Van Veterinary Journal

https://dergipark.org.tr/tr/pub/vanvetj

Cite this article as: **Aysondu MH, Özyürek S, Türkyılmaz D (2022).** Comparative Study between Ewe and Goats Milk Fatty Acid Profile and Some Healthy Index in The First 30 Days of Lactation. *Van Vet J*, 33(1), 31-35. DOI: https://doi.org/10.36483/vanvetj.1068512

ISSN: 2149-3359 **Original Article** e-ISSN: 2149-8644

Comparative Study between Ewe and Goats Milk Fatty Acid Profile and Some Healthy Index in the First 30 Days of Lactation

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Received: 04.02.2022 Accepted: 03.03.2022

ABSTRACT Fatty acid composition in milk has a vital importance in the early lactation period when lambs are milking. In this study, the change in milk fatty acid composition of Akkaraman ewe and Hair goats fed under the same conditions in the first 30 days of lactation was investigated. 10 Akkaraman ewe and 10 Hair goats were used in 2-5 parities. Ewe and goats were born in February. The animals were kept to the same feeding indoor, while experiment was going on. In addition to 1 kg of barley per animal, wheat straw was given ad libitum. Individual milk samples were taken from each animal on 0th, 1st, 3rd, 7th, 15th and 30th of lactation days. While C16:1, C18:3n3 were found more in goat milk ($p<0.05$), C20:5n3 (EPA) was found mostly in ewe milk ($p<0.01$). The mean CLAC9t11 was 0.378±0.1 g/100 in ewe milk and 0.426±0.1 g/100 in goat milk throughout the 30-day lactation. Contrary to the general literature information, the highest CLA ratio in milk was found in goat milk and most lipid health indexes were determined in favor of goats. Omega 6/3 ratio was determined as 7.90±2.5 g/100 g in fatty acids in Akkaraman ewe milk and 10.35±4.7 g/100 g in fatty acids in Hair goat milk ($p<0.05$). It is an important issue which should be emphasized that the ratios of SFA, MUFA, PUFA, MUFA/SFA, PUFA/SFA and UFA/SFA only in goat milk change in the first 30 days of lactation.

Keywords: *Conjugated linoleic acids, Fatty acid, Goat, Sheep.*

ÖZ

Laktasyonun İlk 30 Gününde Koyun ve Keçi Sütündeki Yağ Asidi Profili ile Bazı Sağlık İndekslerinin Karşılaştırılması

Kuzuların süt emdiği laktasyon başı dönemde sütteki yağ asidi kompozisyonunun hayati önemi vardır. Bu çalışmada, aynı koşullarda beslenen Akkaraman koyunu ve Kıl keçilerinin laktasyonun ilk 30 gününde süt yağ asidi kompozisyonundaki değişim araştırılmıştır. 2-5 laktasyon arasında 10 Akkaraman koyunu ve 10 Kıl keçisi kullanılmıştır. Doğumlar şubat ayında gerçekleşmiş olup, hayvanlar kapalı ortamda aynı beslenmeye alınmıştır. Çalışma süresince hayvan başına 1 kg arpaya ek olarak buğday samanı ad libitum olarak verilmiştir. Laktasyonun 0, 1, 3, 7, 15 ve 30. günlerinde her bir hayvandan ayrı ayrı süt örnekleri alınmıştır. Çalışmanın sonucunda C16:1, C18:3n3 keçi sütünde daha fazla bulunurken ($p<0.05$), C20:5n3 (EPA) en fazla koyun sütünde ($p<0.01$) bulunmuştur. Ortalama CLAC9t11, 30 günlük laktasyon boyunca koyun sütünde 0.378±0.1 g/100 ve keçi sütünde 0.426±0.1 g/100 olarak bulunmuştur. Aterojenik ve trombojenik indeks değerleri keçi sütü lehine bulunmuştur. Omega 6/3 oranı koyun ve keçi sütünde sırasıyla 7.90±2.5 ve 10.35±4.7 g/100 g olarak belirlenmiştir ($p<0.05$). Laktasyonun ilk 30 gününde sadece keçi sütündeki SFA, MUFA, PUFA, MUFA/SFA, PUFA/SFA ve UFA/SFA oranlarının değişmesi keçilerin beslenme fizyolojisindeki farkı ortaya koyması açısından üzerinde durulması gereken önemli bir konudur.

Anahtar Kelimeler: *Keçi, Konjuge linoleik asitler, Koyun, Yağ asidi.*

INTRODUCTION

According to 2019 FAO data, there are 10 922 427 goats and 35 194 972 ewes in Turkey (FAO 2019). In the coastal areas of the country, small ruminant breeding is generally carried out in the direction of milk production, while breeding activities in the direction of meat production are common in the interior. Approximately 200 different cheeses are produced from ewe and goat milk in Turkey. The goat breed used in the study is Hair goat, which constitutes approximately 99% of the country's goat population. In 180-220th days of lactation, there is a milk yield of 80-150 liters with 3-4% fat. Akkaraman ewe breed constitutes approximately 50% of the country's ewe stock.

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In addition, lactation milk yield and lactation period are reported to be 96.4 kg and 198.8 days, respectively (Aşkan and Aygün 2020).

It is thought that saturated fatty acids and trans fatty acids, which are concentrated in milk fat, have negative effects on the health of consumers. However, numerous studies have shown that whole milk is more effective than skim milk in preventing cardiovascular disease in humans. The reason for this is attributed to the functionality of the fatty acids (FA) found in the fat of whole milk. Cholesterol is an oily carrier that is found in the cell structure and blood circulation of all mammals, including humans, and is necessary for vital activities. HDL (high-density lipoprotein), known as good cholesterol, ensures the transport of cholesterol from tissues and vessels to the liver, while LDL (low-density lipoprotein), known as bad cholesterol, is responsible for transporting cholesterol in the tissue to the areas where it is needed in the body. So, omega-3 fatty acids lower LDL in the blood and increase the level of HDL, which has an important role in preventing cardiovascular diseases; reduces hypertension, regulates hormonal secretions and stimulates nerve cell growth in children. Studies on animal models have shown that CLA has anticancer effects, prevents obesity, and has antioxidant properties (Rubino et al. 2006).

In recent years, studies on components with important health benefits (dietary FA) such as Omega-3, PUFA and CLA have been increasing. Recent studies have reported that milk composition and fatty acid composition vary according to species. Conjugated linoleic acid (CLA) refers to the generality of many conjugated isomers of linoleic acid, which is an essential and omega-6 fatty acid for the body, has 18 carbon atoms and two double bonds (Köknaroğlu 2007). The emergence of the importance of conjugated linoleic acid in terms of health has led researchers to this subject and studies have been conducted examining the effects of diet, species and season on CLA (Talpur and Bhanger 2005; Tsiplakou et al. 2006; Talpur et al. 2009). However, there is no study comparing two different species and lactation period at the same time. The general aim of the study is to determine the milk fatty acid composition of different species in the period of lambs suckling, and in this way to reveal the difference between species in determining the growth performance of lambs before weaning in the future. The special aim of the study, the change in milk fatty acid composition of ewe and goats fed under the same conditions in the first 30 days of lactation was investigated.

MATERIAL AND METHODS

This study has been approved by the Local Ethics Committee of Inonu University (decision date 07.02.2022 and numbered 142751).

General Procedure of the Study

The present study was carried out in a typical mountainous highland of Turkey, the province of Erzincan, Kemaliye (sea level at 950, 39.26" north latitudes and 38.49" east longitudes). In this study, 10 Akkaraman ewe and 10 Hair goats were used in 2-5 parities. Ewe and goats were born in February. The animals were kept to the same feeding indoor, while experiment was going on. In addition to 1 kg of barley per animal, wheat straw was given ad libitum. Individual milk samples were taken from each animal 0^{th}, 1^{st}, 3^{rd}, 7^{th}, 15^{th} and 30^{th} of the lactation days. The milk samples were put in 50 ml plastic tubes and then kept at + 4 °C and brought to the milk analysis laboratory.

Fat was extracted from the collected milk samples, and then methylation was performed to determine the fatty acid composition in the GC-FID. Extraction and methylation processes of fat from milk samples were performed as reported by Cebi and Ozyurek (2021).

Fatty acids were analyzed by Perkin Elmer Clarus 500 Chromatography; FID (flame ionization detector) and Restek (Rtx-2330) capillary column (30 m x 0.25 mm x 0.2 µm) were used. The operating conditions of the GC was as follows (Cebi and Ozyurek 2021).

A mixture of methyl esters of 37 fatty acids was used as standard in the identification of fatty acids (Food Industry FAME Mix-Restek). The standard of Cayman Chemical was used to determine the CLA. The fatty acid composition was expressed as percent amount (%) of fatty acid per total fatty acids (Meľuchová et al. 2008). A total of 29 different fatty acids were identified in the analysis.

Statistical Analysis

The data were first transferred to Microsoft Excel 2010 and then SPSS 22.0 package program was used. Independent samples t-test was used to determine the effect of species on milk fatty acid composition, and ANOVA test was used to determine the effect of lactation days on milk fatty acid composition. Duncan statistics were computed for the post hoc analysis. $p \leq 0.05$ was assumed as the significant level.

RESULTS

The milk fatty acid composition of Hair goat and Akkaraman ewe breeds is presented in Table 1. In the study; C12:0, C14:0, C16:0, C18:0 and C18:1n9c are the most abundant fatty acids in milk for both species. Only three fatty acids (C16:1, C18:3n3 and C20:5n3 (EPA)) were statistically different between species. While C16:1, C18:3n3 were found more in Hair goat milk ($p<0.05$), C20:5n3 (EPA) was found most in Akkaraman ewe milk ($p<0.01$).

The mean CLAC9t11 was 0.378±0.1 g/100 in Akkaraman ewe milk and 0.426±0.1 g/100 in Hair goat milk throughout the 30-day lactation. CLAc10t12 was detected at the same ratio (0.178±0.0 g/100 g) for both species. C16:1, C18:2n6t, C18:3n3, C22:2n6 and C22:6n3 (DHA) were affected by the day factor at statistically different levels in both species (Table 1). In addition, while 14 fatty acids in Hair goat milk were statistically different between days, 8 fatty acids in Akkaraman ewe milk changed statistically according to the days. CLAC9t11 was found to differ by days only in Hair goat milk ($p<0.05$). The lowest CLAC9t11 rate in Hair goat milk was determined on the 3^{rd} day, and the highest CLAC9t11 rate was determined on the 10^{th} day.

SFA, MUFA, PUFA, MUFA/SFA, PUFA/SFA and UFA/SFA were statistically different between days ($p<0.05$) only in Hair goat milk (Table 2). Omega 6/3 ratio was determined as 7.902±2.5 g/100 g in fatty acids in Akkaraman ewe milk and 10.35±4.7 g/100 g in fatty acids in Hair goat milk, and this difference is statistically significant. No differences were found between species for AI and TI. However, TI in Hair goat milk was different according to days ($p<0.05$). 16:1/16 was found to be different both between species and days in Akkaraman ewe milk ($p<0.05$). On the other hand, 18:1/18 was affected by the day factor only in Hair goat milk ($p<0.001$).

Table 1: Amount of fatty acids (g/100 g) in milk fat of Akkaraman Ewe and Hair goat.

Fatty acids		General Mean	0. day Mean	1. day Mean	3. day Mean	7. day Mean	10. day Mean	15. day Mean	30. day Mean	p Species	p Day
C10:0	Ewe	3.079±1.0	3.633	3.438	4.199	2.987	1.891	2.397	2.977	ns	ns
	Goat	2.538±1.0	2.869^{b}	3.424^{b}	3.849^{b}	1.287^{a}	1.821^{a}	2.490^{a}	1.942^{a}		*
C12:0	Ewe	6.919±5.0	10.372	7.052	7.770	10.189	2.444	2.376	8.888	ns	ns
	Goat	6.844±4.6	6.806^{b}	11.106^{b}	11.902^{b}	3.367^{a}	2.418^{a}	6.507^{ab}	5.266^{ab}		*
C13:0	Ewe	4.469±1.3	3.742	4.976	5.182	4.977	3.706	3.834	5.068	ns	ns
	Goat	3.761±1.2	4.498	4.375	4.834	3.254	2.712	3.675	2.965		ns
C14:0	Ewe	11.40±1.8	9.104	10.465	11.265	12.878	13.213	11.694	11.136	ns	ns
	Goat	10.93±2.7	12.980^{ab}	9.648^{a}	9.946^{a}	15.323^{b}	9.247^{a}	10.329^{a}	9.177^{a}		*
C14:1	Ewe	0.255±0.0	0.227	0.266	0.272	0.249	0.344	0.257	0.137	ns	ns
	Goat	0.224±0.0	0.222	0.241	0.278	0.264	0.191	0.113	0.285		ns
C15:0	Ewe	0.840±0.2	0.658	1.089	0.868	1.037	0.690	0.691	0.856	ns	ns
	Goat	0.706±0.2	0.929	0.809	0.826	0.458	0.688	0.645	0.639		ns
C15:1n5	Ewe	0.261±0.0	0.190	0.258	0.314	0.266	0.261	0.244	0.315	ns	ns
	Goat	0.245±0.0	0.208	0.272	0.263	0.143	0.250	0.291	0.302		ns
C16:0	Ewe	28.72±3.1	25.861	28.700	27.988	30.425	31.279	29.409	26.709	ns	ns
	Goat	27.04±2.2	29.121^{b}	25.610^{a}	24.421^{a}	30.318^{b}	28.459^{b}	25.662^{a}	26.108^{a}		***
C16:1	Ewe	1.402±0.4	1.321^{b}	1.316^{b}	1.328^{b}	0.748^{a}	1.957^{c}	1.782^{bc}	1.350^{b}	*	**
	Goat	1.713±0.7	1.335^{ab}	1.224^{ab}	0.963^{a}	2.644^{c}	2.152^{c}	1.448^{bc}	2.294^{c}		**
C17:1	Ewe	0.667±0.2	0.493	0.528	0.478	0.478	0.888	1.006	0.867	ns	ns
	Goat	0.688±0.3	0.368^{a}	0.498^{a}	0.554^{a}	0.433^{a}	0.948^{b}	1.023^{b}	0.986^{b}		**
C18:1n9	Ewe	0.461±0.2	0.422	0.118	0.559	0.524	0.581	0.565	0.458	ns	ns
	Goat	0.552±0.3	0.551	0.491	0.183	0.682	0.777	0.594	0.612		ns
C18:0	Ewe	8.456±2.8	9.625	10.694	6.659	6.884	7.404	8.746	9.548	ns	ns
	Goat	9.308±2.7	7.917	10.531	12.245	6.060	8.882	10.255	8.557		ns
C18:1n9c	Ewe	24.79±5.1	26.010	23.010	25.014	20.095	26.854	28.361	23.887	ns	ns
	Goat	27.12±5.0	22.967^{a}	23.815^{a}	22.127^{a}	27.027^{ab}	32.950^{ab}	28.857^{b}	32.518^{b}		*
C18:2n6t	Ewe	0.484±0.2	0.294^{a}	0.284^{a}	0.382^{a}	0.477^{ab}	0.670^{b}	0.664^{b}	0.691^{b}	ns	*
	Goat	0.511±0.2	0.413^{a}	0.344^{a}	0.286^{a}	0.512^{a}	0.596^{a}	0.544^{a}	1.018^{b}		*
C18:2n6c	Ewe	2.022±0.2	1.909	2.064	2.110	1.821	2.055	2.252	1.905	ns	ns
	Goat	2.173±0.2	2.159	1.898	2.175	2.432	2.307	2.120	2.088		ns
CLA_{c10t12}	Ewe	0.178±0.0	0.155	0.202	0.209	0.192	0.162	0.150	0.181	ns	ns
	Goat	0.178±0.0	0.200	0.172	0.211	0.196	0.178	0.151	0.134		ns
C18:3n6	Ewe	0.494±0.1	0.643	0.513	0.491	0.321	0.504	0.557	0.402	ns	ns
	Goat	0.549±0.1	0.612	0.515	0.463	0.376	0.712	0.656	0.522		ns
CLA_{C9t11}	Ewe	0.378±0.1	0.369	0.325	0.324	0.314	0.485	0.495	0.315	ns	ns
	Goat	0.426±0.1	0.388^{ab}	0.321^{a}	0.231^{a}	0.487^{c}	0.587^{c}	0.485^{c}	0.500^{c}		*
C18:3n3	Ewe	0.044±0.0	0.033^{ab}	0.029^{a}	0.033^{ab}	0.036^{ab}	0.067^{c}	0.064^{c}	0.054^{ab}	*	*
	Goat	0.056±0.0	0.039^{a}	0.030^{a}	0.024^{a}	0.085^{bc}	0.077^{bc}	0.062^{b}	0.080^{bc}		***
C20:2n6	Ewe	0.038±0.0	0.028	0.042	0.048	0.049	0.029	0.030	0.048	ns	ns
	Goat	0.038±0.0	0.049	0.032	0.050	0.049	0.032	0.028	0.025		ns
C20:3n3	Ewe	0.025±0.0	0.029^{a}	0.059^{b}	0.017^{a}	0.013^{a}	0.017^{a}	0.022^{a}	0.016^{a}	ns	*
	Goat	0.029±0.0	0.043	0.015	0.015	0.020	0.020	0.075	0.022		ns
C20:4n6	Ewe	0.219±0.0	0.186	0.194	0.180	0.197	0.286	0.277	0.212	ns	ns
	Goat	0.223±0.0	0.243^{ab}	0.191^{a}	0.156^{a}	0.347^{b}	0.254^{ab}	0.142^{a}	0.244^{ab}		*
C23:0	Ewe	0.010±0.0	0.008	0.011	0.006	0.013	0.009	0.013	0.015	ns	ns
	Goat	0.010±0.0	0.008	0.007	0.014	0.018	0.013	0.004	0.005		ns
C22:2n6	Ewe	0.075±0.0	0.102^{c}	0.089^{c}	0.075^{ab}	0.055^{ab}	0.081^{ab}	0.073^{c}	0.046^{a}	ns	*
	Goat	0.070±0.0	0.112^{c}	0.094^{bc}	0.069^{ab}	0.057^{ab}	0.063^{ab}	0.055^{ab}	0.048^{a}		*
C24:0	Ewe	0.072±0.0	0.005^{a}	0.068^{b}	0.066^{b}	0.096^{b}	0.091^{b}	0.091^{b}	0.098^{b}	ns	*
	Goat	0.066±0.0	0.035	0.047	0.073	0.046	0.077	0.088	0.106		ns
C20:5n3 (EPA)	Ewe	0.174±0.1	0.143	0.121	0.147	0.098	0.372	0.204	0.115	**	ns
	Goat	0.086±0.0	0.052^{a}	0.126^{b}	0.084^{ab}	0.089^{ab}	0.121^{b}	0.050^{a}	0.064^{a}		**
C24:1n9	Ewe	0.013±0.0	0.003^{a}	0.005^{a}	0.055^{b}	0.003^{a}	0.016^{a}	0.006^{a}	0.008^{a}	ns	**
	Goat	0.066±0.1	0.423	0.069	0.025	0.017	0.021	0.005	0.007		ns
C22:5n3	Ewe	0.155±0.0	0.171	0.170	0.172	0.151	0.153	0.137	0.121	ns	ns
	Goat	0.170±0.0	0.297	0.164	0.117	0.195	0.212	0.136	0.088		ns
C22:6n3 (DHA)	Ewe	0.087±0.0	0.198^{c}	0.125^{b}	0.066^{a}	0.046^{a}	0.073^{a}	0.047^{a}	0.045^{a}	ns	***
	Goat	0.069±0.0	0.227^{b}	0.092^{a}	0.033^{a}	0.042^{a}	0.052^{a}	0.040^{a}	0.048^{a}		**

Means with different superscript in each column (a, b, c) differ significantly; ns; not significant; ∗; p<0.05, ∗∗; p<0.01, ∗∗∗; p<0.001.

Table 2: Nutritional indexes of Akkaraman ewe and Hair goat milk samples (g/100 g).

Fatty acids		General Mean	0. day Mean	1. day Mean	3. day Mean	7. day Mean	10. day Mean	15. day Mean	30. day Mean	p Species	p Day
SFA	Ewe	63.97±5.7	63.010	66.493	64.003	69.486	60.727	59.250	65.296	ns	ns
	Goat	61.21±6.1	65.162^{b}	65.556^{b}	68.110^{b}	60.131^{ab}	54.319^{a}	59.655^{ab}	54.765^{a}		*
MUFA	Ewe	27.85±5.6	28.666	25.501	28.019	22.362	30.901	32.221	27.022	ns	ns
	Goat	30.61±5.9	26.072^{a}	26.610^{a}	24.394^{a}	31.209^{ab}	37.289^{ab}	32.329^{b}	37.005^{b}		*
PUFA	Ewe	4.379±0.6	4.260	4.218	4.253	3.769	4.953	4.974	4.152	ns	ns
	Goat	4.583±0.6	4.835^{ab}	3.994^{a}	3.914^{a}	4.887^{ab}	5.211^{b}	4.543^{ab}	4.882^{ab}		*
MUFA /SFA	Ewe	0.446±0.1	0.457	0.392	0.455	0.334	0.512	0.545	0.418	ns	ns *
	Goat	0.513±0.1	0.411^{a}	0.406^{a}	0.363^{a}	0.528^{ab}	0.687^{ab}	0.546^{b}	0.676^{b}		
PUFA /SFA	Ewe	0.069±0.0	0.068	0.063	0.069	0.056	0.082	0.084	0.064	ns	ns
	Goat	0.076±0.0	0.076^{b}	0.061^{ab}	0.058^{a}	0.082^{b}	0.096^{c}	0.076^{b}	0.089^{c}		*
UFA /SFA	Ewe	0.515±0.1	0.525	0.456	0.523	0.390	0.594	0.629	0.482	ns	ns
	Goat	0.590±0.1	0.487^{a}	0.467^{a}	0.421^{a}	0.610^{ab}	0.782^{b}	0.622^{ab}	0.765^{b}		*
Omega 3	Ewe	0.486±0.1	0.573	0.505	0.434	0.345	0.681	0.474	0.351	ns	ns
	Goat	0.412±0.1	0.659	0.428	0.273	0.430	0.482	0.362	0.302		ns
Omega 6	Ewe	3.514±0.4	3.318	3.388	3.496	3.111	3.786	4.004	3.486	ns	ns
	Goat	3.743±0.4	3.788	3.245	3.411	3.970	4.142	3.696	4.080		ns
Omega 6/3	Ewe	7.902±2.5	5.902	6.985	8.411	9.248	5.928	9.546	9.998	*	ns
	Goat	10.35±4.7	6.433	7.575	16.189	9.244	8.736	10.541	13.529		ns
AI	Ewe	2.655±0.8	2.229	2.735	2.644	3.790	2.441	2.118	2.620	ns	ns
	Goat	2.314±0.7	2.942	2.468	2.809	2.717	1.597	2.023	1.625		ns
TI	Ewe	3.176±0.8	2.775	3.522	3.049	4.130	2.929	2.716	3.087	ns	ns
	Goat	2.820±0.5	3.393^{c}	3.034^{b}	3.388^{c}	2.966^{b}	2.239^{a}	2.555^{a}	2.127^{a}		*
16:1/16	Ewe	0.049±0.0	0.051^{b}	0.048^{ab}	0.048^{ab}	0.025^{a}	0.063^{b}	0.061^{b}	0.051^{b}	*	*
	Goat	0.062±0.0	0.046	0.048	0.040	0.087	0.075	0.056	0.088		ns
18:1/18	Ewe	2.905±0.7	2.699	2.219	2.905	3.040	3.624	3.248	2.601	ns	ns
	Goat	3.132±0.9	2.864^{ab}	2.265^{a}	1.978^{a}	4.499^{d}	3.837^{bc}	2.814^{ab}	3.803^{bc}		***

Means with different superscript in each column (a, b, c) differ significantly; ns; not significant; ∗; p<0.05, ∗∗; p<0.01, ∗∗∗; p<0.001 SFA (Saturated fatty acids) = C14:0 + C15:0 + C16:0 + C18:0 + C20:0 + C22:0 + C23:0 + C24:0, MUFA (monounsaturated fatty acids)= C14:1 + C15:1 + C16:1 + C17:1 + C18:1, PUFA (polyunsaturated fatty acids)=C18:2n6c + C18:2n6t + C18:3n6 + C18:3n3 + CLA + C20:2 + C20:3n6 + C20:4 + C20:5, UFA (unsaturated fatty acids) = PUFA+MUFA, AI (The atherogenic index): (12:0 + 4 × 14:0 + 16:0) / (MUFA + PUFA), TI (Thrombogenic index): (C14:0 + C16:0 + C18:0) / (0.5 × MUFA + 0.5 × PUFAn-6 + 3 × PUFAn-3 + PUFAn-3 / PUFAn-6) (Ulbricht and Southgate 1991).

DISCUSSION AND CONCLUSION

In both Akkaraman ewe and Hair goat milk, the fatty acid profile in milk affects the quality, texture, aroma and flavor of milk and dairy products (Yurchenko et al. 2018). Depending on the column structure used in the GC-FID, 29 different fatty acids from C10:0 to C22:6n3 (DHA) were detected.

Considering that Capric acid (C10:0), which is among the medium-chain fatty acids, plays a major role in the unique odor of goat milk, the continuous decrease in the C10:0 ratio in goat milk shows that the aroma change in goat milk is higher than ewe milk (Park and Haenlein 2010).

α–linolenic acid (C18:3n3) is a fatty acid that must be taken into the body with food. Moreover, in recent scientific studies, it has been stated that consumption of α-linolenic acid reduces the risk of cardiovascular heart disease and prostate cancer in men (Erkkila et al. 2008). Contrary to what was reported by Talpur et al. (2009) the ratio of C18:3n3 (α-linoleic acid) found in both Hair goat and Akkaraman ewe milk is statistically different between species. In addition, the data obtained for both Akkaraman ewe and Hair goats in C18:3n3 were found to be lower than those reported by Alonso et al. (1999), Sevi et al. (2002), Bernard et al. (2005) and Atti et al. (2006). It is thought that this difference between the studies may be due to the breed and feeding factor.

Although PUFAs are present in small concentrations in milk fat, they exert several health-promoting effects, including anticarcinogenic, antimutagenic, hypocholesterolemic, and anti-atherosclerotic properties (Jahries et al. 1999; Jensen 2002). The difference in PUFA ratio in ewe and goat milk in our study is consistent with the Talpur et al. (2009) reports but not with the Tsiplakou et al. (2006). The content of PUFAs may have been affected by changes in the composition of the supplement meals. It is also known that the increase in the ratio of unsaturated fatty acids in the diet is also effective on PUFA (Ozyurek et al. 2020).

In our study, even if the C16:0 ratio in goat's milk was irregular, it was affected by the lactation period (p<0.001), and in this respect, it is similar to Yakan et al. (2019) and Alizadehasl and Unal (2021). Again, the change in SFA, MUFA and PUFA in goat's milk was the same as determined by Goetsch et al. (2011). The effect of lactation on SFA, MUFA and PUFA in ewe's milk was not the same as determined by Tsiplakou et al. (2006).

The total ratio between Omega 6/3, which is one of the indexes used to evaluate the nutritional value of oils, should not exceed 4.0 (Ulbricht and Southgate 1991). It was found above this limit in both species in this study. It is thought that feeding the animals with feeds with high dry matter content and not feeding them with green fresh plants during the study period reveals this situation. It was also found above the value that Park and Haenlein (2010), Yurchenko et al. (2018) and Yakan et al. (2019), found for goat's milk.

Milk containing high levels of unsaturated fatty acids has low AI and TI. In other words, it is accepted that the lower the AI and TI of milk and dairy products, the lower the risk of cardiovascular diseases. Consumption of milk and products with low AI has a lowering effect on total cholesterol and LDL cholesterol (Poppitt et al. 2002). However, both AI and TI values found in the current study were noted to be above the desired value of 1 during the lactation period (Ulbricht and Southgate 1991). The ratio of fatty acids in milk is mostly under the influence of feeding. The barley and wheat straw used in feeding can cause this situation.

Chilliard et al. (2002) and Kondyli et al. (2012) found the CLAC9t11 ratio in ewe milk to be higher in contrast to our study. Some differences in CLA content of milk fat seen between individual animals consuming more or less similar rations are thought to be due to differences in the ability of the ewe/goat to produce CLA from trans-11 C18:1. In this study, the fact that the ratio of C16:1/C16:0 was statistically different in both animal species confirms our opinion. It can also be explained by the fact that C18:0 is the most preferred substrate for Δ-9 desaturase in the mammary gland (Chilliard et al. 2000).

In the study, the changes in fatty acid profile and some lipid health indices in Akkaraman ewe and Hair goat milk during the first 30 days of lactation were investigated. Contrary to the general literature information, the highest CLA ratio in milk was found in Hair goat milk and most lipid health indexes were determined in favor of Hair goats. It is an important issue that should be emphasized that the ratios of SFA, MUFA, PUFA, MUFA/SFA, PUFA/SFA and UFA/SFA only in Hair goat milk change in the first 30 days of lactation.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

AUTHOR CONTRIBUTIONS

Idea / Concept: MHA, SÖ
Supervision / Consultancy: DT
Data Collection and / or Processing: MHA, SÖ
Analysis and / or Interpretation: MHA, SÖ, DT
Writing the Article: MHA, SÖ
Critical Review: MHA, SÖ, DT

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