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Research Article

Performance Testing Studies and the Selection of Hasmer, Hasak, Hasiv and Linmer Crossbreed Sheep Types: III. Fattening Performance*

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Abstract: This study was conducted to evaluate the fattening performance of Hasmer (31.25% Hampshire Down (HD) + 31.25% German Black Headed Mutton (GBM) + 37.50% Merino), Hasak (31.25% HD + 31.25% GBM + 37.50% Akkaraman), Hasiv (31.25% HD + 31.25% GBM + 37.50% Awassi) and Linmer (50% Lincoln + 50% Merino) types. The research was performed between 1997 and 1999. Potential sires were selected based on their performance test results. The general linear model and Tukey's honestly significant difference test were used for statistical analyses. Year and genotype were introduced into the model as fixed factors and initial weight was introduced as a covariate along with year x genotype interaction.

The year, genotype, year x genotype interaction and initial weight factors statistically affected the weight performance of ram lambs tested at 150 days. The live weights of lambs at 150 days were 40.7, 41.0, 44.0 and 41.7 kg in 1997; 42.6, 44.3, 46.1 and 41.1 kg in 1998; and 41.6, 42.8, 41.7 and 40.5 kg in 1999 for the Hasmer, Hasak, Hasiv and Linmer types, respectively. The differences between genotypes were statistically significant in all 3 years, and the differences between years were also significant in all genotypes, except for the Linmer group. The values obtained in 1998 were generally higher than those for 1997 and 1999. The superiority of genotypes over others varied year by year, but the Linmer registered the lowest value in all 3 years. The same statistical results were obtained for daily gains, the values being 258, 263, 302 and 272 g in 1997; 284, 307, 330 and 264 g in 1998; and 270, 287, 272 and 255 g in 1999 for the genotypes in the same order as above ($P < 0.05$ in all 3 years). The feed efficiencies were 4.38, 5.00, 5.03 and 4.22 kg in 1997 ($P < 0.05$); 4.28, 4.17, 4.14 and 4.06 kg in 1998 ($P > 0.05$); and 4.30, 4.28, 4.09 and 4.76 kg in 1999 ($P < 0.05$) for these genotypes, respectively. The differences between years were significant in all genotypes except for the Hasmer group.

The 150-day live weight averages of the selected ram lambs were 42.1, 49.4, 51.9 and 46.0 kg in 1997; 50.3, 54.3, 51.5 and 44.9 kg in 1998; and 50.9, 53.8, 48.9 and 47.2 kg in 1999 ($P < 0.05$ in all 3 years). The relative superiority of the selected rams to others was 10-17.3% in 1997; 13.7-19.5% in 1998; and 14.0-22.0% in 1999 in all 4 genotypes.

A moderate level of mean daily live weight gain was thus obtained in this study. However, the Linmer group had generally lower values. Although the Hasiv group had relatively higher values, the limited number of animals in this genotype could be considered a disadvantage for the selection procedure. We recommend that Hasmer and Hasak crossbreeds in particular be reared and improved; however, Hasiv and Linmer crossbreeds may be reared or culled. Performance test and selection studies should be continued.

Key Words: Mutton sheep breed, crossbreeding, performance test, selection, fixing new types.

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Hasmer, Hasak, Hasiv ve Linmer Melez Koyun Tiplerinde Performans Test ve Seleksiyon Çalışmaları: III. Besi Performansı

Özet: Bu araştırma, Hasmer (% 31,25 Hampshire Down (HD) + % 30,25 Alman Siyah Baş (ASB)+ % 37,50 Merinos), Hasak (% 31,25 HD + % 31,25 ASB + % 37,50 Akkaraman), Hasiv (% 31,25 HD + % 31,25 ASB + % 37,50 İvesi) ve Linmer (% 50 Lincoln + % 50 Merinos) tiplerinde besi performansı testi ve bu test sonucuna göre koç adaylarını belirlemek amacı ile yapılmıştır. Araştırma 1997-1999 yıllarında yapılmıştır. İstatistik analizlerde Genel Doğrusal Model (GLM) kullanılmıştır. Modele yıl ve genotip sabit faktör olarak, besi başı ağırlığı kovaryeyt olarak dahil edilmiştir.

Performans teste tabi tutulan erkek kuzuların 150. gün ağırlığına yıl, genotip, yıl x genotip interaksiyonu ve besi başı ağırlığı faktörleri etkili olmuştur. Hasmer, Hasak, Hasiv ve Linmer gruplarında bulunan değerler, sırasıyla, 1997'de 40,7, 41,0, 44,0 ve 41,7 kg; 1998'de 42,6, 44,3, 46,1 ve 41,1 kg; 1999'da 41,6, 42,8, 41,7 ve 40,5 kg olup her üç yılda da genotipler arası; Linmer grubu hariç her genotipte yıllar arası fark önemli olup genel olarak 1998 yılında daha yüksek değerler elde edilmiştir. Genotiplerin birbirine üstünlüğü yıldan yıla değişse de, her yıl Linmer grubu en düşük değeri göstermiştir. GCAA bakımından da aynı istatistik sonuçlar alınmış olup genotiplerde elde edilen değerler, aynı sıra ile, 1997 yılında 258, 263, 302 ve 272 g, 1998'de 284, 307, 330 ve 264 g ve 1999'da 270, 287, 272 ve 255 g bulunmuştur (her üç yılda $P < 0,05$). Yemden yararlanma, sırasıyla, 1997 yılında 4,38, 5,00, 5,03 ve 4,22 kg ($P < 0,05$), 1998'de 4,28, 4,17, 4,14 ve 4,06 kg ($P > 0,05$), 1999'da 4,30, 4,28, 4,09 ve 4,76 kg ($P < 0,05$); Hasmer grubu dışındaki genotiplerde yıllar arası fark önemli bulunmuştur.

Performans test sonucu seçilen koç adaylarının 150. gün canlı ağırlığı ortalamaları, aynı sıra ile, 1997 yılında 42,1, 49,4, 51,9 ve 46,0 kg; 1998'de 50,3, 54,3, 51,5 ve 44,9 kg; 1999'da 50,9, 53,8, 48,9 ve 47,2 kg (her üç yılda $P < 0,05$); seçilenlerin ortalamasının gruplarının genel ortalamasına nispi üstünlüğü 1997'de % 10-17,3, 1998'de % 13,7-19,5 ve 1999'da % 14,0-22,0 arasında bulunmuştur.

Sonuç olarak, 1998 yılı GCAA değerleri biraz yüksek olsa da, genel olarak orta seviyede değerler elde edilmiştir. Dört tipten Linmer'in genellikle düşük performans göstermesi, Hasiv'in -yüksek performans gösterse de- damızlık sürü olarak sayıca az olması bir dezavantajdır. Bu nedenle, Hasmer ve Hasak tiplerinin öncelikli olarak yetiştirilmesi, diğer ikisinin de yetiştirilebileceği veya reforme edilebileceği ve performans test çalışmalarının devam ettirilmesi gerektiği kanaatına varılmıştır.

Anahtar Sözcükler: Etçi ırk, melezleme, performans test, seleksiyon, tip sabitleme

Introduction

Selection studies are critically important for improving the quality of animal products. In the selection of new mutton sheep types, the live weight, daily gain, feed efficiency, and carcass conformation of the ram lambs, during the period from birth to 1.5 years of age, are very important criteria. In practice, weaning weight, post-weaning fattening performance and ultrasonic carcass measurements have usually been used for ram selection. Today, the selection of breeding rams is based on these criteria that are widely used in farms and test stations in European countries (l-6). Similar studies should be initiated in Turkey.

Crossbreeding efforts in Turkey have been generally limited to research, and there is almost no field application. However, studies aiming to improve new sheep types, which can make the genotype of these culture breeds permanent in Turkish sheep breeding, should be performed. Therefore, performance testing and selection studies on new crossbred types should be done. The stock can thus be improved, based especially on live weight and carcass conformation.

The general objective of this study was to develop new mutton sheep types which can be used in commercial crossbreeding programs as sire lines. In this project, a performance test study was conducted on 4 crossbreed types, and the selection based on the ram lambs was made over 3 years. This research involved the fattening performance of crossbred lambs as part of the project.

Materials and Methods

Animal Material: The study was conducted at the Konya Animal Research Institute from 1997 to 1999. During the 3 year experimental period, a total of 129 Hasmer (31.25% HD + 31.25% GBM + 37.5% M), 99 Hasak (31.25% HD + 31.25% GBM + 37.5% Akk), 50 Hasiv (31.25% HD + 31.25% GBM + 37.5% A) and 85 Linmer (50% L + 50% M) sheep were used as animal materials.

Food Material: The rations used in this study are shown in Table 1.

Table 1. The composition of rations used in fattening.

Composition		(%)
Barley		25.5
Wheat		20
Corn		23
Soyabean meal		15
Sunflower oil meal		10
Molasses		2
Limstone		3
Salt		1
Vit.-Min. premix		0.5
Dry matter	1997	90.40
	1998	92.02
	1999	90.96
Crude protein	1997	14.15
	1998	16.43
	1999	16.09

Care and feeding of lambs: Lambs weaned at 75 days old were selected for the fattening program according to age. When the lambs reached 150 days old, the fattening program finished. Lambs were fed with 100 g/day/animal alfalfa hay and the rations shown in Table 1 ad libitum. In addition, a continuous water supply, salt and mineral licking stones were made available to the lambs. To calculate weight gains and feed efficiency, lambs were weighed every 2 weeks and the data were recorded.

Performance Testing and Selection: The 150-day weights of ram lambs, daily gains in the fattening and pre-weaning period, and feed efficiencies were adjusted according to environmental factors. In each variable lambs were ordered from smallest to the largest and an index was formed for each lamb according to their ordered points. From each genotype, 10% of the lambs with higher index scores were selected for use in the following year's mating. All of the ewe lambs were kept in reserve until they reached to 1.5 years old, and 90% of these ewes, those which were healthy and had a higher live weight, were used for breeding.

Statistical Analysis: Data from ram lambs were evaluated independently in each year to select potntial sires. At the end of the 3 years, the data were analysed together using the GLM model with 2 fixed factors (genotype and year). In addition, genotype x year interaction and the initial weight of lambs were introduced into the model (7). The model was: $Y_{ijn} = a + b_{1i} + b_{2j} + b_{1i}b_{2j} + b_3X_{ijn} + e_{ijn}$, where; Y_{ijn} is the live weight and daily gain of the n^{th} lambs from the i^{th} year and the j^{th} genotype; a: constant; b_{1i},: year (1997, 1998, 1999); b_{2j}: genotype (Hasmer, Hasak, Hasiv, Linmer); $b_{1i}b_{2j}$: year x genotype interaction; e_{ijn}: randomised error; and X_{ijn}: the initial live weight of each lamb. As a post hoc analysis, Tukey's HSD test was used (7).

Results

The analysis of variance results of the fattening performance are shown in Table 2. Means and standard deviations of live weights, daily gains and feed efficiencies are given in Table 3. The effects of year, genotype, initial age and year x genotype interaction on live weight and daily live weight gain were significant (Table 2). Since year x genotype interaction was determined, the

Table 2. ANOVA (GLM) table of live weights (W), daily gains (DG) and feed efficiencies (FE).

		75-day W	150-day W	DG	FE
Sources	DF	MS	MS	MS	MS
75-day weight	1		8133.2 ***	21516 ***	5.1 **
Year	2	72.9 *	121.8 ***	21644 ***	6.5 ***
Genotype	3	130.0 ***	100.3 ***	17836 ***	0.6 -
Year x Genotype	6	56.5 **	34.6 **	6154 **	3.1 ***
Error	351	17.8	10.1	1794	0.5
Total	363				

***: $P < 0.001$, **: $P < 0.01$, *: $P < 0.05$, -: $P > 0.05$
DF: Degree of freedom, MS: Mean of squares

Table 3. Least squares means ($\bar{x}$) and standard deviations (Sd) of live weight and daily gains.

	Year											
	1997				1998				1999			
Genotype	n[ψ]	[ϕ] $\bar{x}$		Sd	n	$\bar{x}$		Sd	n	$\bar{x}$		Sd
75-day weight												
Hasmer	41	[b] 19.2	C	0.66	42	[b] 20.8	AB	0.65	46	[a] 23.5		0.62
Hasak	26	22.3	AB	0.83	38	22.6	A	0.69	35	22.4		0.71
Hasiv	15	23.9	A	1.09	20	20.6	AB	0.94	15	22.4		1.09
Linmer	24	19.6	BC	0.86	31	18.7	B	0.76	31	20.8		0.76
150-day weight												
Hasmer		[b] 40.7	B	0.50		[a] 42.6	B	0.49		[ab] 41.6	AB	0.48
Hasak		[b] 41.0	B	0.62		[a] 44.3	AB	0.52		[ab] 42.8	A	0.54
Hasiv		[ab] 44.0	A	0.83		[a] 46.1	A	0.71		[b] 41.7	A	0.82
Linmer		41.7	B	0.65		41.1	C	0.58		40.5	B	0.57
Daily gain												
Hasmer		[b] 258	B	6.7		[a] 284	BC	6.5		[ab] 270	AB	6.4
Hasak		[b] 263	B	8.3		[a] 307	AB	6.9		[ab] 287	A	7.2
Hasiv		[ab] 302	A	11.0		[a] 330	A	9.5		[b] 272	AB	11.0
Linmer		272	B	8.7		264	C	7.7		255	B	7.6
Feed efficiency												
Hasmer		4.4	B	0.11		4.3		0.11		4.30	A	0.11
Hasak		[a] 5.0	A	0.14		[b] 4.2		0.12		[b] 4.3	AB	0.12
Hasiv		[a] 5.0	A	0.19		[b] 4.1		0.16		[b] 4.1	B	0.19
Linmer		[b] 4.2	B	0.15		[b] 4.1		0.13		[a] 4.8	A	0.13

ϕ: Means without a common superscript within each variable differ ($P < 0.05$); in the same column, for genotype (right hand, [A, B, C]); in the same row, for year (left hand, [a, b]).
ψ: The numbers (n) for 75-day weight are also valid for other traits.

comparisons of genotypes are presented year by year, and the comparisons of years are separately presented for each genotype.

The daily gain means in the fattening period were 258-302 g in 1997, and the Hasiv group showed significantly higher levels than did the others. In the 1998 animals, the means were 264-330 g, and the differences between genotypes were significant. Although the highest values were exhibited by the Hasak and Hasiv, the Hasmer and Linmer values were similar to each other in 1998. The means were between 255 and 287 g for 1999, with the Hasak group having the highest value and the Linmer group having the lowest value. The differences between these genotypes were significant, although the Hasmer and Hasak groups resembled each other. When the years were compared based on daily gains, the differences between the years were significant in the first 3 genotypes. The values for 1998 were higher than those for 1997 and similar to those for 1999 in the Hasmer and Hasak groups. However, in the Hasiv group, the values for 1998 were higher than those for 1999 and similar to those for 1997. The differences among the years were not significant in the Linmer type. Therefore, year by year, there was an improvement in the Hasmer and Hasak groups, but there was underdevelopment in the Hasiv group. No variation, however, was observed in the Linmer group.

According to Table 3, in respect of the 75-day and 150-day weights, there were significant differences among the genotypes in 1997 and 1998. However, the differences were significant only in 150-day weights in 1999. The finishing live weight (150-day weight) of the

Hasiv group was higher than those of the others in 1997 and 1998, and the Linmer group had the lowest value. In 1999, the lowest value again belonged to the Linmer group; but the highest value was that of the Hasak group. When the live weights were compared in respect of years, there were no significant differences among the years for Linmer group. The values for 1998 were higher than those for 1997, but were similar to those for 1999 for the Hasmer and Hasak groups. The values for 1998 were higher than those for 1999 but resembled those for 1997 in the Hasiv group.

The feed consumption of lambs per kg of live weight gain was 4.2-5.0 kg in 1997 and the differences among the genotypes were significant. The values of the Hasak and Hasiv groups were higher than those of the Hasmer and Linmer types. Feed consumption was 4.1-4.3 kg in 1998 for all genotypes, and the differences among the genotypes were not significant. The 1999 year figures were 4.1-4.8 kg, and the values for the Hasmer and Linmer groups were higher than those for the Hasiv group but similar to those for the Hasak group; unlike in 1997. When the genotypes were compared year by year, the differences among the years were not significant in the Hasmer group, but they were significant in the other genotypes. The values for the Hasak and Hasiv groups were high in 1997, but there was a decrease in 1998 and 1999. in contrast, the values for the Linmer group were lower in the first 2 years but higher in the last year.

The 150-day live weight and daily gains of the selected ram lambs and their relative superiority over the other group members are shown in Table 4. The differences between genotypes were significant in the 150-day live weights in all 3 years, but the differences in daily gains were only significant in 1998 and 1999. Whilst the Linmer type had low values, the Hasak group showed high values in all years (Table 4). However, this varied in the Hasmer and Hasiv types. The values for these genotypes varied year by year, with an increase in the Hasmer genotype but a decrease in the Hasiv genotype.

Discussion

Daily live weight gains of 255-330 g were obtained in this study, which were similar to those in studies carried out in Turkey in purebred and crossbred lambs (8-12) and others (13,14). These findings were lower than those in some performance test studies conducted in Europe (2,4,5,15,16) and were also lower than the findings obtained in F_1 and B_1 crossbred lambs sired by mutton sheep (17-19). These differences can be explained by the quality of rations, especially compared

Table 4. Descriptive statistics of 150-day weight and daily gains of selected ram lambs.

		150-day weight					Daily gains during fattening				
	n	x̄	Sd	min	max	D^{η}	x̄	Sd	min	max	D^{η}
1997		***					-				
Hasmer	8	42.1	2.36 ^{c}	39.5	46.3	10.0	292.6	23.73	261.9	328.6	13.6
Hasak	6	49.4	1.46 ^{ab}	47.5	50.9	17.3	278.7	37.12	230.0	323.2	6.1
Hasiv	4	51.9	1.49 ^{a}	49.9	53.4	10.7	318.0	31.27	289.3	362.2	5.3
Linmer	8	46.0	3.33 ^{b}	41.0	51.3	15.9	308.2	46.90	232.9	375.2	13.2
1998		***					*				
Hasmer	10	50.3	3.13 ^{b}	46.4	54.9	19.5	325.7	34.62 ^{ab}	290.8	397.4	14.8
Hasak	9	54.3	2.83 ^{a}	48.8	58.9	18.9	357.8	22.22 ^{a}	318.6	390.7	16.6
Hasiv	6	51.5	2.45 ^{ab}	47.7	54.7	13.7	343.0	27.44 ^{ab}	311.7	391.4	3.9
Linmer	8	44.9	1.64 ^{c}	42.6	47.0	17.9	307.2	44.16 ^{b}	270.5	404.3	16.3
1999		**					**				
Hasmer	11	50.9	2.83 ^{ab}	46.8	55.3	15.7	318.9	30.22 ^{ab}	262.6	355.8	18.2
Hasak	8	53.8	2.66 ^{a}	50.8	59.1	22.0	356.8	35.23 ^{a}	316.3	423.7	24.4
Hasiv	5	48.9	4.32 ^{b}	46.2	56.5	14.0	314.9	23.75 ^{b}	282.4	346.7	15.8
Linmer	7	47.2	2.38 ^{b}	42.9	51.0	18.3	298.6	25.38 ^{b}	274.7	341.7	13.3

$^{a, b}$: Means without a common superscript within each year in the same column differ ($P < 0.05$).
$^{\eta}$: Differences: The proportional differences (%) between selected lambs and their population.

with findings of Akmaz et al. (17,18). For example, the highest crude protein (CP) ratio used in this study was 16.43%; however, the rations used by Akmaz et al. (17,18) included 19.70% CP. This was also confirmed by the findings for 1998. Since it had the highest CP ratio (16.43%), the daily gains in 1998 were higher than those in 1997 and in some cases higher than those in 1999. However, other environmental and genotypic factors should also be considered. The feed efficiency differences among genotypes were significant in 1997 and 1999, but not in 1998. It can be said that the feed efficiencies of the genotypes were good in all 3 years. When the findings were compared with the literature, it was clear that the interpretations made for daily gains could also be accepted for the feed efficiencies. Our findings were similar to several reports in Turkey (11,12,17-19). We expect that if environmental factors such as quality of rations are improved, the fattening performance will also be improved.

The superiority of the means of the selected lambs over the overall means of the genotypes varied from 10% to 22% year by year, and the ratios of 1999 were higher than those for 1997 and 1998. From the daily gains point of view, the differences between the groups were not significant in 1997 but were significant in 1998 and 1999; in these years the values for the Linmer group were lower than those for the Hasak group, but those of the other types were similar to each other. The daily gains of selected lambs as group averages or as individual values were similar to those in the previous research (2,4,5,15-19). This indicates that if ram lambs are systematically selected, the daily gain will be improved.

In conclusion, even though the 1998 findings were relatively high, the general findings obtained during the 3 years were average. If environmental factors can be improved, the fattening performance of crossbred lambs will also be improved. The Linmer genotype generally showed a lower performance than the other 3 genotypes. The Hasiv genotypes showed a high performance, but it has low population numbers. These were disadvantages for these genotypes. The Hasmer and Hasak genotypes displayed an acceptable performance. When the pregnancy and growth traits of these genotypes are considered (20,21), we can recommend that the Hasmer and Hasak genotypes in particular be reared and improved. On the other hand, the Hasiv and Linmer crossbreeds may be reared or culled. In addition, performance test and selection studies should be continued.

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