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Growth traits and survival rates of Akkaraman lambs in breeder flocks in Konya Province

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Abstract: This trial was carried out to determine the growth traits and survival rates of Akkaraman ('White Karaman' in Turkish, WK) lambs in breeder flocks in Konya Province. In this study, the effects of birth year, lamb's sex, birth type, dam's age, and farm on the birth weight (BW), weaning weight (WW) at day 75, live weight (LW) at day 120, and average daily weight gain (ADWG) of lambs were investigated. Survival rates of lambs up to weaning were determined based on years. Data were collected from 19,207 lambs born between the years of 2007 and 2010 in 2 different villages of Konya Province in Turkey. The overall BW, WW, LW at day 120, ADWG, and survival rate of lambs were found as 4.05 kg, 19.5 kg, 31.7 kg, 231 g, and 91.4%, respectively. All of the investigated factors had significant effects on the BW, WW, and LW at day 120 and ADWG of lambs ($P < 0.01$). Differences between the survival rates of lambs were significant ($P < 0.01$). These results showed that birth year, sex of lamb, birth type, dam's age, and farm have important effects on the growth of WK lambs. It can also be said that the genetic capacity for rapid growth and ADWG of WK lambs is not low.

Key words: Akkaraman (White Karaman), growth, survival rate, environmental factor, live weight, daily weight gain

1. Introduction

Sheep and lamb meat is popular, high-priced, and a valuable source of nutrients in Turkey. Early lamb meat production is also an important source of income for small farms (1). However, for many reasons, in the last 30 years, the number of sheep in Turkey has gone down by 50% and declined to 23,089,691 in 2010 (2). In regions with arid climate, which have low-quality pastures, the most profitable livestock sector is sheep husbandry. Although the number of Akkaraman ('White Karaman' in Turkish, WK) sheep in Turkey has reached to 45% of the total Turkish sheep population and it is common in the Central Anatolian steppes, the breeding of WK sheep is carried out by traditional methods. It is thus clear that activities to improve the quality and yield of this breed are important (3). It has been expressed that native sheep breeds in Turkey have low productivity (1,3). However, this statement is not entirely accurate. Since the fat-tailed WK makes up almost half of the native sheep population, it is an important breed in Turkey (4).

In recent years, the WK breed has faced a danger of excessive crossbreeding. Therefore, the number of WK, which is the most important native sheep breed, has been decreasing day by day. The reason for excessive crossbreeding may be changes in recent years to consumer preferences

in favor of thin-tailed sheep meat. In order to protect and improve the breeding conditions of the WK breed, the Turkish Ministry of Food, Agriculture, and Livestock initiated a research project called "The Improvement of White Karaman Sheep in Breeder Conditions".

It is known that the effects of some factors, such as genotype, birth year, birth type, sex of lamb, dam's age, dam's live weight at mating season, and the maintenance and feeding of ewes, have significant influence on birth weight (BW) and weaning weight (WW) (5-9).

In some previous studies, BWs of WK lambs were reported between 2.83 and 3.81 kg (10-12) and between 4.28 and 4.99 kg (13-20), and WWs were reported as 19.1 kg (16) at 64 days old; as 22.9 kg (13) and 17.7 kg (17) at 75 days old; as 25.8 kg for males and 22.8 kg for females (15), as 23.1 kg (10), as 28.1 kg for males and 23.4 kg for females (18), as 22.3 kg (19), and as 21.1 kg (20) at 90 days old; and as 20.2 kg (11) and 33.6 kg (14) at 105 days old. In some earlier studies, 4-month weights of WK lambs were found as 27.7 and 22.7 kg (11,21) and 6-month weights were found as 30.4 and 31.9 kg (19,20).

In 2 previous studies, average daily weight gains (ADWGs) up to weaning (day 90) of WK lambs were found as 200 g (22) and as 208 and 190 g for male and female WK lambs, respectively (23).

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This trial was carried out to determine the growth traits and survival rates of WK lambs in breeder flocks in Konya Province by examining the effects of birth year, lamb's sex, birth type, dam's age, and farm.

2. Materials and methods

2.1. Animal material

The study was carried out in the Karakaya and Divanlar villages of Karatay District of Konya Province in Turkey (located at 37°54'N, 32°53'E and 1020 m a.s.l.; average temperature from 1970 to 2010: 11.4 °C). Annual precipitation amounts of Karatay District of Konya Province in the years of the study are shown in Table 1 (24). In the study, the data of 19,207 lambs born to 6000 WK ewes in 2007, 2008, 2009, and 2010 were used from the project entitled "The Improvement of White Karaman Sheep in Breeder Conditions".

2.2. Feedstuffs and feeding

Except for the snowy winter period, WK sheep, which were the focus of the study, were fed in the pasture and with cereal stubbles. During the winter, the ewes were fed with a diet that consisted of mostly wheat straw and a small amount of grain feed. However, during the last phase of pregnancy, the ewes were given daily 400 g of concentrate feedstuffs that contained barley and cottonseed. Additionally, they were given 1 kg of concentrate feedstuffs daily following the birth until the start of the pasture period.

The lambs suckled their mothers twice a day up to the weaning (day 75). As supplemental feed, lambs were usually given daily a mixture of 300 g of concentrate feed that consisted of barley, wheat, and cottonseed meal. After the age of 2 months, the lambs were grazed in the pastures near the stockyards as separate flocks away from the ewes.

2.3. Data recording

According to the project, ear tags were attached to all lambs born since 2006. Births were recorded and BWs were determined. Lambs were weighed 2 times with an interval of 40 days with digital weighing and live weights (LWs) of the lambs were determined at days 75 and 120. To calculate the survival rates of the lambs, the numbers of dead lambs were determined until weaning.

2.4. Statistical analysis

In this study, the effects of birth year, dam's age, sex of lamb, birth type, and farm on the BW, WW, LW at day 120, and ADWGs of lambs were examined by Least Squares Means. However, data related to farm effect were not shown in the

tables. Significant differences between the means were compared by Tukey test. The survival rates up to the weaning of WK lambs were determined by chi-square test. Statistical analysis was performed with the Minitab program (25).

3. Results

The results related to the effects of birth year, dam's age, sex of lamb, and birth type on the LWs of WK lambs in different periods are given in Table 2. The findings about the growth characteristics (ADWG) of lambs are provided in Table 3. The survival rates of WK lambs until weaning are given on the basis of years in Table 4.

When Table 2 is examined, it is seen that all of the discussed factors have a significant effect on LWs of lambs. The WWs and LWs of the lambs at day 120 increased until 2009, but there was a slight decrease in 2010 compared to the previous year.

When evaluated in 2007–2010, LWs of lambs at day 120 in 2010 were higher by 3.9% than the LWs of lambs at day 120 in 2007. Therefore, it can be said that there was an increase in the growth of WK lambs within the study period. In all periods, the LWs of the male lambs were higher than those of female lambs and the LWs of singletons were higher than those of twins. The LWs of the lambs born from ewes that gave birth for the first time were significantly lower than the LWs of the lambs born from ewes that had given birth previously. In terms of LWs of lambs at day 120, the difference between the highest and lowest rates of farms was found significant ($P < 0.01$) at 11.0 kg.

There was an increase in the survival rates of lambs until 2009, with the survival rate in 2009 markedly higher than the other years within the study (Table 4).

4. Discussion

4.1. Effect of environmental factors

In this experiment, birth year, birth type, sex of lamb, dam's age, and farm had a significant effect on the LWs of lambs. This result was similar to the results of some previous studies (5–9). However, in a previous study, the effect of birth type was not significant on preweaning ADWG (26). This result was different from results of the present study and other previous studies (5–9). This different result may have stemmed from the genetic, maintenance, feeding, and climatic differences for Norduz sheep.

Table 1. Annual average precipitation amounts of Konya Province by years.

Years	2007	2008	2009	2010	1970–2010
Average precipitation, mm	262	294	410	352	319

Table 2. Least square means and standard errors of the live weights of White Karaman lambs at different ages (kg).

Factors	n	Birth	Day 75	Day 120
		LSM ± SE	LSM ± SE	LSM ± SE
Birth year				
2007	3846	4.21 ± 0.008 ^a	18.6 ± 0.07 ^d	31.0 ± 0.10 ^c
2008	4784	3.98 ± 0.008 ^c	19.0 ± 0.07 ^c	30.9 ± 0.09 ^c
2009	5037	3.99 ± 0.007 ^c	20.5 ± 0.06 ^a	32.9 ± 0.09 ^a
2010	5540	4.02 ± 0.006 ^b	19.9 ± 0.06 ^b	32.2 ± 0.08 ^b
P		0.01	0.01	0.01
Sex				
Female	9570	3.97 ± 0.006	18.7 ± 0.05	30.1 ± 0.07
Male	9637	4.14 ± 0.006	20.3 ± 0.05	33.4 ± 0.07
P		0.01	0.01	0.01
Birth type				
Singleton	13,396	4.30 ± 0.005	20.6 ± 0.04	33.3 ± 0.06
Twin	5811	3.81 ± 0.007	18.4 ± 0.06	30.2 ± 0.08
P		0.01	0.01	0.01
Dam's age (years)				
2	3002	4.00 ± 0.008 ^b	18.7 ± 0.07 ^c	30.8 ± 0.10 ^b
3	4318	4.05 ± 0.007 ^a	19.4 ± 0.06 ^b	32.0 ± 0.09 ^a
4	5079	4.07 ± 0.007 ^a	19.6 ± 0.06 ^{ab}	32.0 ± 0.08 ^a
5	3860	4.07 ± 0.007 ^a	19.8 ± 0.07 ^a	32.0 ± 0.09 ^a
6	2291	4.06 ± 0.010 ^a	19.8 ± 0.09 ^a	32.0 ± 0.12 ^a
7	657	4.08 ± 0.018 ^a	19.7 ± 0.16 ^{ab}	31.6 ± 0.21 ^a
P		0.01	0.01	0.01
Overall	19,207	4.05 ± 0.004	19.5 ± 0.04	31.7 ± 0.06

^{a,b,c,d}: Means in the same column with different superscripts differ significantly ($P < 0.05$). LSM: Least square means, SE: standard error.

4.2. Birth weight

The overall BW value of this study (4.1 kg) was higher than the values reported in some studies (10–12), but it was generally lower than the values indicated in many other studies (13–20). A probable reason for low birth weights in the present study may be the high rates of twin births (18%–20%). It was also reported in earlier studies that BWs of twin-born WK lambs were lower than those of single-born WK lambs (20,22). Another reason for this may be different feeding levels of pregnant ewes during the last gestation in this study and previous studies. The BWs

of lambs increase with sufficient feeding of pregnant ewes during the last gestation (27,28).

A possible reason for the decrease with regard to BW may be that the twin rate increased from 11% to 18%–20% since 2007 in this study. The increase in the twin rate may be due to studies related to the “Improvement of White Karaman Sheep in Breeder Conditions” project.

4.3. Weaning weight

In this study, the WW of lambs (males, 20.3 kg; females, 18.7 kg) was determined at day 75. In some studies (10,11,13–19), weaning of lambs was conducted at different ages (days 64,

Table 3. Least square means and standard errors of the average daily weight gains of White Karaman lambs (g).

Factors	n	Birth to weaning	Birth to day 120
		LSM ± SE	LSM ± SE
Birth year			
2007	3846	192 ± 1.0 ^d	223 ± 0.8 ^c
2008	4784	200 ± 0.9 ^c	224 ± 0.8 ^c
2009	5037	220 ± 0.8 ^a	241 ± 0.7 ^a
2010	5540	212 ± 0.7 ^b	235 ± 0.6 ^b
P		0.01	0.01
Sex			
Female	9570	196 ± 0.7	218 ± 0.6
Male	9637	215 ± 0.7	244 ± 0.6
P		0.01	0.01
Birth type			
Singleton	13,396	217 ± 0.6	241 ± 0.5
Twin	5811	194 ± 0.8	220 ± 0.7
P		0.01	0.01
Overall	19,207	206 ± 0.5	231 ± 0.4

^{a,b,c,d}: Means in the same column with different superscripts differ significantly ($P < 0.05$).

Table 4. Survival rates of White Karaman lambs until weaning by years.

Years	2007	2008	2009	2010	χ^2	P	Overall
Number of born lambs	5751	5999	5937	6495			24182
Number of weaned lambs	5080	5342	5612	6084			22118
Survival rates (%)	88.3 ^c	89.0 ^c	94.5 ^a	93.7 ^b	228.9	0.01	91.4

^{a,b,c}: Means in the same row with different superscripts differ significantly ($P < 0.05$).

75, 90, and 105). Therefore, an exact comparison could not be made in terms of the WW. However, the values obtained in this study were close to previous values reported for 64- and 75-day-old lambs (16,17), were similar to previous values by calculations made on the basis of daily weight gain (10,19,20), and were higher than those of another study (11), but were lower than those of some other studies (14,15,18). The differences in terms of WW in lambs of the same age between this study and previous studies (11,14,15,18) may stem from differences in genetic capacity, milk yield of dams, and climatic, maintenance, and feeding conditions.

4.4. Live weights of lambs at day 120

In this study, the overall LW value (31.7 kg) of lambs at 4 months of age was found higher than the values (27.7 and 22.7 kg) of 2 other studies (11,21) of lambs at the same age or older. They were similar to the values (30.4 and 31.9 kg) of 2 studies (19,20) conducted among lambs 6 months age. In different studies, differences between the LWs of lambs at 4 and 6 months of age could originate from differences in genetic capacity and climatic, maintenance, and feeding conditions.

A possible reason for the decrease in terms of WW and LW at day 120 in 2010 compared to the previous year could be different rainfall levels, as 2009 was rainier than 2010. The growth of pastures was probably better for this reason.

4.5. Average daily weight gain of lambs

In this experiment, from 2007 to 2010, ADWGs up to weaning and day 120 of male and female lambs were found as 215 and 196 g and as 244 and 218 g, respectively (Table 3). The values related to ADWGs until weaning obtained in this study were similar to those of earlier studies (22,23).

4.6. Survival rates

The survival rate of lambs in this study (overall: 91.4%) was close to the rate (91.2%) reported in a prior study (20) and was lower than the rate (96.1%–97.6%) of a different study (14). The latter mentioned was carried out on Malya

State Farm. The maintenance and feeding conditions of Malya State Farm may thus be better than conditions of breeders in Konya. This also may affect survival rates.

In conclusion, it can be said that birth year, sex of lamb, birth type, dam's age, and farm condition have important effects on the growth of WK lambs. It can also be said that the genetic capacity with regard to rapid growth and ADWG of WK lambs is not low. Therefore, with planned, deliberate, and long-term studies, the rapid growth traits of WK lambs that are adapted to the perfect to poor pasture conditions of Central Anatolia can be increased to more advanced levels.

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