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The Effects of Different Fattening Methods and Sex on Fattening Performance in Native Turkish Geese

Yerli Türk Kazlarında Farklı Besi Yöntemleri ve Cinsiyetin Besi Performansı Üzerine Etkisi

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ABSTRACT

The animal material of the study consisted of native Turkish geese. Regardless of the sex of the chicks, the first 4 wk of age were fed together, and the 5 and 6 week of age were fed ad libitum in groups using the starter feed. From the sixth wk onwards, four fattening method were formed until the 16 week of age as feed, pasture + cracked barley, pasture + feed and pasture. In the feed, pasture + cracked barley, pasture + feed groups, general body weight increase averages are 39.81, 37.46 and 39.90 g, respectively; average feed daily consumption is 426.95, 207.99 and 200.76 g, respectively; feed conversion ratio were 10.72, 5.55 and 5.03, respectively. At the end of the study, body weights were determined as 4209, 4108, 4239 and 3971 g in the feed, pasture + cracked barley, pasture + feed groups and pasture groups, respectively (P<0.01). As a result, the average body weight of geese was found to be similar with some literature data, which is lower than some literature data. This may be due to the fact that the geese used in the study are native Turkish geese and no selection studies have been performed on them. Although the highest body weight increase was determined in the pasture + feed group, it was concluded that it would be more appropriate to make pasture feed since the geese fed economically in the pasture provide body weight increase similar to other groups. It was determined that fattening with only feed is not economical for goose breeding and does not provide much daily weight gain compared to other groups.

Keywords: Fattening methods, fattening performance, native Turkish goose, sex

ÖZ

Araştırmanın hayvan materyalini yerli Türk kazları oluşturmuştur. Kaz civcivlerinin cinsiyetine bakılmaksızın ilk 4 hafta birlikte, 5 ve 6. haftalar gruplar halinde başlangıç yemi kullanılarak ad libitum olarak beslenmiştir. Altıncı haftadan itibaren 16. haftaya kadar konsantre yem, mera + arpa kırması, mera + konsantre yem ve mera olmak üzere dört besi yöntemi oluşturulmuştur. Konsantre yem, mera+arpa kırması, mera+ konsantre yem gruplarında genel canlı ağırlık artış ortalamaları sırasıyla 39.81, 37.46 ve 39.90 g; ortalama günlük yem tüketimi sırasıyla 426.95, 207.99 ve 200.76 g; yemden yararlanma oranı ise sırasıyla 10.72, 5.55 ve 5.03 olarak bulunmuştur. Çalışma sonunda canlı ağırlıklar konsantre yem, mera+ arpa kırması, mera + konsantre yem ve mera gruplarında canlı ağırlıklar sırasıyla 4209, 4108, 4239 ve 3971 g olarak belirlenmiştir. Sonuç olarak kazların ortalama canlı ağırlıklarının bazı literatür verileriyle benzer ve düşük olduğu tespit edilmiştir. Bunun nedeni, çalışmada kullanılan yerli Türk kazları üzerinde herhangi bir seleksiyon çalışması yapılmamış olması olabilir. En yüksek canlı ağırlık artışı mera+yem grubunda belirlenmekle birlikte merada ekonomik olarak beslenen kazların diğer gruplara benzer şekilde canlı ağırlık artışı sağlaması nedeniyle mera besisi yapılmasının daha uygun olacağı sonucuna varılmıştır. Kaz yetiştiriciliğinde sadece konsantre yemle beslemenin ekonomik olmadığı ve diğer gruplara göre çok fazla günlük canlı ağırlık artışı sağlamadığı belirlenmiştir.

Anahtar Kelimeler: Besi performansı, besi yöntemi, yerli Türk kazı, cinsiyet.

This study was summarized from the first author's PhD thesis with same title.

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INTRODUCTION

The impact of scientific and technological developments leads to changes in the standard of living and nutritional habits of human beings. This change inevitably creates demands for an increase in animal protein needs and diversity. In order to meet the expressed demands, the products obtained from the animals that are the only source will be increased, and different animal species can be included in the production sector. The largest resource used to increase species diversity in animal production is poultry. An important part of this wide range extending from ostrich to quail is composed of water birds. In waterfowl, geese are in a different position with their breeds raised for different purposes and the variety they offer to production.[1-2]

In recent years, the demand for poultry meat with taste that differs from that of broiler chickens has increased among consumers. Among the various alternative poultry species, geese have interesting biological characteristics; such as a high growth rate, a good adaptation to free range and grazing, disease resistance and a high dietary meat quality. Besides, goose breeding is a part of the culture in certain region of Türkiye. Geese grown in summer and slaughtered in autumn are stored in special conditions. In winter, goose meat becomes indispensable for banquet tables[1-6]. Goose breeding is carried out in the Northeastern Anatolia region, especially in province of Kars, Ardahan and Muş in Türkiye. The total of three province constitutes approximately 53.2% of all Türkiye (TÜİK: https://biruni.tuik.gov.tr/).

Several studies have been conducted on the growth, slaughter and carcass traits of native Turkish geese breeds.[4,7,8.] However, there have been no studies comparing a native Turkish goose breed with different food methods. The farming traditionally made goose, geese are usually fed pasture-based, are also rarely barley in Türkiye. Based on this point, the effects of the use of food and cracked barley in addition to pasture and pasture were investigated on the growth characteristics of the study. In addition, with this study, it is aimed to develop different maintenance-fattening methods that will make goose breeding more economical and to increase the producer's income in this way.

MATERIALS AND METHODS

Animal Material

The animal material of the study consisted of native Turkish geese. In the study, four groups were formed as feed, pasture + cracked barley, pasture + feed and pasture. The experiment was carried out on 14 males and 14 females of the feed group, 13 males and 14 females of the pasture + cracked barley group, and 13 males and 15 males of the pasture + feed and pasture grups, a total of 111 birds. After being weighed one-d-old goslings were weighed, they were divided into 4 groups according to the sensitive sampling methods.[9] The room temperature was 32-35 °C in the 1 wk of age in fattening period, then gradually decreased by aproximatelly 2-3 °C every 3 days so that at 4 wk of age of goslings the temperature was 18-20 °C. Relative humidity was 50-65%.

Feed Material

Chick starter feed containing 2949 ME, kcal/kg energy and 21.32% crude protein was used in the feeding of birds. Starter feed was given to all geese during the first 6 wk. After 6 wk of age, birds were given 3034 ME, kcal/kg energy and 15.35% crude protein growth feeding to pasture + feed and feed groups (Table 1). The nutrient composition of barley used in the feeding of pasture + cracked barley group was calculated as 2784 ME, kcal/kg energy and 12.57% crude protein (Table 2).10 After the geese were divided into fattening method, they started to be left to pasture from the 6th wk. The first pasture analysis samples were taken to represent the pasture from 7 different points of the pasture on the day the geese were placed in the pasture and mixed and sent to the laboratory (0th, 30th and 65th days) (Table 3).

Method

The study was conducted at the private enterprise in Kars Türkiye. The birds were weighed after hatching and the wing number was fitted. Then they are grouped into 4 groups. Birds were fed at 0-4 wk together, and 5-6 wk divided into groups and fed with starter feed as *ad libitum*. These four group was fed from the 6 wk of age until the 16 wk of age as feed, pasture + cracked barley, pasture + feed and pasture. The geese have been provided with *ad libitum* water. The study started at the 6 wk because the hatched chicks feathers did not develop to protect them from the cold and therefore they might cause problems in living in nature conditions. While geese are in the pasture, the shelters were cleaned daily. For each group, sections of 3.5 m width and 4.5 m length of 15.75 m^2 were prepared and shelters were regularly ventilated. This area is arranged to be at least 0.5 m^2 per goose.

No additional lighting was applied for the lighting of the shelters, and daylight was used. The feed group geese are fed only as *ad libitum* and this group were never taken to

the pasture. Pasture + cracked barley group; It was taken to the pasture at 8.00 in the morning and taken to the shelters from the pasture at 17.00 in the evening, and the geese in this group were given cracked barley as *ad libitum* in their pasture return. Pasture + feed group; It was taken to pasture at 8.00 in the morning and taken to shelters from the pasture at 17.00 in the evening. This group was given feed as *ad libitum* on pasture return. The pasture group was left to the pasture at 8.00 in the morning and remained in the pasture until the evening and were taken inside at 17.00 in the evening. No additional feeding was made to the pasture group.

Table 1. Ingredient and analysis nutrients of the concentared fed

Ingredients, %	Starter feed	Finisher feed
Wheat	20.00	36.00
Corn	34.58	39.00
Vegetable oil	3.50	2.00
Soybean meal	22.00	8.63
Sunflower meal	8.51	6.00
Cottonseed meal	8.00	5.00
Antioxidant	0.09	0.09
Di-calcium phosphate	1.50	1.50
DL-methionine	0.25	0.20
Limestone	0.55	0.55
L-lysine hydrochloride	0.09	0.10
L-tryptophan	0.08	0.08
Sodium bicarbonate	0.20	0.20
Salt	0.30	0.30
Vitamin-mineral mix*	0.35	0.35
Dry matter	90.10	89.76
Crude protein	21.32	15.35
Crude fat	4.51	3.46
Crude fiber	8.40	8.58
Ash	5.72	4.61
Calcium	0.70	0.65
Available Phosphorous	0.37	0.35
Sodium	0.24	0.25
Methionine+cysteine	0.88	0.71
Lysine	1.06	0.67
Threonine	0.75	0.50
Tryptophan	0.35	0.25
Linoleic acid	2.77	1.92
ME, kcal/kg**	2949.30	3034.18

*: Premix provided the following per kg of basal diet: Vit A 1000000 IU; Vit D3 200000 IU; Vit E 1.0 g; Fe 3.0; Mn 2.4 g; Cu 0.45 g; Co 0.015 g; Zn 4.5 g; I 0.06 g; Se 0.015 g; Ca 21.99 g. **: It was found by calculation. ME: Metabolizable energy

Table 2. Nutritient value of cracked barley

Nutrients	%
Dry matter	92.50
Crude protein	12.57
Crude fat	2.24
Crude fiber	5.00
Ash	1.95
Sugar	5.05
Starch	48.00
N-free substance	70.74
Calcium	0.07
Phosphorous	0.13
Methionine+cystine	0.47
Lysine	0.43
Tryptophan	0.15
Arginine	0.17
Threonine	0.36
ME, Kcal/kg*	2784.00

*: It was found by calculation. ME: Metabolizable energy

Table 3. Nutrient value of Pasture

Parameters%	d 1	d 30	d 65	Analysis Methods
Dry matter	19.05	27.7	25.04	1974 RG14987
Crude protein	13.70	13.00	13.44	TS 4717 ISO 5983
Crude fat	3.05	2.67	2.80	1974 RG14987

Statistical Analysis

The statistical analyses of the study data were performed using the IBM SPSS v. 23 software package. The General Linear Model (GLM) detailed below in statistical notation was used for body weight and daily weight gain of geese. According to this model; Yijk = μ + ai + bj + a * bij + eijk equation is created. Model;

Yijk: Yield value of any geese examined,

μ: Means of population,

ai: Fattening method (i: 1-4; Feed, Pasture + Cracked barley, Pasture + Feed, Pasture),

bj: Sex (j: 1-2; Male, Female)

a * bij: Interaction between fattening method*sex

eijk: It is the error term.

Duncan test was used to compare the examined significant factors (SPSS 23.0).

RESULTS

Body weight means and standard errors by fattening method and sex are presented in Table 4. The mean hatching weight were determined as 92.71 g and averages 16 wk of age weight was determined as 4132 g. The mean body weights in final body weights of feed, pasture + cracked barley, pasture + feed and pasture groups were found 4209, 4108, 4239 and 3971 g, respectively. It was

observed that the mean weight obtained in pasture + feed and feed groups at 14 and 16 wk of age were higher than pasture + cracked barley and pasture groups. There was no significant difference between fattening method x sex interactions (P>0.05) (Table 4).

The daily weight gain means and standard errors by fattening methods and sex are shown in Table 5. The highest average daily weight gain from the beginning of the study to the end was found 73.88 g in 5-6 wk, and the lowest average daily weight gain was found 8.57 g in 14-16 wk of age. There were statistically significant differences between the sex between 4-5, 5-6, 6-7, 8-9 and 9-10 wk of age in terms of daily weight gain averages (P<0.05-P<0.01). The highest daily weight gains in feed and pasture + feed groups were found 5-6 wk of age, in pasture + cracked barley group was found 3-4 wk of age, in pasture group was found 4-5 wk of age (Table 5).

Table 4. Body weight means and standard errors by fattening method and sex (g)

Traits	n	Hatching	1 wk	2 wk	3 wk	4 wk	5 wk	6 wk
Overall	111	92.71±0.61	269.94±1.91	559.11±4.62	957.38±10.45	1442±19.82	1947±24.36	2464±24.80
Fattening method								
Feed	28	93.88±1.23	265.36±3.80	541.68±9.19	956.61±20.78	1444±39.41	1936±48.42	2473±49.46
Pasture+cracked barley	27	92.70±1.25	264.54±3.88	551.51±9.37	942.53±21.18	1469±40.16	1976±49.34	2467±50.41
Pasture + feed	28	91.89±1.23	278.37±3.82	589.97±9.21	982.42±20.83	1439±39.50	1933±48.54	2457±49.59
Pasture	28	92.37±1.23	271.51±3.81	553.27±9.20	947.96±20.84	1417±39.51	1942±48.55	2459±49.60
Sex								
Male	53	93.37±0.90	274.15±2.77	572.73±6.68	986.32±15.11	1496±28.66	2025±35.21	2580±35.97
Female	58	92.05±0.85	265.74±2.65	545.49±6.39	928.44±14.45	1388±27.40	1869±33.60	2348±34.39
Fattening method							0.920	0.996
Sex							0.002	<0.001
Fattening method X Sex							0.976	0.857

Traits	n	7 wk	8 wk	9 wk	10 wk	12 wk	14 wk	16 wk
Overall	111	2870±23.36	3168±24.52	3408±26.20	3627±27.20	3855±27.94	4012±27.86	4132±27.23
Fattening method								
Feed	28	2904±46.44	3209±48.74	3458±52.08	3693±54.07	3903±55.55	4085±55.38[a]	4209±53.92[a]
Pasture+cracked barley	27	2846±47.32	3149±49.67	3354±53.08	3547±55.10	3771±56.61	3954±56.43[ab]	4108±55.16[ab]
Pasture + feed	28	2861±46.56	3165±48.88	3432±52.22	3663±54.21	3912±55.69	4105±55.52[a]	4239±54.26[a]
Pasture	28	2870±46.55	3151±48.87	3388±52.21	3606±54.20	3836±55.69	3903±55.51[b]	3971±54.27[b]
Sex								
Male	53	3016±33.77	3332±35.45	3591±37.88	3832±39.32	4089±40.40	4240±40.27	4371±39.36
Female	58	2724±32.29	3004±33.88	3225±36.21	3423±37.59	3622±38.62	3775±38.50	3893±37.63
Fattening method		0.840	0.806	0.518	0.252	0.256	0.028	0.003
Sex		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fattening method X Sex		0.256	0.101	0.233	0.109	0.198	0.394	0.533

a, b: Differences in in superscript letters within columns represent significant differences between groups (P<0.05).

In the 4-16 wk of age, daily weight gain (ADG, g), daily feed consumption (ADFD, g) and feed conversion ratio (FCR, %) of all geese in the study are presented in Table 6. The average ADG were determined as 39.81, 37.46 and 39.90 g, respectively; ADFD as 426.95, 207.99 and 200.76 g, respectively; FCR as 10.72, 5.55 and 5.03, respectively in feed, pasture + cracked barley, pasture + feed groups (Table 6).

Table 5. Daily weight gain means and standard errors by fattening method and sex (g)

Traits	n	0-1 wk	1-2 wk	2-3 wk	3-4 wk	4-5 wk	5-6 wk	6-7 wk
Overall	111	25.32±0.28	41.31±0.67	56.90±1.44	69.20±1.63	72.22±1.72	73.88±1.67	58.04±1.70
Fattening method								
Feed	28	24.50±0.59	39.47±1.33	59.28±2.86	69.59±3.25	70.36±3.42	76.73±3.31	61.60±3.38
Pasture+cracked barley	28	24.55±0.57	41.00±1.35	55.86±2.92	75.09±3.31	72.63±3.48	70.14±3.37	54.12±3.44
Pasture + feed	27	26.64±0.56	44.52±1.33	56.07±2.87	65.11±3.26	70.78±3.43	74.90±3.32	57.62±3.38
Pasture	28	25.59±0.56	40.26±1.32	56.38±2.87	67.02±2.25	75.12±3.42	73.75±3.32	58.81±3.39
Sex								
Male	53	25.82±0.40	42.66±0.96	59.09±2.08	72.76±2.36	75.70±2.48	79.24±2.41	62.39±2.46
Female	58	24.81±0.39	39.96±0.92	54.71±1.99	65.64±2.26	68.75±2.37	68.52±2.30	53.69±2.35
Fattening method						0.752	0.561	0.484
Sex						0.046	0.002	0.012
Fattening method X Sex						0.683	0.240	0.078

Traits	n	7-8 wk	8-9 wk	9-10 wk	10-12 wk	12-14 wk	14-16 wk
Overall	111	42.59±1.35	34.23±1.11	31.32±0.99	16.30±0.62	11.17±0.38	8.57±0.28
Fattening method							
Feed	28	43.55±2.69	35.55±2.21^{ab}	33.57±1.97	15.02±1.22	12.98±0.76^{a}	8.90±0.55^{b}
Pasture+cracked barley	28	43.26±2.74	29.35±2.25^{b}	27.60±2.01	15.94±1.25	13.11±0.77^{a}	10.97±0.56^{a}
Pasture + feed	27	43.46±2.61	38.11±2.20^{a}	33.00±1.98	17.78±1.23	13.83±0.76^{a}	9.59±0.55^{b}
Pasture	28	40.07±2.60	33.93±2.21^{ab}	31.10±1.99	16.46±1.22	4.77±0.75^{b}	4.84±0.55^{c}
Sex							
Male	53	45.14±1.96	36.96±1.60	34.39±1.43	18.36±0.89	11.39±0.55	8.76±0.40
Female	58	40.03±1.87	31.52±1.53	28.25±1.37	14.24±0.85	10.96±0.53	8.39±0.38
Fattening method		0.762	0.048	0.148	0.452	0.001	0.001
Sex		0.062	0.016	0.003	0.001	0.578	0.499
Fattening method X Sex		0.406	0.209	0.170	0.477	0.009	0.001

a,b,c: Differences in in superscript letters within columns represent significant differences between groups (P<0.05).

Table 6. ADG, ADFD and FCR by fattening methods (4-16 wk)

Wk	Feed			Pasture + Cracked Barley			Pasture + Feed		
	ADG	ADFD	FCR	ADG	ADFD	FCR	ADG	ADFD	FCR
4-5	70.36	374.49	5.32	72.63	163.00	2.24	70.78	124.42	1.76
5-6	76.73	461.73	6.02	70.14	196.47	2.80	74.90	147.46	1.97
6-7	61.60	421.29	6.84	54.12	200.02	3.70	57.62	183.27	3.18
7-8	43.55	446.85	10.26	43.26	216.40	5.00	43.46	200.51	4.61
8-9	35.55	476.48	13.40	29.35	229.53	7.82	38.11	196.01	5.14
9-10	33.57	459.81	13.70	27.60	237.73	8.61	33.00	218.58	6.62
10-12	15.02	425.67	28.34	15.94	202.44	12.70	17.78	262.30	14.75
12-14	12.98	368.86	28.42	13.11	208.63	15.91	13.83	226.66	16.39
14-16	8.90	407.36	45.77	10.97	217.71	19.85	9.59	247.61	25.82
4-16	39.81	426.95	10.72	37.46	207.99	5.55	39.90	200.76	5.03

ADG: daily weight gain (g), ADFD: daily feed consumption (g), FCR: feed conversion ratio (%)

DISCUSSION

In the study, the most appropriate fattening method was tried to be determined by giving pasture, pasture + cracked barley, pasture + feed and feed in geese cultivated by almost every family, and the possibilities of saving fattening period and labor. Also in this study, the effects of barley on the growth characteristics of the region as a traditional method of goose breeding were investigated.

The differences between body weight averages at 14 and 16 wk of age were statistically significant (P<0.05-P<0.01). The average hatching weight of geese is 92.71 g, the average hatching weight of male geese is 93.37 g and the

average hatching weight of female geese is 92.05 g. Male geese have a heavier body weight than female geese since the first weeks. Saatcı et al.[3] in a study on the effects of sex, color and fattening period on body weights of native Turkish geese; the results of this study are similar. Similarly, the results obtained in the study were similar to the values reported by Knizetova et al.[11] in Bohemian, Italian White and their hybrids. In the 4th wk of the study, the mean body weight of geese was similar to that reported by Ünal et al.[12] determined in geese fed with rations containing different protein levels, and Aksu and Kaya[13] determined in geese fed with 4 different rations with the same level of energy.

In the 8 wk of the study, the highest body weight was determined in the feed group, and the averages of the other 3 feed groups were quite close to each other. The difference between the body weight of male geese and female geese is gradually increasing. Average body weights were lower than similar studies.[14-16.] Again, in the 10 wk of the study, the highest body weight was determined only in geese fed to the shaft. This is followed by the feed + pasture group. Body weights of 10th wk of age male and female geese was similar to that reported by Tilki et al.[17], and was lower than that reported by Aksu and Kaya[13], Eroglu and Erisir[18.] This value was found to be higher than that detected by Tilki et al.[8], Şahin et al.[19] and Rayan et al.[20.]

In the 14 and 16 wk of the study, the highest body weight was determined in the feed and feed + pasture group and it was found statistically significant in the differences between the groups. The difference between the body weights of male geese and female geese has been further expanded. On the 16 wk of the study, the mean body weights were higher than that reported by Tumova and Uhlirova[21] for Czechoslovakian geese and Akbaş et al.[22] for Lindovskaya geese, but lower than that determined Kucharska-Gaca et al.[23] and Lin et al.[24] for White Koluda geese. This result was similar to that reported by Tilki et al.4, Boz and Sarica[25] for Native Turkish geese. Guy et al.[26] reported that body weights were 4784 and 5602 g in 119 days, 5993 and 6074 g in 168 days for geese fed with pasture and concentrate feed. The body weights of the geese in the pasture and concentrate feed fattening group are close to each other and this result is similar to with our study.

It was determined that the ADG continued to increase until the 6 wk and started to decrease after this week. When the ADG between the groups are evaluated, the best ADG was determineted in the group that only consumes feed in 5-6 wk of age. Secondly, it was determined geese in the pasture + feed group in all weeks. Similar results, Lui et al.[16] found the highest body weight increase in grinded and grain-fed geese between 29-49 days. Tilki et al.4 reported that the increase in ADG after 8th wk showed a decreasing tendency, but in this study, it was observed that ADG decreased in all groups starting from the 6th week.

The highest average ADFD in the fattening method was found to in 8-9th wk geese. The geese in the pasture + cracked barley and pasture + feed groups consumed 51.30% and 52.98% less feed than geese consuming only feed in general. In the 5-6 wk of the study, ADFD was made in a similar study by Arroyo et al.[27] was found close to the value determined fed with pellet feed on the 44 day. Average ADFD values in pasture + cracked barley and pasture + feed groups were found to be lower than that reported by Arroyo et al.27 the values that the geese fed with pellet feed determined in 53-55 days. These results were higher than that reported by Uhlirova et al.[28] for Czech and hybrid Novohdradska geese, Abou-Kassem et al.[29] for Egyptian geese and Mancinelli et al.[30] for Romagnola geese. In the present study, ADFD values determined for pasture + cracked barley, pasture + feed group were found to be similar to the values determined by Lui et al.16, Wang et al.[31]. These results are similar to those reported for dry feed and wet feed geese by Liu et al.32, for sorghum dried distillers grains with solubles geese by Wang et al.[31], who found that feed conversion ratio between 3.87-4.81 and feed intake between 193.0-239.3 g.

The best feed conversion ratio was determined in the pasture + feed and pasture + cracked barley group, which was higher in the feed group. In the study, the rate of FCR for pasture + cracked barley and pasture + feed group was similar to the values reported by Mancinelli et al.[30], Elminowska et al.[33], and lower than those reported by Arroyo et al.[34], Chen et al.[35]. In adition, FCR in all feed groups were found to be lower than the value determined by Wang et al.[36] for Sichuan white geese and Ölmez et al.[37] for native Turkish Geese. Aslan and Oztürk[38] stated that by using rouhghage isntead of some of the concentrated feed in geese diets, savings in feed costs can be achieved and geese can be produced more economically.

It is seen that there are some differences between the body weight, ADG increase and FCR values determined in the study and other study results. Factors such as breed, origin, age, care, fattening type and fattening period can be counted as the reason for these differences.

In Türkiye, goose breeding is generally made only on pasture. Large businesses are almost non-existent. In this form of breeding, feed and labor expenses are minimized and geese that can use the pasture well are fed in this way

until the slaughter season.

As a result, the average body weight of geese was found to be similar with some literature data, which is lower than some literature data. This may be due to the fact that the geese used in the study are native Turkish geese and no selection studies have been performed on them. Although the highest body weight increase was determined in the pasture + feed group, it was concluded that it would be more appropriate to make pasture feed since the geese fed economically in the pasture provide body weight increase similar to other groups. It was determined that feeding with only feed is not economical for goose breeding and does not provide much ADG compared to other groups.

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REFERENCES

1.Saatcı M, Tilki M, Sarı M, Şahan Yapıcıer Ö. Her Yönüyle Kaz Yetiştiriciliği. Antalya: Kutlu&Avcı Ofset Ltd. Şti.; 2021.
2.Tilki M, Saatcı M. Dünya'da ve Türkiye'de Kaz Yetiştiriciliği. *Türkiye Klinikleri J Reprod Artif Insemin-Special Topics*. 2016;2(1):27-34.
3.Saatcı M, Arslan C, Ünal Y, et. al. Effect of fattening length, sex and feather colour on growth and fattening performance in Native Turkish Geese. *Eurasian J Vet Sci*. 2011;27(3):183-189.
4.Tilki M, Gül B, Sarı M, Önk K, Işık S. Yetiştirici koşullarındaki yerli Türk kazlarının büyüme, kesim ve karkas özellikleri. *Atatürk Üniv Vet Bil Derg*. 2011;6(3):209-215.
5.Boz MA, Sarıca M, Yamak US. Production traits of artificially and naturally hatched geese in intensive and free-range systems: I. Growth traits. *Bri Poult Sci*. 2017;58(2):132-138.
6.Boğa Kuru B, Kırmızıbayrak T, Cengiz MM, Yazıcı K. The effect of gender on growth performance, live weight gain, growth pattern modeling and survival rate in Turkish native geese of the Kars region. *Turkish J Vet Res*, 2024; 8(1):19-28.
7.Saatcı M. Effects of age, sex, feather colour, body measurements, and body weight on down and feather yield in native Turkish geese. *Turk J Vet Anim Sci*. 2008;32(4):293-297.
8.Tilki M, Şahin T, Sarı M, et. al. Effect of age and sex on fattening performance and carcass characteristics of Native Turkish Geese. *Kafkas Üniv Vet Fak Derg*. 2009;15(2):245-250.
9.İnal Ş. Biyometri. Konya: Selçuk Üniversitesi Veteriner Fakültesi Yayın Ünitesi, 1998.
10.NRC. Nutritient reguirements of poultry. 9nd ed. Washington, DC: National Academy Press; 1994.
11.Knizetova H, Hyanek J, Veselsky A. Analysis of growth curves of fowl. III. Geese. *Bri Poult Sci*. 1994;35(3):335-344.
12.Ünal Y, Kaya İ, Saatcı M, et. al. Farklı protein düzeylerinde beslemenin kazlarda besi performansına etkisi. *Lalahan Hay Arast Enst Derg*. 2005;45(1):33-39.
13.Aksu Elmalı D, Kaya İ. Farklı düzeylerde enerji-protein içeren rasyonlarla beslemenin kazlarda besi performansı ve karkas özelliklerine etkisi. *Kafkas Üniv Vet Fak Derg*. 2008;14(2):123-128.
14.Tilki M, İnal Ş. Türkiye'de yetiştirilen değişik orjinli kazların verim özellikleri II. Büyüme özellikleri. *Turk J Vet Anim Sci.* 2004;28(1):157-163.
15.Fortin A, Grunder AA, Chambers JR, Hamilton RMG. Live

and carcass characteristics of four strains of male and female geese slaughtered at 173, 180, and 194 days of age. *Poult. Sci.* 1983;62(7):1217-1223.
16. Lui ZJ, Chu HH, Wu YC, Yang SK. Effect of two step time-restricted feeding on the fattening traits in geese. *Asian Australas J Anim Sci*. 2014;27(6):841-846.
17. Tilki M, Saatcı M, Kırmızıbayrak T, Aksoy AR. Effect of age on growth and carcass composition of Native Turkish Geese. *Arch Geflügelk*. 2005; 69 (2): 77-83.
18. Eroglu M, Erisir Z. The effects of breeder age and hatching period on fattening performance and carcass characteristics in geese. *Emir J Food Agric*. 2021;33(12):1028-1037.
19. Şahin T, Tilki M, Kaya İ, et. al. Effect of different protein levels for finishing period on fattening performance and carcass traits in Native Turkish Geese. *J Anim and Vet Adv*. 2008;7(11):1364-1369.
20. Rayan GN, Makram A, Hanafy A, et. al. Carcass traits of geese (*Anser anser*) as affected by age, gender and their interactions. *Indian J Anim Res*. 2022;56(11):1416-1421.
21. Tumova E, Uhlirova L. The evaloation of meat yield and physycal properties in the Czech goose and the commercial hybrid the Novohradska Goose. *Maso Int J Food Sci and Tech*. 2013;3(2):133-138.
22. Akbaş AA, Sarı M, Buğdaycı KE, Saatcı M. The effect of sex and slaughter age on growth, slaughter, and carcass characteristics in Lindovskaya geese reared under breeder conditions. *Turk J Vet Anim Sci*. 2020;44(5):1087-1092.
23. Kucharska-Gaca J, Adamski M, Biesek J. Effect of parent flock age on hatching, growth rate, and features of both sexes goose carcasses. *Poult Sci.* 2022; 101(8):101920.
24. Lin MJ, Chang SC, Lin LJ, et. al. Effect of the age and sex on growth performance and feather quality of 13 to 25-weeks-old White Roman geese. *Poult Sci.* 2023; 102: 102941.
25. Boz MA, Sarıca M. Growth Performance, Slaughter and Carcass Traits in White and Multicolour Native Geese. *IJAPOB*. 2021;2(1):17-22.
26. Guy G, Rousselot-Pailley D, Rozinski A, Rouvier R. Comparasion of meat geese performance fed with or without grass. *Arch Geflügelk*. 1996;60(5): 217-221.
27. Arroyo J, Auvergne A, Dubois JP, et. al. The influence of loose-mix feding on behavior, feed intake and body weight of growing geese. *Poult Sci*. 2013;92(6):1454-1460.
28. Uhlirova L, Tumova E, Chodova D. Fatty acid composition of goose meat depending on genotype and sex. *Asian-Australas J Anim Sci*. 2019;32(1):137-143.
29. Abou-Kassem DE, Ashour EA, Alagawany M, et. al. Effect of feed form and dietary protein level on growth performance and carcass characteristics of growing geese. *Poult Sci*. 2019;98(2):761-770.
30. Mancinelli AC, Mattioli S, Dal Bosco A, et. al. Rearing Romagnola geese in vineyard: pasture and antioxidant intake, performance, carcass and meat quality. *Italian J Anim Sci*. 2019;18(1):372-380.
31. Wang C, Huang Y, Zhao X, et. al. Nutritive value of sorghum dried distillers grains with solubles and its effect on performance in geese. *J Poult Sci*. 2018;55(1):54-59.
32. Liu ZL, Huang XF, Luo Y, et al. Effect of dry and wet feed on growth performance, carcass traits, and apparent nutrient digestibility in geese. *J Appl Poult Res*. 2019;28(4):1115-1120.
33. Elminowska-Wenda A, Rosinski A, Klosowska D, Guy G. Effect of feeding system (intensive vs. semi-intensive) on growth rate, microstructural characteristics of pecroralis muscle and carcass parameters of the white Italian geese. *Arch Geflügelk*. 1997;61(3):117-119.
34. Arroyo J, Auvergne A, Dubois JP, et. al. Influence of feeding sorghum on the growth, gizzard development and carcass traits of growing geese. *Animal*. 2012;6(10):1583-1589.
35. Chen X, Yang H, Wang Z**.** The effect of different dietary levels of defatted rice bran on growth performance, slaughter performance, serum biochemical parameters, and relative weights of the Viscera in geese. *Animals*. 2019;9(12):1040.
36. Wang C, Liu ZL, Xue JJ, Wang YM, et. al. Effect of stocking density on growth performance, feather quality, carcass traits, and muscle chemical component of geese from 49 to 70 days of age. *J Appl Poult Res.* 2019;28(4):1297-1304.
37. Ölmez M, Şahin T, Özlem et. al. Effect of probiotic mixture supplementation to drinking water on the growth performance, carcass parameters and serum biochemical parameters in native Turkish geese. *Kafkas Univ Vet Fak Derg*. 2022;28(1):131-138.
38. Aslan R, Öztürk E. Effects of maize silage feeding on growth performance, carcass characteristics, digestive system length, chemical composition, and meat quality of domestic geese. *Trop Anim Health Prod*. 2022;54(5):325