

Growth characteristics in lambs of estrus synchronized ewes in grower conditions

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Abstract: The aim of this study was to determine the growth characteristics of lambs of estrus-synchronized ewes in an extensive production system during 2 different periods. The animal material of this study was composed of 325 head Chios × Kıvrıcık cross breeds. These lambs were provided by mating 124 Kıvrıcık sheep on 2 farms with 8 Chios rams provided by the Adnan Menderes University, Faculty of Agriculture, Sheep Research Unit. The estrus cycles of the ewes were synchronized with intra-vaginal progestagen sponges impregnated with 30 mg of cronolone. After 12-14 days the sponges were removed, the females received an intramuscular injection of 500 IU PMSG, and 5 or 6 ewes were mated with Chios rams. This research lasted for 3 years, and detailed flock records were kept. The average birth weight, average weight of 100-day-old lambs, and average marketing weight of Kıvrıcık × Chios F₁ were 3.18 kg, 19.71 kg, and 29.10 kg, respectively. Lambing season, birth type, and the sex of the lambs were found to significantly affect birth weight, which is an important factor in lamb production ($P < 0.01$). In this study daily gains in the live-weight of 100-day-old lambs and daily gains in the live-weight during the marketing period were 163.07 g and 167.48 g, respectively. Year of birth, lamb sex, and growing methods were significant in determining the characteristics mentioned ($P < 0.01$). In addition, the 100th day performances indicated significant changes according to the farms, and the performances during the marketing period varied significantly according to the ages of the ewes. The survival rates of lambs up to 100 days of age and the marketing period were 66.81% and 63.57%, respectively. The effect of year was also significant ($P < 0.01$). The results of this study indicate that, with respect to lamb development and marketing, more advantageous results can be achieved by synchronizing estrus and having earlier births than traditional production methods allow.

Key words: Synchronization, lamb productivity, live-weight, survival rate

Yetiştirici koşullarında senkronize edilen koyunlarda kuzuların gelişme özellikleri

Özet: Bu çalışmada, yetiştirici koşullarında senkronize edilen koyunlarda, kuzuların gelişme özelliklerinin belirlenmesi amaçlanmıştır. Çalışmanın Hayvan materyalini 325 baş Sakız × Kıvrıcık melezi kuzular oluşturmuştur. Bu kuzular iki yetiştirici işletmesinde bulunan 124 baş Kıvrıcık koyun ile Ziraat Fakültesi Koyunculuk Araştırma Ünitesinden sağlanan 8 Sakız koç kullanılarak elde edilmiştir. Koyunlara 30 mg cronolone içeren süngerler 12-14 gün süreyle takılmıştır. Süngerler çıkarıldıktan sonra kas içi 500 IU PMSG uygulamasıyla kızgınlıklar toplulaştırılmıştır. Koyunlar gruplandırılarak, her bir Sakız koç, 5-6 baş koyun ile çiftleştirilmiştir. Üç yıl devam edilen uygulamalarda işletmeler de sürülerin ayrıntılı kayıtları tutulmuştur. Kıvrıcık × Sakız melezi F₁ kuzularının doğum ağırlığı, 100 günlük ve pazarlama dönemi canlı ağırlığı sırasıyla 3,29, 19,71 ve 29,10 kg olarak bulunmuştur. Kuzu üretimi bakımından önemli bir özellik olan doğum ağırlığı üzerine dönem, doğum tipi ve cinsiyet önemli bulunmuştur ($P < 0,01$). Yüz günlük ve pazarlama

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dönemi günlük canlı ağırlık artışları sırasıyla, 163,07 ve 167,48 g olarak bulunmuştur. Söz konusu özellikler üzerine yıl, cinsiyet ve büyütme şekli etkilidir. Ayrıca 100. gün performansları işletmelere, pazarlama dönemi performansları ise ana yaşlarına göre de önemli derecede değişim göstermiştir. Kuzuların doğumdan 100. gün ve pazarlama dönemine kadar yaşam güçleri sırasıyla % 66,81 ve % 63,57 olarak bulunmuştur. Yaşam gücü üzerine yılın etkisi önemli bulunmuştur ($P < 0,01$). Bu çalışmanın sonuçları göstermektedir ki kuzu gelişimi ve pazarlamasına ilişkin olarak, östrusun senkronizasyonu ve daha erken doğumlar ile geleneksel kuzu üretim yöntemlerine göre daha avantajlı sonuçlar elde edilebilir.

Anahtar sözcükler: Senkronizasyon, kuzu verimi, canlı ağırlık, yaşama gücü

Introduction

The mating season for sheep in Western Anatolia is between August and December. Early lambing is an important source of income for sheep breeders. For this reason, if mating could take place before the autumn it would be economically beneficial for lambing in the area (1). According to research carried out in Aydın province, lambs are the sheep breeders' main source of income (2).

Hormonal effects are used in sheep breeding to increase fertilization and arrange the synchronization of estrus. Progestagen and prostaglandin analogues are widely used for estrus synchronization in sheep. One of these analogues, pregnant mare serum gonadotrophin (PMSG), is injected into the muscle at the end of synchronization treatment (3-8). Among the known advantages of estrus synchronization, especially in the marketing season, is the production of a single pattern in terms of lamb age and live-weight. In addition, synchronization allows breeders to work in a more productive way during the following period (8).

In studies carried out on the sheep population of Aydın province, it has been observed that the main income in sheep breeding is derived from lambs (2). In this region 2 main factors are significant for economical sheep breeding: the condition of the pastures before birth and marketing seasons, and the number of lambs weaned during the annual aggregate animal sale season. During the marketing season, breeders who have a large number of lambs that have been excluded from breeding and have reached marketing weight will be more competitive (9).

Lamb production could also be arranged to synchronize births with the highest market price. In this manner, standard sized lambs of similar age and live-weight could be provided for sheep breeders (10).

Lambs can achieve the necessary weight by using exogen hormone, and lamb birth can be timed for the period just before the beginning of the dry summer when the pasture resources are sufficient. If lambing is correctly timed, the sheep will be better able to benefit from meadows and pastures (11). For profitable sheep breeding the number of lambs available should be high, not only at birth, but also during the marketing period. Fertilization becomes economical according to its ability to increase the availability of lambs at the most advantageous times.

With the traditional production method most widely used in the region at present, sheep mating season lasts about 3 to 4 months (June to September), and in Aydın Province the birth period for sheep lasts from 3 to 5 months. Due to the long time period involved, there are significant differences in the lambs' live-weight during the marketing period. In addition, the long breeding period prevents sheep breeders from using their work power more effectively and hinders planning for lamb growth and milking. Finally, the weaning period coincides with the marketing period in the region.

The objective of the present study was to determine some of the growth characteristics—and their contribution to animal breeding applications—of lambs under extensive production systems. It is hoped that the results of this study will aid breeders in lamb production and marketing.

Materials and methods

This study was conducted in Kasaplı village in the Koçarlı district of Aydın, Turkey (37°45'02.59' N and 27°34'35.24' E; 28 m above sea level). In the study 325 head of Chios × Kıvırcık cross breeds were obtained from 124 head of Kıvırcık ewes and 8 head of Chios

rams. Kıvırcık ewes were provided by 2 member farms of Adnan Menderes University, Sheep Breeding Program Group (ADU-GKYP), and the 8 head of Chios rams were taken from the ADU-GKYP upper flock.

Records for the animals involved have been kept by ADU-GKYP since 1994. The determination of age was made through farm records. The animals from both flocks were randomly divided into 2 groups. Ewes from the first and second groups were synchronized in the first week of the month of May and in the middle of June, respectively. The estrus cycles of the ewes were synchronized with intra-vaginal progestagen sponges impregnated with 30 mg of cronolone (Chrono-Gest®-Intervet, Istanbul, Turkey). Sponges were removed after 12 days in the first group and 14 days in the second group. In addition, the females received an intramuscular injection of 500 IU PMSG (Chrono-Gest®-Intervet, Istanbul, Turkey), and 5 or 6 ewes were mated with each ram. Rams rejoined flocks of non-pregnant sheep 20 days later than in the second mating group. Parameters of the lambs born from non-pregnant sheep were not taken into account in this study. Birth records, birth weights, live-weights on the 100th day, marketing weights, and the fate of the lambs were recorded each year. Annual maintenance/feeding and applied flock management were also recorded.

Ewes from the first and second groups started lambing in the first week of October and the first week of December, respectively. Ewes were separated from their lambs 3 days after birth. During this short period before the ewes were sent to pasture the flocks were given silage and a little barley. After the fourth day, only the ewes were grazed. Ewes and lambs were sent to the pasture area together 10 days after the births. Ewes and lambs were pastured in the field area from the end of February until mid-April and were then pastured in hilly areas. The southern part of the village consists of hills and mountains, while the northern side has corn and cotton fields. These pasture fields can only be used after harvest season (October to December) and before planting season (February to April). The main pasture is a hilly area with olive trees. This area is used for pasture all year long, except during olive harvesting season (October to February) every 2 years (12). In the first and third

years of the present study sheep were kept from the hilly areas because of olive harvesting. As a result, the affected flocks were not pastured enough; they were given barley and corn silage.

The parameters of Kıvırcık × Chios (F1) lambs at birth, live-weights on the 100th day, weaning dates, daily gains in live-weight, and survival rates were examined. The statistical analysis of this data was carried out with SAS statistical software (13).

Results

Live-weight

Birth weight, live-weight on the 100th day and at the marketing (weaning) period, and daily gains in live-weight are given in Table 1. Birth type and sex were found to have a significant effect on birth weight, which was a statistically significant characteristic for lamb production ($P < 0.01$). Year, farm, and mother's age were not statistically significant. As for the 2 groups, it was observed that the second group had higher birth weights than the first group. This was likely due to better pasture conditions during the final period of pregnancy in the second group.

As the lamb number at birth increased, the birth weight decreased, as expected. The relationship between a ewe's live-weight and a lamb's birth weight is significant ($P < 0.01$) and directly proportional. For this reason, it is important for ewes to be well-fed during the final period of their pregnancies.

The effect of year on live-weight at the 100th day and during the marketing period, as well as on daily live-weight gains up until these periods, was significant ($P < 0.01$). The lambs were determined to have the greatest value in the second year, with regard to live-weight on the 100th day and during the marketing (weaning) periods. The effect of longer pasture usage during the second year was also observed.

In this study management differences between the farms were statistically significant ($P < 0.01$) in terms of live-weight on 100th day and daily live-weight gains. The second farm was observed to have higher values than the first farm. The effect of the periods on 100th day live-weights and marketing (weaning) periods was insignificant. The superiority

Table 1. The minimum square means and standard errors of live-weights on the 100th day and marketing (weaning) periods and daily live-weight gain of lambs.

Classification	N	Birth weight (kg)	N	100th day live-weight (kg)	100th day daily live-weight gain (g)	N	Marketing (weaning) period live-weight (kg)	Marketing period daily live-weight gain (g)
Years		NS		**	**		**	**
First year	101	3.21 ± 0.06	73	17.59 ± 0.47 ^a	142.14 ± 4.68 ^a	68	27.20 ± 0.72 ^a	154.76 ± 4.96 ^a
Second year	117	3.18 ± 0.07	95	21.64 ± 0.42 ^b	182.13 ± 4.17 ^b	92	31.29 ± 0.50 ^b	183.04 ± 3.46 ^b
Third year	107	3.16 ± 0.07	86	19.91 ± 0.45 ^c	164.81 ± 4.45 ^c	85	28.81 ± 1.40 ^{ab}	164.64 ± 9.62 ^{ab}
Farm		NS		*	*		NS	NS
1	244	3.18 ± 0.04	205	20.33 ± 0.25 ^a	169.03 ± 2.52 ^a	192	29.53 ± 0.38	170.04 ± 2.61
2	81	3.18 ± 0.08	53	19.08 ± 0.49 ^b	156.60 ± 4.93 ^b	53	28.67 ± 0.68	164.91 ± 4.70
Period		**		NS	NS	NS	NS	NS
1	191	2.90 ± 0.0 ^a	149	19.67 ± 0.33	162.44 ± 3.34	144	27.05 ± 1.45	155.90 ± 9.72
2	134	3.46 ± 0.0 ^b	105	19.75 ± 0.40	163.19 ± 4.00	101	31.15 ± 1.985	179.54 ± 13.58
Age of ewe		NS	NS	NS	NS		**	*
2	44	3.05 ± 0.10	37	19.27 ± 0.65	158.43 ± 6.52	36	28.10 ± 0.80 ^{ab}	162.27 ± 5.48 ^{ab}
3	51	3.21 ± 0.10	41	20.01 ± 0.67	165.86 ± 6.70	38	28.70 ± 0.86 ^{ab}	164.65 ± 5.96 ^{ab}
4	66	3.17 ± 0.08	59	20.83 ± 0.50	174.09 ± 6.44	57	30.63 ± 0.65 ^a	177.92 ± 4.46 ^a
5	60	3.31 ± 0.08	41	20.01 ± 0.56	165.72 ± 5.59	41	30.49 ± 0.75 ^{ab}	174.72 ± 5.19 ^{ab}
6	53	3.31 ± 0.08	38	19.41 ± 0.59	159.78 ± 5.92	37	28.93 ± 0.86 ^{ab}	166.38 ± 5.87 ^{ab}
≥ 7	51	3.04 ± 0.08	38	18.74 ± 0.55	153.73 ± 5.57	36	27.73 ± 0.76 ^b	158.92 ± 5.22 ^b
Birth type		**		-	-		-	-
Single	103	3.99 ± 0.0 ^a		-	-		-	-
Twin	185	3.16 ± 0.0 ^b		-	-		-	-
Triplet	37	2.39 ± 0.1 ^c		-	-		-	-
Sex		**		**	**		**	**
Female	164	3.09 ± 0.0 ^a	127	18.94 ± 0.35 ^a	155.09 ± 3.51 ^a	123	27.82 ± 0.50 ^a	159.03 ± 3.43 ^a
Male	161	3.27 ± 0.0 ^b	127	20.48 ± 0.34 ^b	164.07 ± 3.49 ^b	122	30.38 ± 0.52 ^b	175.92 ± 3.56 ^b
Growth type		-		**	**		**	**
Single		-	113	21.81 ± 0.38 ^a	183.84 ± 3.83 ^a	109	31.52 ± 0.53 ^a	183.20 ± 3.64 ^a
Multiple		-	141	17.61 ± 0.35 ^b	141.79 ± 3.48 ^b	136	26.67 ± 0.53 ^b	151.76 ± 3.63 ^b
Linear regression		-		-	-		-	-
Ewe wt. (kg)		0.025 ± 0.007 ^{**}		-	-		-	-
Birth wt. (kg)		-		1.643 ± 0.354 ^{**}	6.427 ± 3.540		2.121 ± 0.45 ^{**}	7.243 ± 3.098 [*]
Marketing age (days)		-		-	-		0.187 ± 0.07 [*]	0.022 ± 0.502
Overall mean	325	3.18	254	19.71	163.07	245	29.10	167.48

*: $P < 0.05$; **: $P < 0.01$; NS: not significant; a, b, c: the differences among the averages, indicated with different letters in a factor, are significant ($P < 0.05$).

of lambs born in the beginning of December was remarkable, although this was not important in the marketing period. The effect of the mother's age on lamb development was more distinctive during the marketing period. When age of the mother was taken into account, the lowest performances were observed in lambs born to mothers 7 years of age or older.

The effect of sex on so-called characteristics was statistically significant ($P < 0.01$). Males were superior to females in this regard. In addition, the development features of lambs that were suckled by their mothers alone were clearly higher ($P < 0.01$). The marketing weight of lambs that grew up alone was 31.52 kg, which was a very good value. Birth weight and marketing age positively and significantly influenced the marketing weight. In other words, providing heavier lambs at birth is economically important for marketing.

Lambs were marketed after weaning when they were 150 days old, on average. Average marketing ages were 161, 154, and 136 days in the 1st, 2nd, and 3rd years, respectively. Both farms marketed their lambs at approximately the same age. The average marketing ages for the first and second groups were 173 and 128, respectively.

Survival rate of lambs

Survival rates for the lambs are given in Table 2. The effect of the year on lamb survival until the 100th day and marketing period was significant ($P < 0.05$ and $P < 0.01$).

The survival rate was higher in the second year (2005-2006) of the 3 year study than in the other study years (2004-2005 and 2006-2007). The lowest value was observed in the first year of the study. The importance of the olive tree area, which was used as pasture during the second year, was observed as well. It was thought that productivity was lower in the final year than the second year, but higher than in the first year because the third year of the study was the fertility year for the olives. When these areas were prohibited for pasture use, poor pasturing was the result. In addition, 2006 and 2007 were too hot and dry.

The effect of the farm on the survival rate of the lambs until the 100th day and marketing period was statistically significant ($P < 0.01$). The better

maintenance and management used by the first farm resulted in a higher (approximately 20%) survival rate. While the effect of the period on the 100th day survival rate was significant, its effect on the marketing period was insignificant.

The 100th day survival rates in the first and second groups were 71.58% and 62.04%, respectively. Following the cotton harvest the sheep were pastured in the cotton fields from September onwards. It was thought that the first group of sheep used the stubble before the birth of the lambs and for a short time after and that this may have had a positive effect on the lambs. They may have started the winter with more strength because these lambs were in the sucking period. The effect of the mother's age was significant for both factors ($P < 0.01$). The observed survival rate was highest in lambs with mothers 2 years of age.

The 100th day survival rates of the lambs—which were grown up as singles, twins, and triplets—were 83.10%, 80.54%, and 36.79%, respectively. Marketing period survival rates were 79.83%, 74.60%, and 36.29%, respectively. The 100th day and marketing period rates for singles and twins are both similar and higher than the triplet survival rates. Breeders in particular do not want triplets because of the increased labor requirements under existing conditions. For this reason, the most convenient births are twin births. Birth weight significantly influenced the survival rate ($P < 0.05$ and $P < 0.01$). Naturally, the chance of survival for lambs that are livelier and heavier at birth will be higher.

Discussion

In this study the average birth weight of the Kırıcık × Chios F_1 lambs was 3.18 kg. In other studies carried out in the region the average birth weight was 3.56 kg for Kırıcık lambs (14) and 3.45 kg and 3.43 kg for Karya type and Menemen × Cine Type (F_1) lambs (15), respectively. These results were better than the average birth weight found in this study. On the other hand, the average birth weight findings in the current study were higher than those in some studies, which found an average birth weight of 2.75 kg for Çine Çaparı lambs (15), 2.81 kg for Kırıcık lambs, 2.94 kg for Chios × Kırıcık F_1 crossbred lambs, and 2.85 kg for Kırıcık × Karya crossbreds (16).

Table 2. The minimum squares means and standard errors considering the survival rates of the lambs until the 100th day and marketing period.

Classification	N	100th day survival rate	Marketing period survival rate
Year		*	**
First year	99	60.78 ± 3.69 ^a	49.49 ± 4.00 ^a
Second year	108	74.95 ± 4.10 ^b	75.88 ± 4.44 ^b
Third year	103	64.70 ± 4.23 ^{ab}	65.35 ± 4.58 ^b
Farm		**	**
1	227	75.87 ± 2.73 ^a	73.12 ± 2.96 ^a
2	83	57.75 ± 4.24 ^b	54.02 ± 4.58 ^b
Period		*	NS
1	179	71.58 ± 3.54 ^a	67.48 ± 3.83
2	131	62.04 ± 3.38 ^b	59.65 ± 3.66
Age of ewe		**	**
2	41	84.08 ± 6.07 ^a	86.75 ± 6.57 ^a
3	49	55.72 ± 5.78 ^b	50.55 ± 6.25 ^c
4	63	75.35 ± 4.95 ^a	73.60 ± 5.36 ^{ab}
5	56	53.27 ± 4.95 ^b	49.55 ± 5.35 ^c
6	52	66.20 ± 4.70 ^{ab}	61.15 ± 5.09 ^{bc}
≥ 7	49	66.23 ± 5.06 ^{ab}	59.83 ± 5.47 ^{bc}
Sex		NS	NS
Female	162	63.81 ± 3.30	61.86 ± 3.57
Male	148	69.81 ± 3.29	65.28 ± 3.56
Growth type		**	**
Single	118	83.10 ± 3.64 ^a	79.83 ± 3.94 ^a
Twin	162	80.54 ± 2.91 ^a	74.60 ± 3.15 ^a
Triplet	30	36.79 ± 6.98 ^b	36.29 ± 7.56 ^b
Linear regression			
Birth wt. (kg)		8.106 ± 3.051**	7.459 ± 3.301*
Overall mean	310	66.81	63.57

*; P < 0.05; **: P < 0.01; NS: not significant; a, b, c: the differences among the averages, indicated with different letters in a factor, are significant (P < 0.05).

The average birth weight in our study (3.18 kg) was lower than the average found by other studies performed in different regions and on different genotypes [Chios \times Akkaraman F_1 , 4.72 kg; Kıvırcık \times Akkaraman F_1 , 4.75 kg; Chios \times (Kıvırcık \times Morkaraman) F_1 , 4.45 kg; Kıvırcık \times (Chios \times Morkaraman) F_1 , 4.25 kg; crossbred lambs (17,18); Kıvırcık lambs under half-intensive conditions, 3.69 kg (19); and Akkaramans, Merino, and their crosses under village conditions, 3.74 kg (20)].

The average birth weight of lambs observed in the present study (Table 1) was considerably lower than values observed in hormone-treated native ewes of Turkey and other sheep breeds (21,22,23). In addition, the average birth rate was lower than the estimates found in some studies done abroad (26,27). However, the values were higher than those found in other studies in Turkey (24,25).

Generally, the average 100th day live-weight for lambs in this study was 19.71 kg. In similar studies, the 90th and 105th day live-weights were: 22.88 kg and 25.67 kg for Chios \times Kıvırcık F_1 lambs and 21.84 kg and 24.26 kg for Kıvırcık \times Akkaraman F_1 lambs, respectively (17). Average weights for 105 day old Kıvırcık \times (Chios \times Morkaraman) F_1 and Chios \times (Kıvırcık \times Morkaraman) F_1 lambs were 25.48 kg and 25.99 kg, respectively (18).

In the present study average gains in live-weight at the 100th day and marketing periods were 163 g and 167 g, respectively. In a study carried out in breeding flocks in the same region daily live-weight gain during the marketing period was 158 g for Kıvırcık lambs (28). At 89-103 days the average daily live-weight gains of Kıvırcık and Chios \times Kıvırcık crossbred lambs were 197.4 g and 163.0 g, respectively; at 103-117 days the average daily live-weight gains were 182.6 g and 175.9 g, respectively (16).

In Aydın province the weaning time and the marketing period are the same because the lambs are weaned in preparation for marketing. At the end of this 3 year study the average marketing weight was 29.10 kg. In the studies carried out at ADU-GKYP it was reported that the live-weight of Kıvırcık lambs weaned at around 125 days was 26.78 kg (29). At 3 and 5 months the live-weights for Karya type lambs were 20.85 kg and 25.56 kg, Menemen \times Karya (F_1) lambs were 21.71 kg and 23.83 kg, and Çine Çapari

lambs were 21.32 kg and 25.20 kg, respectively (15). In a study performed under flock breeding conditions the average live-weight of Kıvırcık lambs at the marketing period was 21.90 kg (28). As these other findings clearly demonstrate, the live-weights produced in our study were higher than all findings from similar studies performed in the same region.

A high survival rate is one of the important characteristics of lambs. In our study the survival rates until the 100th day and the marketing period were 66.81% and 63.57%, respectively. In a study performed on Kıvırcık sheep in the same village the 90th day survival rate was 87.8% (30). In another study carried out on breeding flocks the survival rate of Kıvırcık lambs until the marketing period was 68% (28). The survival rates in different regions with different feeding and maintenance conditions up until the weaning period (90-120 days) were: 85-98% for Kıvırcık lambs (31-34), 89.51% for Chios \times Kıvırcık (F_1) (35), and 50% for Chios lambs (32). In this study the survival rates at the 100th day and in the marketing period were similar. Real losses for the breeders occurred between birth and the 100th day.

Conditions prevalent in previous studies, such as regional and seasonal differences, the use of hand mating and artificial insemination, maintenance conditions, feeding, breeding, animal number, brand, and the concentrate of hormones could account for the different outcomes. In order to obtain more realistic results, it is important to compare studies performed with the same breed, under the same environmental conditions, in the same region, and in parallel time periods.

In order to produce a more profitable outcome in sheep breeding, which is influenced directly by garden and field agriculture, it was found that more advantageous results could be achieved by synchronizing estrus and encouraging earlier births than the present production methods allow. At the end of the study it was observed that the breeders were content with the present situation and were looking forward to better lamb sales than in previous years. This was largely because a great majority of the lambs produced were sacrificed, as the births of the previous year took place over a longer period and the cost of feeding them over this extended period by

hand was high. The easy and economic feeding of the lambs together with improving pasture conditions in late January and early February made the lamb sales more attractive to the breeders. Improving the maintenance and feeding conditions on farms would ensure more profitable production by positively influencing the development of the lambs and their survival rate until the marketing period. It is expected that the results of this study, carried out in

the Koçarlı district of Aydın province, will contribute to rehabilitation programs in the region and provide a basis for future studies.

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