

Investigation on the changes in concentrations of vitamin D₃ and E in Honamli and hair goat breed' colostrum in early postpartum

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Untersuchung zur Vitamin D₃ und E Konzentration im Kolostrum von Honamli – und Angoraziegen in der frühen postpartalen Phase

Kolostrum enthält höhere Mengen an Vitamin D₃ und E als die normale Milch. Aufgrund des Aufbaus der Ziegenplazenta werden Ziegenlämmer mit sehr geringen Reserven an fettlöslichen Vitaminen geboren und sind für ausreichend hohe Plasmakonzentrationen von Vitamin D₃ und Vitamin E auf die Kolostrumaufnahme angewiesen. In der vorliegenden Studie wurde Vitamin E, in Form der in der Milch am stärksten vorkommende Isoform von α -Tocopherol gemessen. Das Hauptziel war die Bestimmung der Vitamin D₃ – und E-Konzentration im Kolostrum von Honamli und Angoraziegen in der frühen postpartalen Phase durch Hochleistungsflüssigkeitschromatographie. Am Tag der Geburt sowie am dritten und fünften Tag postpartum wurden bei fünf Honamli – und fünf Angoraziegen Kolostrumproben entnommen. Das Kolostrum beider Ziegenrassen enthielt höhere Konzentrationen an Vitamin D₃ und α -Tocopherol als normale Milch ($p < 0,05$). Die Konzentrationen von Vitamin D₃ und α -Tocopherol unterschieden sich auch zwischen den beiden Ziegenrassen ($p < 0,05$). Die Vitamin D₃ Konzentration unterschied sich zwischen dem ersten und dritten Tag postpartum ($p < 0,05$). Die α -Tocopherol Konzentrationen waren im Kolostrum von Angoraziegen höher als bei Honamli-Ziegen ($p < 0,05$). Zusätzlich unterschied sich die α -Tocopherol Konzentration zwischen dem ersten und fünften Tag postpartum ($p < 0,05$).

Schlüsselwörter: Honamli Ziege, Hair goat, Kolostrum, Vitamin D₃, Vitamin E

Summary

Colostrum contains higher amounts of vitamins D₃ and E than mature milk. Due to the structural feature of the goat placenta, goat kids are born with very low reserves of fat-soluble vitamins and must rely on colostrum to acquire adequate plasma levels of vitamin D₃ and vitamin E. In the present study, vitamin E was measured in the form of α -tocopherol which is the most dominant isoform present in milk samples. The main aim of the present study is to determine the colostrum vitamin D₃ and E content in Honamli and hair goats in the early postpartum stage by high-performance liquid chromatography. Five Honamli and five hair goat colostrum samples were collected on the day of kidding and on the third and fifth days postpartum. On the sampled days, the colostrum of both goat breeds contains higher concentrations of vitamin D₃ and α -tocopherol than that in mature milk ($p < 0,05$) and there was the existence of a breed difference in colostrum vitamin D₃ and α -tocopherol concentrations ($p < 0,05$) was determined. Also, the effect of sampling day on colostrum vitamin D₃ concentration in samples that were obtained between the first and third days was also significant ($p < 0,05$). Hair goat colostrum α -tocopherol concentrations were found to be higher than Honamli goats ($p < 0,05$). Additionally, there was a statistically significant difference between the sampling day and α -tocopherol content on days one and five ($p < 0,05$).

Keywords: Honamli goat breed, Hair goat breed, colostrum, Vitamin D₃, Vitamin E

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Introduction

Hair goat is the most common indigenous breed in compared to Honamli breed which are raised in limited numbers in Turkey's Western Mediterranean Region, and local documentation on Honamli goat colostrum and milk ingredients, such as vitamin content is rather limited. A synepitheliochorial placenta types of small ruminants (sheep and goats) limit the adequate transfer of essential components, primarily immunoglobulins¹⁶ and vitamins.^{7,36, 69} In ruminants, offspring must be dependent upon the ingestion of colostrum to obtain both vitamin D and vitamin E after birth.²² It has been shown in human study that vitamin D deficient mothers are prone to having vitamin D deficient infants with impaired immune and bone health.²⁴ The colostrum of cows and sheep contains a higher amount of vitamin D₃⁵¹ and E,^{21,50,42} than mature milk which may be critical for bone health, mineral metabolism, and protection against oxidative stress in newborns. Vitamin D₃ and E are lipophilic components of colostrum and milk involved in important pathways.^{13,34} The early requirement of vitamin D and α -tocopherol of newborn kids is ensured by colostrum, which is a gift given by nature and produced by mammary glands. There are various isoforms of vitamin D, vitamin D₂ and D₃ that are well-known. Vitamin D₃ (cholecalciferol) is produced in the skin, and Vitamin D₂ (ergocalciferol) is present in plant tissue. Vitamin D₃ has been noted as a prosteroid hormone and is synthesized from 7-dehydrocholesterol that exists in the skin.^{24,6} It involves the metabolism of bone tissue, calcium, phosphorus, and magnesium. With the direct effect of sunlight, it converts the active form of vitamin D₃.¹¹ After the description of the role of vitamin D in calcium homeostasis, its effectiveness in the prevention of milk fever has not been controversial in cattle that are supplemented with adequate vitamin D.²⁶ The reason for this is that vitamin D alone is not biologically active and must be hydroxylated in the animal liver to 1,25-dihydroxyvitamin D₃ (1,25(OH)₂D₃) before being converted to the hormonal form of 1,25(OH)₂D₃ in the kidney for receptor activation, which controls gene expression.¹⁴ 1,25-dihydroxy-vitamin D is categorized as a prosteroid hormone among its roles in the control of calcium and phosphorous homeostasis, immune cell activation, and controlling several immune responses via the vitamin D receptor (VDR).¹⁷ The presence of VDR receptors and the 25-hydroxy-vitamin D-1-hydroxylase enzyme in a variety of tissues, including the brain, prostate, intestines, muscle tissue, activated macrophages, and mammary glands, suggests that vitamin D plays a hormone-like role in these tissues.^{23,34} Mammary adipose tissue is employed as a storage site for vitamin D₃.⁴⁹ Additionally, epithelial and adipocyte cells are skilled at biotransformation of vitamin D₃.^{3,33,49} Apparently, 1,25(OH)₂D₃ also associated with the production of antimicrobial peptides such as nitric

oxide and β -defensin in cattle.⁴¹ Another study reported that vitamin D also contributes to reproductive performance and mammary development of cattle.^{30,48,68} Moreover, 1,25-dihydroxy-vitamin D contributes to the modulation of gene expression in apoptosis and angiogenesis.^{24,40} A study suggested that vitamin D deficiency results in tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) protein expression in breast milk and mammary epithelial cells.⁵⁹ Vitamin E is one of the most potent, fat-soluble cellular members of the antioxidant system, which protects cell membranes from lipid peroxidation.⁵ α -tocopherol, is the biologically active form of vitamin E.^{64,4,61} Moreover, vitamin E deficiency results in immune repression, an increased predisposition to oxidative stress, mastitis,⁵⁴ left displacement of the abomasum,⁴³ and retained placenta.⁴⁵ Selenium and vitamin E play a synergistic role as antioxidants²³ and are necessary for the immune function in cows.⁵⁹ Besides antioxidant properties, vitamin E is an important fat-soluble vitamin for ruminants and its levels start to decrease sharply before birth, reach their lowest levels at delivery, and rise again to the baseline values within a week of lactation in cows.^{65,10,12} The main storage organs for vitamin E are the liver, skeletal muscle, and adipose tissue.² Due to limited placental transfer of vitamin E during pregnancy,^{31,44} ruminant offspring are born deficient in the storage of α -tocopherol. Colostrum is the sole source of vitamin E required by ruminant newborns in the postnatal period to cope with oxidative stress and immune systems evolution. Immunoglobulin absorption is affected by insufficient colostrum intake or colostrum with low α -tocopherol levels.⁴⁶ The composition of colostrum, particularly early in lactation, exclusively fits the goat kid's requirements and is necessary for survival and life sustainability.¹⁶ Colostrum composition has been the subject of many scientific studies, but only few studies focused on changes in the vitamin content with time. The description of the changes in vitamin D₃ and vitamin E content in the period between the transition from colostrum to mature milk in ruminants are studied by number of authors.^{43,35, 29,15} However, there is no information in literature describing the changes in both fat-soluble vitamins in colostrum's of Honamli and hair goats. The general objective of this study was to evaluate the changes in vitamin D₃ and E content in colostrum from the first five days of Honamli and hair goats' third kidding and to compare it with mature milk samples.

Materials and Methods

Five Honamli and five hair goats, aged 3–3,5 years old in their 3rd pregnancy, body condition, lactation number, fed the same ration, and single birth were randomly assigned. Honamli goats were kept at the Burdur Mehmet Akif Ersoy University, Agriculture, Livestock and Food

Application and Research Centre and hair goats used in this study belonged to the local goat breeder farm located adjacent to university Honamli goat flock unit. Both Honamli and hair goats showed their breed representatives. The goats used in this study did not receive vitamin D₃ and vitamin E supplements before parturition. Colostrum samples were milked immediately after parturition from Honamli and hair goats for the determination of vitamin D₃ and vitamin E. From March to April 2020, colostrum samples were collected on the first, third, and fifth post-partum days. The phenotypical characteristics of animal material used in the present study, including management practices and the nutritional conditions of raising, were described elsewhere.^{8,1} During the sampling period, two groups of each breed were randomized to the same diet. The colostrum samples from both goat breeds were collected simultaneously before sucking from the mother as soon as possible after parturition. The colostrum samples were recorded, and mature milk samples were collected from 3 goats in each breed at day 20 post-parturition and pooled. A 50 ml colostrum sample was frozen (-20 °C) before analysis of vitamin D₃ and E. All analyses were carried out within two weeks of colostrum collection. The vitamin D₃ and E levels in the colostrum and pooled mature milk samples were assayed by high-performance liquid chromatography (HPLC). Both the Honamli and hair goats used in the present study did not exhibit any health problems during the sampling period. Both goat flocks are fed in a semi-extensive herd (pasture and integration with concentrate). The Ethics Committee of Burdur Mehmet Akif Ersoy University approved the experimental animal procedures (Approval number: 437, 10.10.2018).

Statistical analysis

Statistically significant differences in the vitamin D₃ and α -tocopherol contents of colostrum samples among goat breeds and collection days were determined by the analysis of variance (ANOVA) using the PROC GLM procedure using the SAS software (SAS System for Windows 9.0, Chicago, USA). Duncan's multiple comparison test was used at the level of $\alpha = 0,05$ to determine any significant difference between the means of vitamin D₃ and α -tocopherol values of colostrum in terms of both goat breeds and collection day. The interaction between breed and collection day was found to be statistically insignificant ($p > 0,05$).

Chemicals and Reagents

Vitamin D₃ catalog number 47763 and α -tocopherol catalog number T3251, Sigma, St Louis, MO, USA), Sigma, St Louis, MO, USA). All organic solvents were

HPLC grades. All chemicals used in *chromatography* were purchased from Merck (Darmstadt, Germany).

Sample Preparation

Sample preparation for the analysis of Vitamin D₃ and E in colostrum and milk samples was carried out by the modified method of Miclova et al.³⁷ The colostrum and milk samples were kept at -20 °C, and before analysis, they were taken into a refrigerator at 4 °C before the extraction of vitamins D₃ and α -tocopherol. 200 μ l methanolic pyrogallol and one milliliter of KOH were added to 2 gr colostrum and milk samples. After vortexing the mixture and leaving it in an ultrasonic bath for 10 minutes, the samples were kept hermetically covered for protection from the harmful effects of light and air. Next, five milliliters of hexane and one milliliter of distilled water were added. The mixture was centrifuged at 1500 \times g for five minutes at 37 °C. The upper phase of the hexane layer was transferred to an evaporation balloon, and the extract was evaporated to dryness. The extract was then diluted with one milliliter of mobile phase and filtered, and a 100 μ l sample was subjected to HPLC.

Chromatographic Analysis

Detection and quantification were carried out with a Shimadzu LC-20AT prominence System controller (Kyoto, Japan), SIL-20A auto sampler, LC-20AT pump, and SPD-M20A Diode Array Detector for vitamins. The Inertsil Sustain C18 (250 \times 4,6 mm, 5 μ m) (GL Sciences, Tokyo, Japan) column was used. The mobile phase consisted of heptane/THF (95/5) (v/v) at a flow rate of 1,0 ml/min. The instrumental set-up included the flow rate at 1,0 mL/min and the temperature of the column oven was set at 30 °C. The detection wavelengths were 240 nm for tocopherol and vitamin D₃.²⁸ Stock standard solutions of 10 mg/mL of each compound were prepared in the mobile phase and stored at -20 °C. In both cases, different working standard solutions were prepared by dilution in the mobile phase. Six concentrations were used for the calibration curves of vitamins. Linear regression analysis was carried out by plotting peak area (y) versus vitamin concentration (x). Vitamin D₃ and α -tocopherol in the samples of goat colostrum and milk were determined and quantified by matching their flow time and area with those of standard stock solutions, respectively.

Results

The amount of vitamin D₃ and α -tocopherol in colostrum and milk samples were calculated by applying the linear

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equations given below to convert areas obtained from external standards of vitamin D₃ $y: 449,00 \times 522,52 \times (r: 0,9991)$ and α -tocopherol $y: 15,192 \times 6673,3 \times (r: 0,9992)$. The correlation coefficients (r) were 0,9991 for vitamin D₃ and 0,9992 for α -tocopherol standards, respectively. The chromatographic peaks corresponding to vitamin D₃, and tocopherol are clearly separated. The chromatogram recorded at $\lambda: 240$ nm representing the elution profile of vitamin D₃ and α -tocopherol in goat colostrum and milk samples is displayed in Figure 1. Retention times for vitamin D₃ and tocopherol were between 5,5 and 9,1 minutes, respectively. Likewise, the peaks corresponding to vitamin D₃, and α -tocopherol are clearly separated from each other. All UV spectrum and chromatography results showed that goat colostrum and milk samples naturally contained the investigated vitamins. HPLC profiles of vitamin D₃ and α -tocopherols in colostrum and milk samples are shown in Figure 1.

Table 1 and Table 2 show changes in colostrum vitamin D₃ and α -tocopherol concentrations in hair and Honamli goat colostrum samples on day one, three and five. The concentrations of vitamin D₃ and α -tocopherol were the highest on day one, decreased sharply on the second sampling and continued to decrease at day five in both goat breeds (Table 1 and Table 2). The data were analyzed to seek whether breed difference and sampling day had any impact on the vitamin D₃ and α -tocopherol concentrations of the colostrum. The concentrations of vitamin D₃ on the first day was $\sim 2,1$ – and $2,8$ -times as high as those from mature milk sample in Honamli and hair goats, respectively. Correlation coefficients among colostrum and milk vitamin D₃ and α -tocopherol concentrations in both goat breeds are presented in Table 1 and Table 2. The statistical analysis of data showed the presence of a breed difference in colostrum vitamin D₃

content. The hair goat colostrum vitamin D₃ contents was higher than ($4,00 \pm 1,74 \mu\text{g}/\text{kg}$) those of Honamli goat colostrum ($2,79 \pm 1,30 \mu\text{g}/\text{kg}$) respectively ($n: 15$) ($p < 0,05$). Moreover, the analysis of data showed the presence of the sampling day effect on vitamin D₃ concentration. The highest mean value of $4,80 \pm 1,67 \mu\text{g}/\text{kg}$ vitamin D₃ was obtained in colostrum samples milked on day one in both breeds ($n: 10$, $p < 0,05$). There was no such a correlation in colostrum samples milked between day 3 and day 5 ($p > 0,05$). The mean α -tocopherol concentration in hair goat breed was higher ($5,57 \pm 1,10 \text{mg}/\text{kg}$) those of Honamli goat breed ($4,83 \pm 0,64 \text{mg}/\text{kg}$) ($n: 15$, $p < 0,05$). The effect of sampling day on colostrum α -tocopherol level revealed the presence of significant difference. The value of $5,80 \pm 1,17 \text{mg}/\text{kg}$ α -tocopherol in colostrum samples was obtained on day one which was greater than the value of $4,63 \pm 0,67 \text{mg}/\text{kg}$ obtained on day five ($n: 10$, $p < 0,05$). However, the value of $5,18 \pm 0,56 \text{mg}/\text{kg}$ for α -tocopherol concentration on day three was found to be similar to that of colostrum on day one ($p > 0,05$). In both goat breeds, mature milk vitamin D₃ and α -tocopherol levels were significantly lower than those of the colostrum that was sampled on sampled all days ($p < 0,05$). The interaction between breed and collection day was found to be statistically insignificant ($p > 0,05$).

Discussion

Colostrum is secretion take place into goat mammary glands before parturition and of the first days of postpartum. Colostrum harvested immediately after birth contains the highest-quality and quantity of vitamin D₃ and vitamin E. Both vitamins are important in goat newborn to meet demand of rapid growth at early postpartum. In

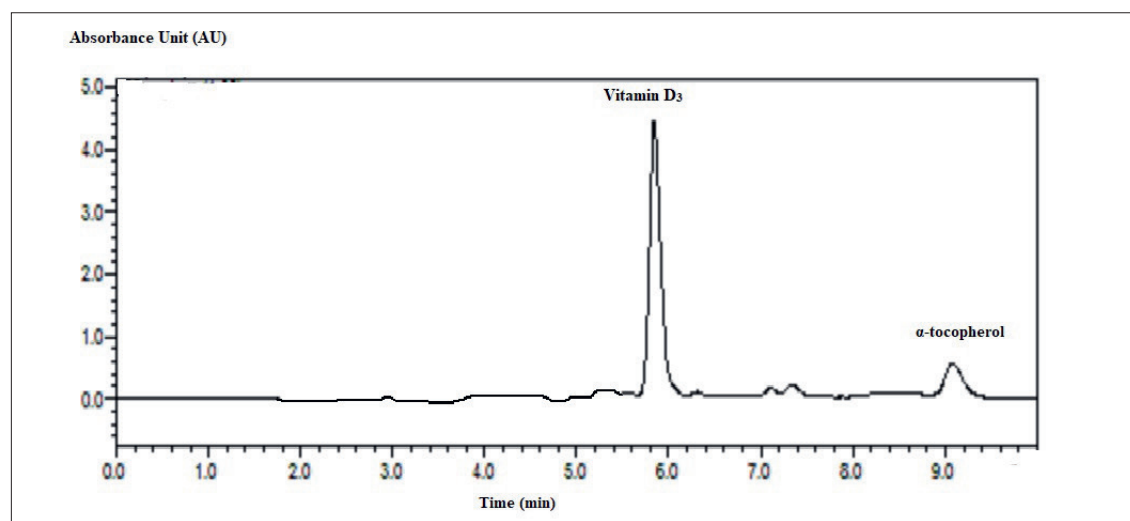


Figure 1: Chromatogram at 240 nm of vitamin D₃ and α -tocopherol extracted from goat colostrum and milk samples. Extraction steps are described in the sample preparation section.

this period, the intake of sufficient quality and amount of colostrum is of great importance to newborn kids as quickly as possible due to its high bioactive factors' composition. In the first 18–36 hours of life, a goat kid's gut is assumed «open,» as enterocytes permeable to immunoglobulin G (IgG) which is absorbed by pinocytosis from the intestinal lumen into blood circulation.³⁹ Also, colostrum intake is also important for goat newborns because of its high fat-soluble vitamin content, so goat kids are born with low blood and tissue fat-soluble vitamin reserves, particularly vitamin E.^{21,31} Because fat soluble vitamins unable to through the maternal placental barrier in ruminants.^{31,47} Diversity in the contents of goat colostrum is closely related to determinants including breed, feeding practice, pasture quality, parturition season, age. Present study showed the presence of breed and sampling day on colostrum vitamin D₃ and α -tocopherol content. Also, Morand-Fehr et al. suggested the importance of farming system (pasture and indoor system) on the composition and quality of sheep and goat milk.³⁸ Some of these determinants affect the metabolism of vitamin D₃ and α -tocopherol in the liver, kidney, mammary glands, bone tissues, thyroid, and parathyroid glands. resulting in alterations in the of vitamin D₃ and α -tocopherol. Also, difference in analytical methods such as vitamin hydrolysis and extraction procedures are results of these variations. Since studies on the level of lipophilic vitamins in goat colostrum are limited, values obtained from colostrum and milk samples of other members of the ruminant family were also used for comparison in presented work.

Both vitamin D₃ and α -tocopherol that were readily available in higher amounts in Honamli and hair goat colostrum and composition changes with each day. Ewe milk vitamin D content was reported as $1,7 \pm 0,22$ ng/ml, 20 days after intra venous injection of 50 mg vitamin D₃.¹⁸ In the presented study, the average vitamin D₃ level was found as $1,96 \mu\text{g}/\text{kg}$ in pooled mature milk samples. According to international food composition databases that have suggested that goat's milk vitamin D₃ was ranged from 0,6 to $2,8 \mu\text{g}/\text{kg}$ ⁵⁸ which is consistent with our results.

On day one, the colostrum- α -tocopherol content in Honamli was $5,20 \pm 0,62$ mg/kg and $6,40 \pm 1,34$ mg/kg in hair goats, respectively. These results are slightly higher than the values observed by Pehrson et al.,⁵⁰ Njeru et al.,⁴² Hidioglou and Batra.²¹ They reported α -tocopherol value changes between 3,3-to $4,5 \mu\text{g}/\text{ml}$ in colostrum and $1-1,65 \mu\text{g}/\text{ml}$ in the milk of sheep. According to Quigley and Bernard, the mean α -tocopherol level in cow colostrum was $2,9 \mu\text{g ml}^{-1}$, with a range of 0,5 to $12,1 \text{ g ml}^{-1}$.⁴⁶ Different values of α -tocopherol such as $1,9 \mu\text{g ml}^{-1}$ in the colostrum of cows have been reported.¹⁹ The measured mean level of α -tocopherol in pooled mature goat milk was $3,47 \pm 0,17$ mg/kg (Table 2). This value in goat milk is higher than previous results,^{34,56} but lower than those reported by Fedele et al.¹⁰ and Pizzoferrato et al.⁵⁴ Hodulová et al. assessed the level of vitamin E in the first colostrum at $5,47$ mg/kg of white short-haired goats.²² These results consistent with our study. In the same study, colostrum α -tocopherol levels

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Table 1: shows changes in colostrum vitamin D₃ concentrations in hair and Honamli goat colostrum samples on days one, three, and five postpartum and mature milk samples at day 20 postparturition.

Days	Vitamin D ₃ ($\mu\text{g}/\text{kg}$)	
	Honamli (n:5)	Hair (n:5)
1	$4,16^{ab} \pm 1,47$	$5,47^a \pm 1,77$
3	$2,22^c \pm 0,51$	$3,81^b \pm 1,55$
5	$2,01^c \pm 0,41$	$2,72^{bc} \pm 0,48$
Pooled mature milk	$1,96^d \pm 0,10$	

Rows with different small letters (a,b,c and d) differ significantly ($p < 0,05$).

Table 2: shows changes in colostrum α -tocopherol concentrations in hair and Honamli goat colostrum samples on days one, three, and five postpartum and mature milk samples at day 20 postparturition.

Days	α -tocopherol (mg/kg)	
	Honamli (n:5)	Hair (n:5)
1	$5,20^{bc} \pm 0,62$	$6,40^a \pm 1,34$
3	$4,84^{bc} \pm 0,26$	$5,51^{ab} \pm 0,46$
5	$4,46^c \pm 0,81$	$4,79^{bc} \pm 0,77$
Pooled mature milk	$3,47^d \pm 0,17$	

Rows with different small letters (a,b,c and d) differ significantly ($p < 0,05$).

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decreased with lactation and reached 1,50 mg/kg at the 132nd hour, as observed in our study at day 20. Michlova et al. reported the α -tocopherol value in East Romanov sheep milk was 4.22 ± 1.75 mg/kg and 3.45 ± 1.50 mg/kg in East Friesian sheep,³⁷ which is in parallel with the results obtained in our study. α -tocopherol in goat milk varies from 0,33 mg/kg to 2,56 mg/kg,³⁷ respectively, which is lower than our measurements. In our study, the mean α -tocopherol levels in mature milk from both breeds were 3,47 gr/kg. which was significantly lower than the previous studies,^{49,37} 1.25 μ g/ml,⁶¹ 0.013–0,121 mg/100 ml.³² Also, Okano et al. compared vitamin D₃ concentrations in colostrum, early and late cow milk samples with HPLC and suggested the presence of the variation among samples.⁴³ A study on Holsteins and Jersey cows on the milk vitamin D content demonstrated that the Jersey breed was superior to that of Holsteins.⁶³ Also, the effect of breed on milk vitamin D₃ in indigenous dairy breeds (Barrosã and Minhota) was found to be higher than that of Friesians and Holstein-Friesians.^{52, 55} Torsein et al. have suggested a positive association between colostrum α -tocopherol and β -carotene concentrations in cow breeds.⁶¹

Our findings confirmed that the secretion of vitamin D₃ and α -tocopherol at high levels via milk take place until 20 or longer days after parturition. Higher milk or colostrum yields of Honamli goats result in lower colostrum vitamin D₃ and α -tocopherol values. The results show that there is a breed difference based on changes in colostrum vitamin D₃ and α -tocopherol levels in the sampled days ($p < 0,05$). Hair goat with higher levels of colostrum or milk vitamin D₃ and α -tocopherol content showed a better utilization efficiency ability of these vitamins than the Honamli breed. At this point, genetic factors are important for the absorption of vitamins from the digestive system and their release into the udder.³¹ Also, the high milk or colostrum yield of Honamli goats is probably associated with the low colostrum vitamin D₃ and tocopherol values. Debier and Laronelle suggested that increases in milk or milk fat content may not result in an increased yield of fat-soluble proteins into milk, such as α -tocopherol and vice versa.⁷ Newborn kids depend upon consumption of sufficient good quality colostrum intake to compensate for low reserves of vitamin D₃ and α -tocopherol at the time of birth due to lack of or limited placental transfer. Results of several studies suggested that factors like breed, feeding practice, management, and milking time might all have had an impact on colostrum composition among animal species. There are high variations in concentrations of fat-soluble vitamins among individuals, and maternal reserve status, diet, and season are the important determinants. However, some authors report an influence of breed characteristics on the colostrum and milk vitamin components. There was a statistical differ-

ence between Honamli and hair goat colostrum vitamin D₃ and α -tocopherol concentrations along the sampled days, indicating the presence of an impact on breed differences. The maternal precolostrum formation and the underlying mechanisms that control the transportation of these fat-soluble vitamins from the maternal reservoirs into the mammary glands are not yet fully elucidated. Future studies on this topic will contribute to the literature in terms of determining the colostrum vitamin levels and changes of both breeds, including not only fat-soluble vitamins, but also water-soluble vitamins, with a larger sample size. Therefore, determination of the optimum vitamin D₃ and E values in goat colostrum and supplementation of the mothers during pregnancy and their offspring following in early life is necessary.

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Conflict of interest

The authors report no conflicts of interest.

Etude sur les changements dans les concentrations de vitamines D₃ et E dans le colostrum de la chèvre Honamli et de la chèvre angora au début du post-partum.

Le colostrum contient des quantités plus élevées de vitamines D₃ et E que le lait. En raison des caractéristiques structurelles du placenta de la chèvre, les chevreaux naissent avec de très faibles réserves de vitamines liposolubles et doivent compter sur le colostrum pour acquérir des niveaux plasmatiques adéquats de vitamine D₃ et de vitamine E. Dans la présente étude, la vitamine E a été mesurée sous la forme d' α -tocophérol qui est l'isoforme la plus dominante présente dans les échantillons de lait. L'objectif principal de la présente étude était de déterminer la teneur en vitamines D₃ et E du colostrum chez les chèvres Honamli et les chèvres angoras au début du post-partum par chromatographie liquide à haute performance. Cinq échantillons de colostrum de chèvres Honamli et cinq de chèvres angoras ont été collectés le jour de la mise bas et les troisième et cinquième jours du post-partum. Aux jours échantillonnés, le colostrum des deux races de chèvres contenait des concentrations de vitamine D₃ et d' α -tocophérol plus élevées que celles du lait ($p < 0,05$) et l'existence d'une différence entre les races dans les concentrations de vitamine D₃ et d' α -tocophérol du colostrum ($p < 0,05$) a été mesurée. De plus, l'effet du jour d'échantillonnage sur la concentration en vitamine D₃ du colostrum dans les échantillons qui ont été obtenus entre le premier et le troisième jour était également significatif ($p < 0,05$). Les concentrations d' α -tocophérol dans le colostrum des chèvres angoras se sont avérées plus élevées que celles des chèvres Honamli ($p < 0,05$). En outre, il y avait une différence statistiquement significative entre le jour d'échantillonnage et la teneur en α -tocophérol aux jours un et cinq ($p < 0,05$).

Mots clés: Race caprine Honamli, race caprine angora, colostrum, vitamine D₃, vitamine E.

Indagine sulle variazioni delle concentrazioni di vitamina D₃ ed E nel colostro delle capre di razza Honamli e Angora nel primo periodo postpartum

Il colostro contiene quantità più elevate di vitamine D₃ ed E rispetto al latte normale. A causa delle caratteristiche strutturali della placenta caprina, i capretti nascono con riserve molto basse di vitamine liposolubili e devono affidarsi al colostro per acquisire adeguati livelli plasmatici di vitamina D₃ e vitamina E. Nel presente studio la vitamina E è stata misurata sotto forma di α -tocoferolo, che è l'isoforma più dominante presente nei campioni di latte. L'obiettivo principale di questo studio era quello di determinare le concentrazioni di vitamina D₃ ed E nel colostro di capre Honamli e Angora nel primo periodo postpartum mediante cromatografia liquida ad alta prestazione. Cinque campioni di colostro proveniente da capre Honamli e cinque da capre Angora sono stati raccolti il giorno del parto e al terzo e quinto giorno postpartum. Nei giorni del prelievo, il colostro di entrambe le razze caprine conteneva concentrazioni più elevate di vitamina D₃ e α -tocoferolo rispetto al latte normale ($p < 0,05$) e si è determinato che le concentrazioni di vitamina D₃ e α -tocoferolo differivano tra le due razze caprine ($p < 0,05$). Inoltre, la concentrazione di vitamina D₃ differiva significativamente nei campioni ottenuti tra il primo e il terzo giorno post-partum ($p < 0,05$) e le concentrazioni di α -tocoferolo erano più elevate nel colostro delle capre d'Angora rispetto alle capre Honamli ($p < 0,05$). Si è pure riscontrata una differenza statisticamente significativa tra il giorno del prelievo e il contenuto di α -tocoferolo nei giorni uno e cinque ($p < 0,05$).

Parole chiave: capre Honamli, capre Angora, colostro, vitamina D₃, vitamina E

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Investigation on the changes in concentrations of vitamin D3 and E in Honamli and hair goat breed' colostrum in early postpartum

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