±0.01	0.09±0.08
Lignoceric acid	C24:0	0.26±0.07	0.26±0.04

When Table 1 is examined, 26 fatty acids were detected in Awassi dark colostrum and 27 fatty acids in Saanen goats. Erucic acid was not detected in Awassi sheep. The colostrum fatty acids with the highest percentage in both breeds were oleic acid (Awassi sheep: 36.32%, Saanen goat: 25.68%) and palmitic acid (Awassi sheep: 28.15%, Saanen goat: 29.20%) was determined as. The sum of oleic acid and palmitic acid constitutes more than half of all fatty acids.

Butyric acid, myristoleic acid, pentadecanoic acid, methylpentadecanoate, palmitoleic acid, margaric acid, stearic acid, oleic acid, vaccenic acid, linoleic acid, alpha linolenic acid, gamma linolenic acid, arachidic acid, eicosanoic acid eicosadienoic acid, behenic acid. and docosahexaenoic acid were detected at higher rates in Awassi sheep colostrum (Table 1). It can be seen in Table 1 that caproic acid, caprylic acid, capric acid, myristic acid, palmitic acid and nervonic acid were detected at higher levels in Saanen goat colostrum than in Awassi sheep colostrum.

Table 2. Colostrum ∑SFA, ∑MUFA and ∑PUFA ratios of Awassi sheep and Sanen goats.

Fatty acid	Awassi sheep (%)	Saanen goat (%)
(C4:0)	1.36±0.01	0.97±0.01
(C6:0)	0.72±0.36	1.06±0.35
(C8:0)	0.64±0.07	1.58±0.54
(C10:0)	1.78±0.45	5.99±0.86
(C14:0)	8.76±0.29	11.08±4.48
(C15:0)	0.62±0.19	0.04±0.00
(C16:0)	28.15±0.76	29.20±4.86
(C17:0)	1.13±0.04	1.04±0.07
(C18:0)	9.21±1.57	8.04±3.18
(C20:0)	1.02±0.09	0.59±0.15
(C22:0)	0.14±0.03	0.03±0.00
(C24:0)	0.26±0.07	0.26±0.04
∑ SFA	**53.79**	**59.88**
(C14:1)	0.27±0.12	0.24±0.01
(C15:1)	0.27±0.09	0.21±0.01
(C16:1)	1.23±0.32	1.10±0.07
(C17:1)	0.85±0.12	0.11±0.01
(C18:1n7)	1.34±0.26	0.85±0.00
(C18:1n9)	36.32±4.56	25.68±4.79
(C20:1n9)	0.12±0.01	0.08±0.00
(C22:1n9)		0.04±0.00
(C24:1n9)	0.06±0.01	0.09±0.08
∑ MUFA	**40.46**	**28.40**
(C18:2n6)	2.78±0.45	2.45±0.16
(C18:3n6)	0.54±0.07	0.10±0.03
(C18:3n3)	0.51±0.06	0.41±0.03
(C20:2n6)	0.07±0.07	0.06±0.02
(C20:3n6)	0.08±0.01	0.08±0.00
(C22:6n3)	0.12±0.02	0.08±0.01
∑ PUFA	**4.10**	**3.18**
MUFA/SFA	0.75	0.47
PUFA/SFA	0.08	0.05
PUFA/MUFA	0.10	0.11
∑n6	3.47	2.69
∑n3	0.63	0.49
n6/n3	5.51	5.49

Total SFA: all saturated fatty acids (without any double bond, 6:0 to 26:0).
Total MUFA: all monounsaturated fatty acids with a single double bond (14:1 to 20:1).
Total PUFA: all polyunsaturated fatty acids
Total n-6 polyunsaturated fatty acids (PUFA): 18:2n6; 18:3n6; 20:2n6; 20:3n6; 20:4n6; 22:2n6; 22:4n6; and 22:5n6.
Total n-3 polyunsaturated fatty acids (PUFA): 18:3n3; 18:4n3; 20:3n3; 20:5n3; 22:3n3; 22:5n3; and 22:6n3.

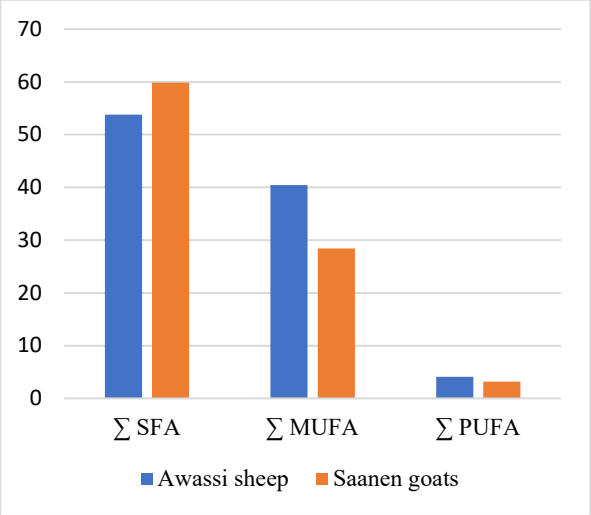

Fig. 1. Colostrum ∑SFA, ∑MUFA and ∑PUFA ratios of Awassi sheep and Sanen goats

When Table 2 was examined, it was seen that ∑SFA rates were higher in Saanen goat colostrum. This high ratio was due to the fact that Capric acid (C10:0) has a ratio of approximately 3 times higher in Saanen goat colostrum (Avassi sheep: 1.78, Saanen goat: 5.99). Also ∑MUFA rates were higher in Awassi sheep colostrum.

The high rate of ∑MUFA in Awassi sheep colostrum. was due to the high level of oleic acid (C18:1n9) detected (Awassi sheep: 36.32, Saanen goat: 25.68). When we look at the ∑PUFA rates, it was seen that it was detected at higher rates in Awassi sheep (Table 2). When the PUFA ratios of sheep and goat colostrum were examined, it was seen that the ratios of linoleic acid, gamma linolenic acid, alpha linolenic acid and docosahexaenoic acid were high in sheep colostrum, while the ratios of homo-γ-linolenic acid were equal (Table 1).

4 Discussion

As a result of the fatty acid analysis colostrum, which is important for offspring development, growth and health, a total of 27 fatty acids were detected in Saanen goat colostrum (Table 1). Marounek et al. [9] detected a total of 38 fatty acids in the colostrum of White Horthaired goats. In the study, the difference in the number of fatty acids in goat colostrum may be due to differences in race, age, analysis method, climate and nutrition [10]. In the study, it was determined that palmitic acid and oleic acid had the highest ratio. When Table 1 was examined, the fact that palmitic acid and oleic acid ratios were higher than other fatty acids was similar to the study of Marounek et al. [9].

When Table 1 was examined, it was seen that myristic acid (C14:0), palmitic acid (C16:0), stearic acid (C18:0) and oleic acid (C18:1n9) have a high ratio in sheep colostrum. These fatty acids detected in high amounts were compatible with the study findings of previous researchers [11,12,13].

The fact that capric acid, which was reported to support the intestinal integrity of animals and increase the intestinal barrier function [14], was three times higher in goat colostrum than in sheep colostrum was probably due to the needs of newborn kids. In the study (Table 1), sheep and goat colostrum capric acid rates were found to be similar to the study results of other researchers [9,11].

Nervonic acid (C24:1n9), which is an important component of nerve cells [15] and is stated to play a very important role in problems such as early myelination [16], peroxisomal disorders and malnutrition [17,18], was detected at a higher rate in Saanen goat colostrum.

It has been stated that after birth, the ability of offspring's to synthesize fatty acids in their bodies is weak and the ratios in their bodies are insufficient to support brain development [19]. Therefore, after birth, the offspring takes nervonic acid from the colostrum and uses it for the optimal development of the brain. Its higher rates in Saanen goats is due to the need for offspring. It can be seen in Table 1 that in the study, the nervonic acid rate in Awassi sheep colostrum was determined to be higher than in Anitaş et al., [13]'s study.

In the study, it was determined that the total unsaturated fatty acid (∑SFA) ratios and total polyunsaturated fatty acid (∑PUFA) ratios of Awassi sheep colostrum were lower than Guiso et al. [11]'s study, and the total monounsaturated fatty acid ratios (∑MUFA) were higher. This difference may arise from reasons such as analysis method, sheep breed, nutrition, shelter and climate [10].

In particular, PUFAs have been shown to be effective on many diseases in body metabolism. It is stated that significant metabolic disorders such as heart and blood-related problems, lipid level imbalance, febrile diseases and arthritis occur in the deficiency of PUFAs [20,21,22]. In addition, the rate of docosahexaenoic acid (DHA), which is in the PUFA group and has roles in the brain development of the offspring and providing more energy production, was found to be lower in both species than in the study of Or-Rashid [12]. It has also been reported that linoleic acid, alpha linolenic acid and arachidonic acid, which are in the PUFA group, positively affect the health of offsprings [23]. Table 1 shows that these fatty acid ratios are detected at higher rates in Awassi sheep colostrum.

It has been stated that n3-PUFA, a long-chain fatty acid, plays an important role in the development and protection of brain, retina and nervous tissue in ruminants [24]. Table 1 shows that the n3-PUFA rate is higher in Awassi sheep colostrum. In our study, goat colostrum n3 PUFA rate was similar to the studies of Koluman et al. [25] and sheep colostrum n3 PUFA ratio was lower rate than in the study of Guiso et al. [11]. The reason why colostrum fatty acid composition differs from that of researchers is that it can be affected by various interacting factors such as lactation, seasonal changes, nutrition, and genetic variation [10].

5 Conclusion

It was concluded that there are differences in colostrum fatty acid composition between goat and sheep species. It was determined that the total unsaturated fatty acid (∑SFA) ratios of Awassi sheep colostrum were lower than the Saanen goat colostrum, while the total monounsaturated fatty acid ratios (∑MUFA) and total polyunsaturated fatty acid (∑PUFA) ratios were higher. Since sheep and goat colostrum is used in the nutrition of newborns, sick and elderly people for their functions of healthy development of the body, growth, brain development, providing energy and preventing diseases, the fatty acid profile it contains needs to be examined in more detail. However, for many reasons many calves, lambs and kids; multiple births, acute mastitis, maladaptive maternal behavior mostly in the first birth, viral arthro-encephalitis in goats, etc. for some reason, they cannot have access to their mother's colostrum. It is also important in terms of quality to examine such ingredients to determine the most suitable colostrum from recently produced frozen colostrum substitutes prepared for these situations. Knowledge of differences in the composition and functional properties of livestock colostrum will increase knowledge of their beneficial effects on animal production and human nutrition, as well as their potential in the prevention or treatment of diseases.

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