Effect of weaning age on the lamb's growth, blood parameters and milk yield in Bafra sheep

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SUMMARY

This study was conducted to determine the effect of weaning age (45 days vs. 90 days) on the lamb's growth, blood parameters and milk yield in the Bafra sheep. The study included 40 lactating Bafra ewes and 48 lambs (21 females and 27 males) born from them. The lambs were divided into two groups, 23 lambs weaned at day 45 (45D) and 25 lambs weaned at day 90 (90D). The lambs were equally divided between the 45D and 90D groups according to birth weight, sex, birth type, maternal age and sire. Live weights and body measurements of lambs were recorded at birth and on days 30, 42, 60, 90, 120, and 205. Blood plasma cortisol, glucose, total concentration and urea levels of the lambs were determined at 42 days of age (before weaning of lambs) and 47 days of age (2 days after weaning of 45D lambs; before weaning of 90D lambs). Bafra sheep were subjected to monthly milk controls. Lactation length, daily milk yield and lactation milk yield of the sheep were determined. Differences in body measurements and live weights between 45D and 90D lambs on the 90th day were found to be statistically significant, and these differences decreased in the following period (120th day and 205th day). The study concluded that early weaning had no negative effect on lamb live weight and body development. Differences in blood plasma cortisol, glucose, total cholesterol and urea levels on day 2 (at 47 days of age) of weaning between 45D and 90D lambs were not found to be statistically significant. Lactation milk yield of ewes was 113.3 kg, lactation length was 98.5 days and daily milk yield was 1.1 kg. The survival rate of lambs from weaning at 45 days to 205 days of age was found to be 100%. According to these results, weaning at 45 days did not have a negative effect on lamb survival. It was concluded that more careful care and feeding of lambs and the evaluation of sheep milk could contribute more to the farm economy.

KEY WORDS

Weaning; lambs; body measurements; blood parameters; milk yield.

INTRODUCTION

Weaning of lambs can be done at periods starting from 2-3 days of age and extending up to 5-6 months of age, the next mating season, depending on the rearing system of the farm (extensive, intensive) and farm facilities (possibility of finding and employing workers, presence of sufficient internal compartments in pen) [1-6]. You may see the adult lamb trying to suckle its mother during mating in a flock where lambs have not been weaned for a long time [4]. Sheep farming is done extensively and primarily based on grazing throughout the world [7]. In this production system, lambs' survival and development depend on their genetic structure, the milk yield of their dams, and farm owners' management. The period when newborn lambs do not need direct care from their mothers and breeders decreases from the age of 2 weeks, and after the age of 35-45 days, when the rumen development is completed, care and feeding decreases to the level shown to other animals [8]. For farmers to keep the enterprise's profitability at the best level, lamb development and milk yield must be evaluated optimally [6, 9, 10]. In order to maintain the profitability of the enterprise at the best level, farm owners need to plan and manage opportunities such as early weaning of lambs [11], milk that can be obtained from sheep, good preparation of sheep for the next mating period, and shortening of lambing intervals in the best way [10].

The Bafra sheep, with its high milk and fertility, is a hybrid breed consisting of 75% Sakız and 25% Karayaka genotypes and was developed to increase the lamb and milk yield of Karayaka sheep [12]. Matings are generally planned so that lambing occurs in January-March. While male lambs leave the herd with the shearing of the sheep (June-July), female lambs stay with the herd and suckle their mothers until the following mating [13, 14]. Considering the number of animals and the products obtained in grazing-based production systems around the world, the potential of the animals cannot be fully utilized and the profitability of the enterprise decreases [11, 15].

In most extensive production systems, the care of newborn lambs is left to the mothers who give birth to the lamb. However, it is thought that the need for dam milk of newborn lambs can be ended by gaining passive immunity with colostrum, that their future needs can be met with lower-cost milk replacers [16], and that the high-value ewe milk produced can be used for human nutrition.

Weaning lambs earlier, at 20 days of age [17] and 28 days of age [18], has been reported to have positive effects on growth performance and the development of the digestive system. This

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study assumed that lambs would complete their rumen development at 45 days of age and that dam milk would not be effective in lamb development after this age. This study aimed to determine the live weight and body measurement values of Bafra breed lambs weaned at 45 days of age (early) and lambs weaned at 90 days of age (normal), and the milk yield and lactation lengths of Bafra sheep. Also, the studied variables' mutual correlations and associations with the lamb's outcome variables at different ages after weaning were assessed.

MATERIALS AND METHODS

The study was conducted on 40 Bafra sheep and their 48 lambs (21 females and 27 males) raised in a public institution (40°50 N and 37°08 E). At birth, the lambs birth dates, birth weights, dam and sire ear numbers, lamb birth types, and genders were recorded, and ear tags were attached. No cases of dystocia were recorded during lambing, and all lambs received colostrum within 3 hours of birth. The lambs were divided into two groups, 23 lambs weaned at day 45 (45D) and 25 lambs weaned at day 90 (90D). The lambs were equally divided between the 45D and 90D groups according to birth weight, sex, birth type, maternal age and sire (Table 1). After separation from their mothers, the 45D lambs were housed and fed in a closed, well-lit pen with 2 square meters of space per lamb. After 45 days old, 90D lambs were allowed to suckle their dams for 1 hour twice a day (morning and evening) and then moved to a pen next to the 45D lambs. The only nutritional difference between lambs in the 45D group and 90D group was that they were deprived of their mother's milk and their mothers.

Live weights (LW) and body measurements were taken at birth, 30th, 42nd, 60th, 90th, 120th, and 205th day in the 45D and 90D lambs. Live weight and body measurements were performed by separating the lambs from their mothers in the evening and keeping them hungry for 8 hours. In preparation for weighing and measuring days, lambs were not denied access to water and mineral salts. The body measurements included: Withers height (WH), Rump height (RH), Back height (BH), Body length (BL), Chest depth (CD), Chest width (CW), Chest circumference (CC), and Leg circumference (LC) [19].

Blood samples were taken from the jugular vein of the lambs at 42 days of age before weaning and on the 2nd day after weaning (at 47 days of age) into 5 mL EDTA vacuum tubes using a 21G needle. Samples were transported in refrigerated bags within twenty minutes after collection and centrifuged at 3500 g for 15 minutes at room temperature to obtain blood plasma. Plasma was stored at -20 °C until analysed. Biochemical parameters, including total protein (TP), albumin (Alb), globuline (Glb), urea (Ure), total cholesterol (TChol), alkaline phosphatase (ALP), creatine kinase (CK), and glucose (Glu), were analyzed using commercial kits. Levels of cortisol (Cort), triiodothyronine (T3), and thyroxine (T4) hormones were measured with commercial ELISA kits using a microplate reader and auto strip washer (Elx800 & Elx50, California, USA). The assay sensitivities were 0.113 nmol/L for T3, 1.42 nmol/L for T4, and 0.57 ng/mL for cortisol. Coefficients of variation were <7.5% for T3, 9.2% for T4, and 10.1% for cortisol.

Table 1 - 45D and 90D groups for lambs' gender, birth type, and their dams.

Distribution of lambs		45D n	90D n
	Overall	23	25
Sex	Female	10	11
	Male	13	14
Birth type	Single	6	7
	Twin	15	17
	Triplet	2	1
Ewe's age, year	1	8	8
	2	10	13
	≥4	5	4

The milk yields and lactation periods of Bafra sheep were determined by collectively evaluating their milk yields. Within this scope, lambs were separated from their mothers in the evening, and the ewes were milked the following morning. This procedure was repeated at 30-day intervals until the milk yield decreased to 50 grams. Additionally, the dams of lambs weaned at 45 days of age were milked at three-day intervals, except on the control day, to maintain udder health.

Control milking was carried out by hand milking at 8:00 in the morning after the lambs were separated from their mothers at 20:00 the previous day. Each single morning milking [20, 21] was multiplied by 2, and daily milk yield was determined [12]. The Dutch method (LMY = ADMY x LL) was used to determine lactation milk yield (LMY, lactation milk yield; ADMY, average daily milk yield; LL, lactation length). The lactation length was calculated by the formula LL = n x a- (a / 2-A) (n, the number of control milking; a, the interval time between control days; A, days between birth and first control milking). The average daily milk yield was calculated by the formula (ki, milk yield at the i control; n, the number of control milking). The quantity of milk calculated from the control milking of the sheep after the 45th day was accepted as the amount that could be added to the farm economy.

In the experiment, lambs were fed with wheat and vetch-sainfoin straw as roughage and pelleted lamb grower feed as concentrate. They were offered feed twice daily (8:00 am and 4:30 pm), with some feed left in front of them at each feeding. The pelleted lamb grower feed contained 2600 kcal metabolizable energy, 16% crude protein, 8.2% crude cellulose, 3.5% ether extract, 7.8% ash, 1.1% calcium, 0.4% sodium, and 0.7% phosphorus. The ewes were fed with wheat and vetch-sainfoin straw as roughage and sheep milk feed as concentrate (16% crude protein, 10% crude cellulose, 3.5% ether extract, 7% ash and 0.3% sodium).

In the study, the birth, 30, 42, 60, 90, 120, and 205-day weights of the lambs were obtained, and the body measurement values taken during these periods were tested for normal distribution conditions with the Kolomogorov-Smirnov test and the homogeneity of variances with the Levene test. It was determined that the data conformed to a normal distribution (p>0.05). T-test analysis determined the difference between the examined data of the lambs that were weaned early and those that were not. Since gender and birth types were equally distributed to the early weaned (45D) and normal weaning (90D) groups, gender and birth type were not evaluated as factors. The relationship between some body measurements and live weight of lambs at different periods before and after weaning was measured using Pearson correlation. IBM SPSS (ver 21) package program was used to evaluate the obtained data.

RESULTS

In the study, the survival rate of lambs between 45 and 205 days of age after weaning on the 45th day was found to be 100%, and and no metabolic disorders were experienced. There was no difference in live weight and body measurements between 45D and 90D lambs until they were 42 days old (Table 2). Differences were detected between 45D and 90D lambs on days 60 and 90 in terms of live weight and some body measurements. On day 60, these differences were determined as 15.80±2.74 vs. 19.10±4.66 kg for LW, 12.80±1.56 vs. 13.90±1.42 cm for CW and 25.30±2.04 vs. 27.60±3.08 cm for LC between the 45D and 90D groups. Similarly, differences were observed between the two groups on day 90 in terms of live weight and some body measurements. However, it was observed that these differences disappeared on the 205th day (LW: 30.3±5.33 vs. 34.3±7.63 kg, CW: 18.1±2.53 vs. 18.1±2.25 cm; LC: 33.4±2.48 vs. 34.4±3.12 cm; Table 3). A large, positive and significant relationship was found between live weight and all body measurements of lambs at different periods before weaning (Table 4; r^{3}0.50; $p<0.01$). There was a moderate to large, positive and significant relationship between some body measurements and body weight of lambs at different periods after weaning (Table 5; r^{3}0.47; $p<0.05$). There was no statistical difference ($P>0.05$) between the blood parameters of 45D and 90D lambs 2 days before and 2 days after weaning, except for ALP (At 42th day ALP: 1276.0±234.31 vs. 1365.5±214.24, p=0.38; At 47th day ALP: 1127.7±235.56 vs. 1814.5±383.56, p<0.001 Table 6). After the lambs were separated from their dams on the 45th day, the lactation milk yield calculated from the control milkings of all ewes in the experiment was found to be 113.3 kg, the lactation period was 98.5 days and the daily milk yield values were 1.1 kg.

DISCUSSION

The results of this study provide insight into the effects of early weaning on the growth performance and biochemical parameters of Bafra lambs. The findings show that weaning at day 45 had a significant effect on various body measurements and

Table 2 - Live weight and body measurement values of the lambs from birth to the weaning age (Mean ± SE, n=23 and 25 for 45D and 90D, respectively).

	Birth			Day 30			Day 42		
Item	45D	90D	P-value	45D	90D	P-value	45D	90D	P-value
LW (kg)	4.01±0.50	3.87±0.77	0.459	11.1±2.00	10.4±2.47	0.277	13.9±0.55	13.0±0.65	0.265
WH (cm)	37.16±1.93	36.60±2.64	0.408	45.8±2.70	45.9±3.32	0.903	49.3±0.70	49.6±0.79	0.507
RH (cm)	37.83±1.82	37.22±2.68	0.362	46.2±3.03	46.6±3.03	0.656	49.5±0.81	50.3±0.76	0.778
BH (cm)	37.23±1.62	36.42±2.46	0.188	45.7±2.87	45.4±3.06	0.777	49.0±0.77	49.0±0.76	0.742
BL (cm)	32.32±1.59	32.31±2.82	0.994	46.1±3.51	44.4±4.58	0.173	51.6±0.97	49.3±1.18	0.339
CD (cm)	11.22±1.18	11.08±1.34	0.701	15.7±1.60	15.4±2.22	0.612	17.5±0.42	17.2±0.52	0.094
CW (cm)	7.93±0.59	7.83±0.71	0.576	11.0±1.63	10.9±1.43	0.888	12.2±0.46	12.2±0.37	0.448
CC (cm)	35.95±2.81	35.66±3.04	0.732	51.1±4.15	50.6±4.51	0.719	57.1±1.06	56.6±1.08	0.545
LC (cm)	15.63±1.19	15.25±1.71	0.383	23.9±2.35	23.0±2.59	0.203	27.3±0.64	26.1±0.64	0.911

LW: Live weight, WH: Withers height, RH: Rump height, BH: Back height, BL: Body length, CD: Chest depth, CW: Chest width, CC: Chest circumference, LC: Leg circumference.
45D: weaned at day 45, 90D: weaned at day 90

Table 3 - Live weight and body measurement values of Bafra lambs from weaning to 205 days of age (Mean ± SE, n=23 and 25 for 45D and 90D, respectively).

	Day 60			Day 90			Day 120			Day 205		
Item	45D	90D	P-value	45D	90D	P-value	45D	90D	P-value	45D	90D	P-value
LW (kg)	15.80±2.74	19.10±4.66	0.007	19.5±3.63	25.3±5.29	<0.001	23.2±3.87	28.6±6.29	<0.001	30.3±5.33	34.3±7.63	0.053
WH (cm)	51.10±2.91	52.10±4.12	0.320	53.9±2.84	56.9±4.47	0.008	56.82±3.08	59.1±3.8	0.026	62.5±3.62	62.9±4.49	0.745
RH (cm)	51.80±2.63	53.10±4.13	0.239	54.9±3.51	57.6±3.93	0.017	58.1±3.79	60.5±4.79	0.064	63.2±3.52	64.4±4.54	0.330
BH (cm)	51.80±2.78	52.50±4.81	0.530	54.4±2.69	57.4±4.10	0.005	57.9±3.05	60.1±3.94	0.043	63.5±2.98	64.0±4.77	0.684
BL (cm)	50.90±3.19	53.30±4.71	0.049	54.5±4.13	58.4±4.99	0.005	57.93±4.31	60.6±4.72	0.046	62.1±3.59	61.9±5.16	0.932
CD (cm)	19.20±1.76	20.00±2.62	0.205	20.2±2.21	22.7±2.02	<0.001	22.7±2.06	24.1±2.39	0.035	24.9±2.2	25.5±2.46	0.363
CW (cm)	12.80±1.56	13.90±1.42	0.013	13.8±1.73	15.6±1.48	<0.001	15.3±1.56	16±1.73	0.136	18.1±2.53	18.1±2.25	0.998
CC (cm)	58.80±4.33	61.00±5.64	0.147	62.5±4.79	69.0±5.52	<0.001	68.1±5.41	72.6±7.12	0.017	77.1±4.14	78.5±7.49	0.444
LC (cm)	25.30±2.04	27.60±3.08	0.005	26.8±2.51	30.8±3.21	<0.001	28.9±3.37	31.7±3.53	0.009	33.4±2.48	34.4±3.12	0.223

LW: Live weight, WH: Withers height, RH: Rump height, BH: Back height, BL: Body length, CD: Chest depth, CW: Chest width, CC: Chest circumference, LC: Leg circumference.
45D: weaned at day 45, 90D: weaned at day 90

Table 4 - Correlation coefficients (r) values and 95% confidence intervals (CI) between some body measurements and live weights of lambs at different periods of pre-weaning growth.

Item	Day	WH (%95 CI)	RH (%95 CI)	CC (%95 CI)	LC (%95 CI)
	0				
RH		0.953**(0.92-0.97)			
CC		0.776**(0.63-0.87)	0.777**(0.63-0.87)		
LC		0.721**(0.54-0.83)	0.737**(0.57-0.84)	0.768**(0.62-0.86)	
LW		0.862**(0.77-0.92)	0.839**(0.73-0.91)	0.845**(0.74-0.91)	0.797**(0.66-0.88)
	30				
RH		0.903**(0.83-.095)			
CC		0.710**(0.53-0.82)	0.696**(0.51-0.81)		
LC		0.714**(0.54-0.83)	0.612**(0.40-0.76)	0.807**(0.68-0.87)	
LW		0.800**(0.67-0.88)	0.748**(0.59-0.85)	0.849**(0.74-0.91)	0.878**(0.79-0.93)
	42				
RH		0.885**(0.80-0.93)			
CC		0.654**(0.45-0.79)	0.639**(0.42-0.77)		
LC		0.672**(0.48-0.81)	0.584**(0.37-0.73)	0.727**(0.59-0.84)	
LW		0.761**(0.60-0.86)	0.688**(0.51-0.82)	0.830**(0.71-0.90)	0.702**(0.57-0.79)

**:Correlations are significant at the p<0.01 level.
[1] :The effect size of Pearson's r value in correlations between two continuous variables; 0.10 < r <0.29 is small, 0.30< r <0.49 is medium, and r ³0.50 has a significant effect [22].
WH: Withers height, RH: Rump height, CC: Chest circumference, LC: Leg circumference, LW: Live weight.

live weight in the early period, but this effect disappeared in later periods and there was no statistical difference in live weight and body measurements at day 205. It was also observed that weaning at day 45 did not lead to significant differences in the biochemical parameters of the lambs.

In the study, the blood plasma TP, Alb, and Glb concentration values increased numerically in the 45D group lambs weaned on day 45. This result is inconsistent with the findings of Freitas-de-Melo et al. [23], who reported that total protein and globulin levels in the blood plasma decreased due to the physiological response of lambs to separation from their mothers. Significant differences between 45D and 90D occurred primarily after weaning, with some measurements showing negative effects on growth in the 45D group. (Tables 2 and 3). The differences that emerged against the 45D group in lambs began to decrease when the 90D lambs were weaned at 90 days of age and disappeared in all comparison parameters at day 205. It is thought that the developmental delays in the live weight and body measurement parameters of 45D lambs compared to 90D lambs after weaning are due to their inability to obtain nutrients equivalent to the nutrients they obtain from the milk they suck from their dams from the offered diet [9, 24].

In this study, the developmental delays that lambs, considered to have completed their rumen development at 45 days of age, showed after weaning indicate that more care should be taken in preparing the offered diet composition. There are different results on the effects of weaning the offspring at various ages on live weight and weight gain in farm animals. In some studies, it is reported that lambs weaned at earlier periods perform better than control groups [9, 10, 17, 25] while early weaning

Table 5 - Correlation coefficient (r) values and 95% confidence intervals (CI) between some body measurements and the live weight of lambs at different periods of post-weaning.

		45D				90D			
Item	Day	WH (%95 CI)	RH (%95 CI)	CC (%95 CI)	LC (%95 CI)	WH (%95 CI)	RH (%95 CI)	CC (%95 CI)	LC (%95 CI)
	60								
RH		0.875**(0.71-0.95)				0.959**(0.90-0.98)			
CC		0.512*(0.14-0.76)	0.554**(0.16-0.78)			0.784**(0.56-0.90)	0.800**(0.59-0.91)		
LC		0.473*(0.08-0.71)	0.481*(0.09-0.73)	0.835**(0.63-0.93)		0.792**(0.57-0.90)	0.827**(0.63-0.91)	0.918**(0.81-0.96)	
LW		0.730**(0.44-0.88)	0.638**(0.29-0.82)	0.891**(0.74-0.95)	0.746**(0.46-0.88)	0.832**(0.65-0.92)	0.864**(0.70-0.94)	0.959**(0.90-0.98)	0.897**(0.77-0.95)
	90								
RH		0.939**(0.85-0.97)				0.974**(0.94-0.99)			
CC		0.681**(0.37-0.85)	0.635**(0.31-0.82)			0.727**(0.46-0.86)	0.741**(0.48-0.87)		
LC		0.481*(0.10-0.72)	0.501*(0.14-0.75)	0.753**(0.50-0.89)		0.771**(0.54-0.89)	0.804**(0.59-0.91)	0.866**(0.71-0.94)	
LW		0.767**(0.51-0.88)	0.707**(0.41-0.86)	0.908**(0.78-0.96)	0.645**(0.32-0.82)	0.849**(0.67-0.92)	0.896**(0.77-0.95)	0.860**(0.69-0.94)	0.898**(0.77-0.95)
	120								
RH		0.906**(0.78-0.96)				0.958**(0.90-0.98)			
CC		0.889**(0.74-0.95)	0.858**(0.68-0.94)			0.798**(0.58-0.90)	0.818**(0.62-0.92)		
LC		0.812**(0.58-0.91)	0.768**(0.51-0.90)	0.928**(0.83-0.97)		0.694**(0.40-0.84)	0.748**(0.49-0.88)	0.814**(0.61-0.91)	
LW		0.840**(0.64-0.93)	0.860**(0.68-0.94)	0.917**(0.81-0.96)	0.808**(0.58-0.91)	0.878**(0.73-0.95)	0.924**(0.82-0.97)	0.905**(0.79-0.96)	0.879**(0.73-0.94)
	205								
RH		0.753**(0.47-0.89)				0.954**(0.89-0.98)			
CC		0.519*(0.13-0.75)	0.710**(0.40-0.87)			0.666**(0.38-0.83)	0.671**(0.38-0.84)		
LC		0.703**(0.38-0.85)	0.621**(0.27-0.82)	0.664**(0.33-0.84)		0.720**(0.44-0.86)	0.730**(0.47-0.87)	0.670**(0.37-0.83)	
LW		0.673**(0.34-0.85)	0.873**(0.69-0.95)	0.848**(0.65-0.94)	0.733**(0.44-0.88)	0.904**(0.78-0.96)	0.863**(0.69-0.93)	0.770**(0.54-0.90)	0.810**(0.61-0.91)

Correlations are significant at **p< 0.01 and *p< 0.05.
[1]:The effect size of Pearson's r value in correlations between two continuous variables; 0.10 < r <0.29 is small, 0.30< r <0.49 is medium, and r ³0.50 has a significant effect [22].
45D: weaned at day 45, 90D: weaned at day 90; WH: Withers height, RH: Rump height, CC: Chest circumference, LC: Leg circumference, LW: Live weight

may impair post-weaning growth performance due to decreased nutrient intake and increased stress levels [20, 21, 26].

Although it has been reported that dam milk does not fully meet the nutritional needs of lambs [17], the better performance of 90D lambs than 45D lambs in this study shows that milk is a good source of nutrition even after the lambs have completed their rumen development.

In the study, the survival rate of lambs between 45 and 205 days of age after weaning on the 45th day was found to be 100%. According to these results, weaning at 45 days of age did not cause any negative effects on the survival rate of lambs.

Significant relationships were found between body measurement parameters and live weight values of 45D and 90D lambs (r= 0.638-.0959; Tables 4 and 5).

The effect of lambs weaned at 45 days of age and not weaned on blood plasma hormones and blood metabolites was not found, except for ALP. Compared to literature reports [9, 27], the ALP concentration values in both 45D and 90D lambs before and after weaning were markedly elevated. For instance, Roccaro et al. [27] reported mean ALP levels approximately 488 ± 205 U/L in goat kids, while in our lambs the levels exceeded this reference (Table 6). While no significant difference in ALP was detected between the groups at 42th day, ALP values were significantly higher in 90D lambs on the at 47th day (r values of 45D and 90D lambs, respectively: 1127.7±235.56 vs. 1814.5±383.56; p <0.001). This aligns with previous research [1, 27], which reported that early weaning does not significantly alter blood biochemistry under controlled nutritional conditions. The lack of difference in albumin and total protein levels between 45D and 90D lambs reflects the similarity of their nutritional status [28].

These results indicate that early weaning did not significantly alter the metabolic or physiological status of the lambs in terms of these blood parameters. The absence of significant changes in CK, Urea, glucose, and cortisol suggests that early weaning did not induce severe metabolic stress or negatively impact liver and kidney function. Similarly, the stability of thyroid hormones (T3 and T4) implies that growth-related hormonal regulation was not significantly disrupted by early weaning. Our finding that no digestive disorders or deaths occurred in weaned lambs is in agreement with a previous study [29], which associated this outcome with the absence of stress-related differences in blood parameters.

Although there was no statistical difference in blood plasma urea concentrations between 45D and 90D weaned lambs, the higher urea concentration in 90D day-old lambs indicates that protein metabolism is higher in them than in 45D lambs [9, 10]. This numerical excess in urea concentration could be an advantage of milk intake's positive effect on the digestive tract (rumen and intestinal development) in 90d lambs. On the other hand, the fact that ALP, which is used as a marker of bone development and daily live weight gain [9, 10], is significantly low in the blood plasma of 45D lambs may indicate inadequacy of the components of the feed offered to them.

In this study, although there was no difference in blood parameters between lambs weaned at 45 days of age and lambs not weaned except ALP, the live weight and body measurement values of 45D lambs were lower than those of the 90D group. There is no difference between TP, Cort, T3, and T4 reported as basic stress parameters. However, there are very significant differences between live weight and body measurement values suggests that either these stress parameters are not indicators in lambs or there is another factor such as the effect of regulating gene expressions of quality milk proteins that are not related to stress [2] and awaits investigation. The high plasma ALP values in the 45D group lambs on day 2 after weaning are thought to be a functional liver response to the absence of milk in their diets. Cai et al. [30] report that dietary changes can cause differences in plasma ALP values (93.11 vs. 123.88 U/L). On the other hand, removing milk from the diets of the 45D group lambs (weaned) did not cause digestive problems (such as diarrhea or constipation) in the lambs.

This study found that the lactation length (98.5 days) and milk yield (113.3 kg) of Bafra ewes were lower than the values reported by Cam and Kirikci [12] (132 days and 153.8 kg).

With the weaning of lambs on the 45th day, 1.1 kg of milk was obtained per sheep per day during the lactation period. Let us assume that this sheep's milk was converted into cash at the current value. The difference in live weight between lambs weaned on the 90th day, and lambs that were not weaned was

Table 6 - Some biochemical parameters of Bafra lambs at 42, 47 and 120 days of age (Mean ± SE, n=23 and 25 for 45D and 90D, respectively).

	Day 42			Day 47			Day 120		
Item	45D	90D	P-value	45D	90D	P-value	45D	90D	P-value
TP (g/dL)	7.1±0.54	7.0±0.98	0.90	9.0±1.46	8.9±1.87	0.90	9.8±1.71	9.7±1.03	0.67
Alb (g/dL)	3.6±0.21	3.6±0.37	0.94	4.2±0.43	4.3±0.41	0.21	4.2±0.54	4.2±0.30	0.67
Glb (g/dL)	3.5±0.46	3.5±0.70	0.84	4.8±1.10	4.6±1.17	0.39	5.6±1.33	5.5±1.37	0.95
Ure (mg/dL)	23.8±5.98	26.3±7.20	0.42	26.1±9.29	30.9±6.5	0.20	37.6±7.04	43.5±9.61	0.14
TChol (mg/dL)	39.5±10.84	42.5±15.15	0.62	39.9±18.7	36.4±16.7	0.66	32.3±5.98	28.5±5.38	0.15
ALP (u/L)	1276.0±234.31	1365.5±214.24	0.38	1127.7±235.56	1814.5±383.56	<0.001	653.2±122.57	690.3±178.23	0.59
CK (u/L)	200.9±104.31	189.2±62.5	0.76	170.1±72.93	230.3±102.11	0.15	240.0±91.21	183.5±76.99	0.15
Glu (mg/dL)	78.7±14.46	81.4±10.97	0.63	88.3±13.05	84.2±13.27	0.50	65.2±10.26	69.0±8.52	0.38
Cort (ng/mL)	41.0±22.16	34.8±18.92	0.51	35.5±19.14	45.0±42.04	0.53	41.1±14.49	45.3±27.97	0.68
T3 (nmol/L)	5.9±1.07	6.3±1.26	0.41	5.9±1.20	5.9±1.72	0.98	6.2±2.00	6.5±1.57	0.67
T4 (nmol/L)	97.0±19.59	92.1±16.59	0.56	93.1±16.92	107.7±34.07	0.24	112.5±41.15	114.2±26.50	0.92

TP: Total protein, Alb: Albumin, Glb: Globulin, Ure: Urea, TChol: Total cholesterol, ALP : Alkaline phosphatase, CK: Creatine Kinase, Glu: Glucose, Cort: Cortisol, T3: Triiodothyronine, T4: Thyroxine

5.8 kg. Let us assume that the lambs were sold in this condition. The approximately 6 kg live weight difference (when the slaughter efficiency is taken as 50% with great optimism) will correspond to 3 kg of meat. When the economic value of milk obtained from sheep and the live weight loss of lambs are compared, it will be revealed that milk obtained from sheep is more profitable for the enterprise (when all other expenses are included).

The lactation length of the 45D ewes was shorter than the 90D because the milking interval was 2-3 days after weaning, and the milk-producing mammary glands were not sufficiently stimulated for continued production. As a result, as expected, the animals dried off earlier, and this was applied as a preference for the ewes to enter the next mating season in better condition.

CONCLUSION

It was observed that early weaning did not cause significant differences in the biochemical parameters measured in Bafra breed lambs. However, the lambs' body measurements and live weight values were affected by early weaning (day 45). The developmental differences between the lambs weaned at 45 and 90 days of age became non-significant after 120 days and were no longer observed at 205 days. Weaning practice did not have a negative effect on the digestive physiology and vitality of the lambs. Studies should be intensified to create standard diets that can replace milk and fully meet the needs of young animals in early weaning practices in lambs. It has been concluded that if early weaning is achieved and more attention is paid to lamb care and feeding, the milk obtained from sheep during this period can contribute more to the farm's economy.

Ethics statement

The study was carefully reviewed and approved by the Ondokuz Mayıs University Local Ethics Committee (OMÜ-HADYEK). The study was formally approved on June 23, 2022, and assigned the code 2022/29.

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Author contributions

Both authors contributed equally to the conception, design, data collection, analysis, interpretation, and writing of the manuscript. Both authors read and approved the final version of the manuscript.

Conflict of interest

As authors, we declare that there is no conflict of interest between us.

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