



## RESEARCH ARTICLE

### Effects of Different Rearing Systems on Growth and Fattening Performance of American Bronze Turkeys

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Received: 22. 03.2023, Accepted: 14.08.2023

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### Farklı yetiştirme sistemlerinin Amerikan Bronz hindilerinde büyüme ve besi performansına etkisi

Eurasian J Vet Sci, 2023, 39, 3, 114-123

DOI: 10.15312/EurasianJVetSci.2023.406

#### Öz

**Amaç:** Bu çalışma farklı yetiştirme koşullarında Amerikan bronz hindilerinin büyüme ve besi performanslarına etkisini araştırmak amacıyla yapılmıştır.

**Gereç ve Yöntem:** Çalışmada toplamda 123 hayvana ait veriler incelendi. Çıkım ağırlığı ölçülen palazlar ilk 10 hafta birlikte yetiştirildikten sonra deneme gruplarına ayrıldı. Birinci grup kesif yem ile ad-libitum beslenmiştir. Mera grupları yarı entansif ve ekstansif yetiştirme sistemidir. Yarı entansif grup, entansif grubun tüketmesi gereken kesif yemin %75 oranında kısıtlanmış beslemeye tabi tutuldu. Ekstansif yetiştirme sistemindeki hindi sürüsü ise entansif besleme grubundaki hindilerin tüketmesi gereken yemin %50 oranında kısıtlandırılmış oranında beslendiler. Mera grupları meradan 09:00-17:00 saatleri arasında faydalandı. Bu yetiştirme şartlarında 10-32 haftalık yaş döneminde yetiştirilerek iki haftada bir düzenli tartım ve ölçümler yapılarak, hindilere ait büyüme ve besi performansları incelendi.

**Bulgular:** Hindilerin 32 haftalık canlı ağırlıkları entansif, yarı entansif ve ekstansif sistemlerde sırasıyla dişilerde 4.60-4.70 ve 4.52 kg, erkeklerde 7.58-7.79 ve 6.71 kg olarak bulundu. Yetiştirme sisteminin etkisi erkeklerde 12-32. haftalarda anlamlı iken, dişilerde 14-28. haftalarda gruplar arasında fark ( $p<0.05$ ) tespit edildi.

**Öneri:** İncelenen tüm parametreler değerlendirildiğinde, Amerikan bronz hindilerin mera koşullarına elverişli bir ırk olduğu söylenebilir. Çalışma gruplarının canlı ağırlık artışı ve yemden yararlanma değerleri esas alındığında, bu ırk için kaliteli meralar sağlandığında 32 haftadan daha uzun sürede de büyümesini devam ettirebileceği görüldü.

**Anahtar kelimeler:** Amerikan bronz, besi performansı, büyüme, yetiştirme sistemi, hindi.

#### Abstract

**Aim:** This study was carried out to investigate the effect of different rearing conditions on the growth and fattening performance of American bronze turkeys

**Materials and Methods:** In the study, data from a total of 123 American bronze turkeys were analyzed. The hatchlings, whose hatching weight was measured, were reared together for the first 10 weeks, and then divided into the experimental groups. The intensive rearing system group (control group) was fed only with concentrated ad libitum. Pasture groups are semi-intensive and extensive rearing systems. The semi-intensive group was subjected to 75% restricted feeding of the concentrate that the intensive group should consume. The turkey flock in the extensive rearing system was fed 50% of the feed that the turkeys in the intensive rearing system group should consume. Pasture groups benefited from the pasture between 09:00-17:00. The growth and fattening performances of the turkeys were examined by regular weighing and measurements every two weeks as they were being reared in these growing conditions between the ages of 10-32 weeks.

**Results:** The 32-week live weights of turkeys were found to be 4.60-4.70 and 4.52 kg in females and 7.58-7.79 and 6.71 kg in males, in intensive, semi-intensive, and extensive systems, respectively. The effect of the rearing system was significant in males at 12-32 weeks, moreover, a difference was determined among groups in females at 14-28 weeks.

**Conclusion:** As a result of, American bronze turkeys can be suitable breed for pasture conditions. Based on the live weight gain and feed efficiency values of the study groups, this breed can continue to grow for longer than 32 weeks when quality pastures are provided.

**Keywords:** American bronze, fattening performance, growth, rearing system, turkey.

**CITE THIS ARTICLE:** Arslan and Cetin, 2023. Effects of Different Rearing Systems on Growth and Fattening Performance of American Bronze Turkeys Eurasian J Vet Sci, 39, 3, 114-123



## Introduction

Factors such as the rapid increase in the human population in recent years, as well as the worldwide COVID-19 pandemic and similar epidemics, have given rise to concerns about food supply and safety, especially in developing countries (Arslan et al 2020). Poultry meat production can be effective in reducing these concerns. Because, poultry have shorter generation intervals than other animal species (Mottet and Tempio 2017).

Considering its existence in the world and the usage areas of the meat obtained, it can be said that turkey is an important alternative to chicken (Arslan and Çetin 2022). The commercially grown turkeys are generally heavy turkeys, medium-heavy turkeys, and medium-weight turkeys. Males of this type of turkey can reach a live weight of 16.8-21 kg in 20 weeks, while females reach 9.3-11 kg at the same period (Murawska 2017). The production of turkey is advanced in terms of modernization and capacity in the poultry meat sector. However, feed costs, which are the most important expense, have a large impact on the development and sustainability of this sector (Arıkan et al 2022). Another problem affecting the profitability of the poultry businesses is the deformations that occur in chicken breasts and turkey meats due to the rapid growth of the animals (Nestor et al 1985, Petracchi and Cavani 2012). This problem is less common in turkeys, as they take longer to complete their growth than broilers. Turkeys can also reach higher live weights than chickens. This feature makes them an alternative poultry species that can contribute to meeting the animal protein deficit in humans in the future (Jahan et al 2018).

In the intensive system, where heavy turkey breeds are preferred, the live weights of male turkeys with controlled environmental conditions can exceed 24 kg in approximately 200 days (Anonymous 2022a). However, in recent years, alternative rearing systems have been discussed, and the most frequently thought of is the free-range system. Reasons for this include consumer demand and the search for different tastes and flavors, and that the animals could roam freely (Aisyah et al 2018). In this regard, it has been reported that birds exhibit more natural behavior and are less exposed to stress compared to indoor rearing systems (Castellini et al 2002, Stadig et al 2016).

The choice of breed for the free-range system is very important (Devatkal et al 2019). It has been reported that generally slow growing genotypes should be used in free-range rearing systems (Ozbek et al 2020). Genotypes with slow growth rate have a better ability to utilize pasture and a greater resistance to tough climatic conditions than commercial hybrids (Castellini et al 2006, Garip et al 2017). Heavy turkeys with white feathers were preferred than

bronze turkey. White turkeys can reach higher live weight and are more desirable for consumers. Bronze turkeys have also contributed to the development of other turkey breeds or lines with better fattening performance and feed efficiency (Arslan and Çetin 2022).

American bronze turkeys are one of the breeds most suitable for organic, ecological, and smallholder production because of good resistant to disease. They will continue to be useful for future production since provided high hatching rate by natural mating. Also, bronze turkeys have a better survival rate than other breeds. Depending on the care and feeding, bronze turkeys can reach slaughter maturity at around 28 weeks of age. Males have a live weight of 10-14 kg and females have a live weight of 5-8 kg. Since bronze turkeys are one of the medium-weight turkey breeds, various researchers (Ozer and Ozbey 2013, Arslan et al 2020, Miah et al 2020, Anonymous 2022b) have reported that they may be more suitable for semi-intensive rearing systems.

Free range breeding systems attract a lot of attention in the poultry industry for both consumers and farmer. This study was to perform the effect of different rearing systems on American Bronze turkeys' growth and fattening performance.

## Material and Methods

### Material

This study was conducted at the alternative poultry unit belongs to Prof. Dr. Hümeýra Özgén Research and Application Farm in Selcuk University. The grazing area provided to the turkeys was sheltered and fenced land. No additional fodder material was planted on the pasture; natural landform was used. Pasture compositions are given in Table 1.

### Animal material

The animal material in the study consisted of 123 turkey poults purchased from a private farm with the necessary vaccinations (Newcastle, TRT). Turkeys were regularly monitored during the experiment.

### Husbandry conditions

The temperature, light, humidity, and all biosecurity were checked the day before the poults brought to the rearing rooms. All poults were weighed on a 0.01 g digital scale and subsequently numbered using wing rings. During the experiment, plastic feeders and drinkers were used to meet the feed and water needs of the poults in the chick care and rearing rooms, which were 4x4 m in the alternative poultry unit.



Heater in the rearing room was adjusted into 36 °C on the first day. Then decreased by two degrees every week until the age of eight weeks, when the second feather change started. The heat was provided by electric heaters. Humidity conditions in the rearing room were regularly checked with a digital temperature and humidity measuring device. Poults were housed at eight and 10 weeks of age in open access, closed, and semi-open cages of 4x4 m, considering the weather, climatic, and other environmental conditions.

All animals were illuminated with 23 hours of light and one hour of darkness for the first eight weeks. While no additional lighting was applied to pasture groups (that is, the semi-intensive and extensive rearing system groups), lighting was provided to the intensive group with 23L:1D.

### Experimental design

The turkey poults reared together for the first 10 weeks were randomly selected according to their live weights using the zigzag method (Inal 2005). They were divided into three groups. In the control group, the animals were fed ad libitum with concentrate under intensive conditions; in the second experimental group, the animals were fed with

75% of the amount of commercial feed consumed by the first group + pasture under semi-intensive conditions; in the third experimental group animals were fed with 50% of the amount of the commercial feed consumed by the first group + pasture under extensive conditions and were grown until the age of 32 weeks. In this study, animals benefited from pasture from 10 weeks of age to 32 weeks of age. This practice continued from the beginning of spring to the middle of autumn as a season. Literatures were consulted to determine the amount of concentrate to be given to the groups (ad libitum, 75%, 50%) and to give 75% and 50% of the feed consumed by the control group (ad libitum) the following week (NRC 1994). Pasture groups benefited from the pasture between 09:00-17:00.

### Contents of feed

The feed used in the study was produced in a special feed factory by determining the energy and nutritional needs of the animals according to the NRC (1994). The purchased turkey feeds were packed in 50 kg bags and stored under appropriate storage conditions. During the experiment, the turkeys were fed with turkey starter feed in powder form at 0-4 weeks of age, granulated turkey grower feed at 5-8

Table 1. Nutrient content of the rations used in the experiment in dry matter

	Starter	Grower	Fattening-I	Fattening-II	Pasture composition
Crude Ash %	5.71	5.21	5.59	4.68	2.97
Crude Oil %	4.81	3.94	5.27	7.58	3.63
Crude Cellulose %	9.03	7.26	5.78	5.81	9.92
Crude Protein %	27.59	25.53	21.38	22.27	6.46
ME kcal/kg*	3004	3052	3127	3241	2920

\*: Calculated by the formula (Karabulut and Canbolat, 2005).

Table 2. Live weights of turkey poults (g) for 0-8 weeks of age (initial period) according to sex ( $\bar{x} \pm S\bar{x}$ )

Age (week)	Male n=64	Female n=59	Total n=123	p
Hatched	47.73±0.48	47.28±0.55	47.50±0.37	-
1	79.58±1.30	74.22±1.04	76.79±0.86	**
2	129.36±2.44	114.52±2.58	121.63±1.90	***
3	231.71±5.17	201.98±4.95	216.24±3.81	***
4	368.21±8.39	315.69±7.85	340.66±6.18	***
5	513.58±11.96	438.86±10.42	474.70±8.56	***
6	665.34±15.00	561.72±12.19	611.42±10.64	***
7	895.30±0.02	746.40±0.02	817.80±0.01	***
8	1135.80±0.02	928.00±0.02	1027.60±0.02	***

Differences between values with different letters on the same line are significant. (-: p>0.05, \*\*: p<0.01, \*\*\*: p<0.001)



Table 3. LWG, DFC, and FCR values of turkey poults in the initial period (0-8 week)

Age (week)	n	LWG (g)	DFC (g)	FCR
0-1	123	29.29	56.45	1.93
1-2	123	44.85	107.19	2.39
3-4	123	94.61	168.86	1.78
0-4	123	73.29	155.34	2.12
5-6	123	134.04	397.66	2.91
6-7	123	136.72	438.19	2.12
7-8	123	206.38	532.28	2.54
0-8	123	122.52	289.1	2.36

LWG: Live Weight Gain, DFC: Daily Feed Consumption, FCR: Feed Consumption Ratio.

Table 4. Fattening performances of turkeys in different rearing systems (LWG, DLWG, DFC, FCR)

Age/ week	Intensive				Semi-Intensive				Extensive			
	LWG (g)	DLWG (g)	DFC (g)	FCR	LWG (g)	DLWG (g)	DFC (g)	FCR	LWG (g)	DLWG (g)	DFC (g)	FCR
11-12	314.72	22.48	110.02	4.89	231.59	16.54	81.77	4.94	116.86	8.35	52.55	6.3
13-14	427.14	30.51	118.51	3.88	366.19	26.16	100.62	3.85	208.5	14.89	69.05	4.64
15-16	448.7	32.05	135.04	4.21	431.2	30.8	120.75	3.92	522.5	37.32	88.1	2.36
17-18	261.94	18.71	172.62	9.22	526.68	37.62	145.16	3.86	332.8	23.77	101.7	4.28
19-20	689.92	49.29	195.14	3.96	426.0	30.43	147.54	4.85	376.2	26.87	101.57	3.78
21-22	469.0	33.5	221.02	6.6	617.0	44.07	150.0	3.4	563.0	40.21	100.0	2.49
23-24	462.98	33.07	185.63	5.61	292.0	20.86	168.64	8.09	304.0	21.71	98.4	4.53
25-26	308.98	22.07	199.74	9.05	694.0	49.57	169.92	3.43	783.0	55.93	111.7	1.20
27-28	440.02	31.43	196.92	6.26	135.0	9.64	159.52	16.54	222.0	15.86	118.34	7.46
29-30	141.96	10.14	164.07	16.18 .0	463.0	33.07	173.08	5.23	545.0	38.93	114.94	2.95
31-32	868.0	62.0	221.8	3.58	501.0	35.79	189.58	5.3	389.0	27.78	111.52	4.01
10-32	439.46	31.39	174.59	6.68	429.79	30.41	146.05	5.76	396.62	28.33	97.08	4.0

LWG: Live Weight Gain, DLWG: Daily Live Weight Gain, DFC: Daily Feed Consumption, FCR: Feed Consumption Ratio.

weeks of age, pelletized turkey fattening feed (fattening-1) at 9-20 weeks and broiler feed (fattening-2) at 21-32 weeks until 32 week of age (Table 1). The feed consumed by the animals during the walk in the pasture is not included.

### Method

#### Data collection

The animals were weighed individually once every week during the first 10 weeks and then every two weeks from 10-32 weeks of age throughout the study. The growth results were obtained with the data obtained from this weighing. The remaining amount of feed given to the animals in the experiment was measured at each weighing time with a digital scale with a precision of 0.01 g. All the data obtained were regularly recorded in Microsoft Excel throughout the study.

Non-repetitive group feeding was applied in the experimental groups. For this reason, feed consumption and feed efficiency values are given only as average values.

Feed conversion ratios were calculated daily by dividing the average weekly feed consumption of turkeys by the average live weight gain in the same week.

#### Statistical analysis

The SPSS 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) software was used to analyze the data. In evaluating the data, the independent t-test was used to compare groups by sex, while analysis of variance (ANOVA) was performed to determine the effect of the rearing system alone. Time-dependent analyses of different ages, rearing systems and



sex group were evaluated with the General Linear Model for Repeated Measure.

## Results

The live weights of the male and female turkeys during the first eight weeks are given in Table 2.

In this study, no difference was found between the sex factor in terms of hatch weight, however the male poults had higher live weights than the females from one to eight weeks of age ( $p < 0.01$ ). Regardless of sex factor, the turkey poults reached about five times their hatch weight at three weeks of age, and about twenty times their hatch weight at eight weeks of age (Table 2).

The values calculated without including the effects of the sex and rearing system on the live weight gain (LWG), feed consumption (FC) and feed conversion ratios (FCR) of the turkey poults in the initial period (0-8 week) are given in Table 3.

As seen in Table 3, the amount of feed used increased as the birds aged. It was determined that the daily feed consumption (DFC) per animal in the initial period (0-4 weeks of age) was 155.34 g, while the FCR value was 2.12 (Table 3). Moreover, it was found that the DFC value per 0-8-week-old turkey poult was 289.10 g, while the FCR value was 2.36.

Table 5. Live weights of turkeys (kg) aged 10-18 weeks reared in different rearing conditions

Age (Week)	Rearing System	Male		Female	
		n	$\bar{x} \pm S\bar{x}$	n	$\bar{x} \pm S\bar{x}$
9-10	Intensive	17	1.43±0.05	16	1.10±0.05
	Semi-Intensive	19	1.44±0.03	27	1.19±0.02
	Extensive	23	1.39±0.05	21	1.20±0.05
	Total	59	1.42±0.02	64	1.17±0.02
	p		-		-
11-12	Intensive	17	1.79±0.06 <sup>a</sup>	16	1.39±0.06
	Semi-Intensive	19	1.71±0.04 <sup>a</sup>	27	1.41±0.03
	Extensive	23	1.50±0.05 <sup>b</sup>	21	1.29±0.05
	Total	59	1.65±0.03	64	1.36±0.03
	p		***		-
13-14	Intensive	17	2.26±0.08 <sup>a</sup>	16	1.76±0.06 <sup>a</sup>
	Semi-Intensive	19	2.13±0.05 <sup>a</sup>	27	1.74±0.03 <sup>a</sup>
	Extensive	23	1.70±0.05 <sup>b</sup>	21	1.49±0.06 <sup>b</sup>
	Total	59	2.00±0.05	64	1.66±0.03
	p		***		***
15-16	Intensive	17	2.78±0.10 <sup>a</sup>	16	2.12±0.07 <sup>a</sup>
	Semi-Intensive	19	2.60±0.05 <sup>a</sup>	27	2.13±0.04 <sup>a</sup>
	Extensive	23	2.23±0.07 <sup>b</sup>	21	1.94±0.07 <sup>b</sup>
	Total	59	2.51±0.05	64	2.07±0.03
	p		***		*
17-18	Intensive	17	3.25±0.13 <sup>a</sup>	16	2.47±0.07 <sup>a</sup>
	Semi-Intensive	19	3.15±0.06 <sup>a</sup>	27	2.58±0.04 <sup>a</sup>
	Extensive	23	2.64±0.08 <sup>b</sup>	21	2.24±0.07 <sup>b</sup>
	Total	59	2.98±0.06	64	2.44±0.04
	p		***		***

Differences between values with different letters in the same column are significant (-:  $p > 0.05$ , \*:  $p < 0.05$ , \*\*\*:  $p < 0.001$ ).





Table 6. Live weights of turkeys (kg) aged 19-32 weeks reared in different rearing conditions

Age (week)	Rearing System	Male		Female	
		n	$\bar{x} \pm S\bar{x}$	n	$\bar{x} \pm S\bar{x}$
19-20	Intensive	17	3.86±0.15 <sup>a</sup>	16	2.83±0.09 <sup>ab</sup>
	Semi-Intensive	19	3.72±0.07 <sup>a</sup>	27	3.00±0.05 <sup>a</sup>
	Extensive	23	3.11±0.08 <sup>b</sup>	21	2.62±0.08 <sup>b</sup>
	Total	59	3.52±0.07	64	2.84±0.05
	p		***		***
21-22	Intensive	17	4.48±0.19 <sup>a</sup>	16	3.25±0.11 <sup>b</sup>
	Semi-Intensive	19	4.49±0.09 <sup>a</sup>	27	3.57±0.07 <sup>a</sup>
	Extensive	23	3.68±0.10 <sup>b</sup>	21	3.09±0.09 <sup>b</sup>
	Total	59	4.17±0.09	64	3.33±0.06
	p		***		***
23-24	Intensive	17	5.12±0.22 <sup>a</sup>	16	3.56±0.09 <sup>ab</sup>
	Semi-Intensive	19	4.88±0.15 <sup>a</sup>	27	3.70±0.07 <sup>a</sup>
	Extensive	23	4.15±0.11 <sup>b</sup>	21	3.29±0.08 <sup>b</sup>
	Total	59	4.66±0.10	64	3.53±0.05
	p		***		***
25-26	Intensive	17	5.72±0.26 <sup>ab</sup>	16	3.81±0.08 <sup>b</sup>
	Semi-Intensive	19	5.99±0.22 <sup>a</sup>	27	4.25±0.08 <sup>a</sup>
	Extensive	23	5.21±0.14 <sup>b</sup>	21	3.95±0.10 <sup>ab</sup>
	Total	59	5.61±0.12	64	4.05±0.06
	p		*		***
27-28	Intensive	17	6.35±0.28 <sup>a</sup>	16	4.02±0.07 <sup>b</sup>
	Semi-Intensive	19	6.39±0.22 <sup>a</sup>	27	4.36±0.09 <sup>a</sup>
	Extensive	23	5.37±0.13 <sup>b</sup>	21	4.06±0.11 <sup>ab</sup>
	Total	57	5.99±0.14	64	4.18±0.06
	p		***		*
29-30	Intensive	17	6.63±0.31 <sup>ab</sup>	16	4.11±0.09
	Semi-Intensive	19	6.96±0.28 <sup>a</sup>	27	4.47±0.09
	Extensive	23	6.12±0.14 <sup>b</sup>	21	4.30±0.13
	Total	59	6.54±0.14	64	4.32±0.06
	p		*		-
31-32	Intensive	17	7.58±0.34 <sup>ab</sup>	16	4.60±0.11
	Semi-Intensive	19	7.79±0.33 <sup>a</sup>	27	4.70±0.11
	Extensive	23	6.71±0.19 <sup>b</sup>	21	4.52±0.13
	Total	59	7.31±0.17	64	4.61±0.07
	p		**		-

Differences between values with different letters in the same column are significant (-:p>0.05, \*:p<0.05, \*\*:p<0.01, \*\*\*:p<0.001).

The values for live weight gain (LWG), daily live weight gain (DLWG), DFC, and FCR of the turkeys at 10-32 weeks of age in the different rearing systems are given in Table 4.

Average live weight gain (LWG), daily live weight gain (DLWG), DFC, and FCR values were presented in Table 4. The LWG values of the intensive, semi-intensive and extensive system were determined as 439.46, 429.79, 396.62 g;

values 31.39, 30.41, 28.33 g; DFC values 174.59, 146.05, 97.8 g per animals, respectively. In addition of these, FCR values of the groups in the intensive, semi-intensive and extensive systems were found to be 6.68, 5.76, and 4.0, in the same line. The live weights of the turkeys reared in intensive, semi-intensive, and extensive rearing systems at the age of 10-32 weeks are given in Tables 5 and 6.





Male turkeys were found to have a higher live weight ( $p < 0.001$ ) than female turkeys for all age periods examined in all experimental groups (Tables 5 and 6). The live weights of American bronze turkeys at 16 and 32 weeks of age in the intensive rearing system were 2.12-4.60 kg in females and 2.78-7.58 kg in males. The live weights of female and male turkeys at the age of 32 weeks in the semi-intensive rearing system were 4.70 and 7.79 kg respectively. In the extensive rearing system, it was found that the females and males had a live weight of 4.52 and 6.71 kg, respectively for the same weekly age.

Table 7. The interactions between Live Weight (kg), Age, Rearing Systems, and Sex in turkeys

Age (Week)	Live Weight (Mean $\pm$ SE)
12	1.51 $\pm$ 0.02 <sup>f</sup>
16	2.30 $\pm$ 0.03 <sup>e</sup>
20	3.19 $\pm$ 0.04 <sup>d</sup>
24	4.12 $\pm$ 0.05 <sup>c</sup>
28	5.09 $\pm$ 0.07 <sup>b</sup>
32	5.97 $\pm$ 0.09 <sup>a</sup>
<b>Rearing System</b>	
Intensive	3.83 $\pm$ 0.08 <sup>a</sup>
Semi intensive	3.86 $\pm$ 0.07 <sup>a</sup>
Extensive	3.39 $\pm$ 0.07 <sup>b</sup>
<b>Sex</b>	
Male	4.31 $\pm$ 0.06 <sup>a</sup>
Female	3.09 $\pm$ 0.06 <sup>b</sup>
<b>Interactions</b>	
Age x Rearing System	*
Age x Sex	***
Rearing System x Sex	*
Age x Rearing System x Sex	-

Differences between values with different letters in the same column are significant (-:  $p > 0.05$ , \*:  $p < 0.05$ , \*\*:  $p < 0.01$ , \*\*\*:  $p < 0.001$ ).

The effect of the rearing system on live weight was no significant at 10 and 12 weeks for female turkeys and at 10 weeks for male turkeys (Table 5).

As seen in Table 6, the rearing system affected the live weights at 19-32 weeks in females, except for the 30th and 32nd weeks ( $p < 0.01$ ). In male turkeys, it was determined that the rearing system had an effect at all these age periods ( $p < 0.05$ ). In addition, those female turkeys take advantage of pasture from the 26th week to slaughter showed a performance close to the intensively reared turkeys ( $p < 0.05$ ).

The interactions between live weight, age, rearing systems, and sex in turkeys are presented in Table 7.

As table 7, American bronze turkey effected by age, rearing systems, and sex factor. Moreover, Age x Rearing system ( $p < 0.05$ ), Age x Sex ( $p < 0.001$ ), and Rearing system x Sex ( $p < 0.05$ ) interactions were found to significantly.

## Discussion

This study was to perform the effect of different rearing systems on American Bronze turkeys' growth and fattening performance. The growth of animals is a significant factor in poultry production for meat (Putra and Kırıkçı 2021). The most rapid development of muscle tissue in turkeys occurs during the initial period (Moore et al. 2005). The average live weights of turkeys for the beginning period are given in Table 2. It was determined that male and female turkeys with similar hatch weights had higher live weights in the first eight weeks of age ( $p < 0.05$ ). The values found in the present study for the beginning period of growth in turkeys are similar to the results of another research (Laudadio et al 2009, Rivera-Torres et al 2011, Mikulski et al 2012, Ozer and Ozbey 2013, Das et al 2018, Nwaodu et al 2018).

The LWG, DFC and FCR of the turkey poults in the initial period are presented in Table 3. In this study, the FCR in the first eight weeks of age was calculated as 2.36. This value is compatible with the values reported by Şengül et al (1999) in bronze turkeys. In commercial white turkeys, Laudadio et al (2009) found evidence of worse FCR between the ages of 31-44 and 45-58 days, varying between 2.06-2.38 and 2.16-2.26 respectively.

That the different results obtained in the study may be due to differences in flock management (Scanen et al 1984). In a mixed flock of male and female turkeys from different turkey genotypes, Damaziak et al 2012 reported feed intake as 1.46 kg and 1.15 kg and FCR as 1.37 and 2.09 in primitive and commercial turkeys, respectively. Safiyu et al (2019) found the DFC and FCR values at 6-12 weeks of age in domestic turkey breeds to be 3.55 and 3.76 in white and black feather-colored turkeys, while they were 3.63 and 3.68 in open-access rearing systems and closed-access rearing systems, respectively. In the present study, it can be said that the DFC and FCR values that are worse than others reported may have been due to genotype, age, or care-feeding differences. Fattening performances of turkeys in different rearing systems are given in Table 4.

In this study, the FCR values at the age of 10-32 weeks were calculated as 6.68, 5.76 and 4.0 in turkeys in the intensive, semi-intensive systems, and extensive system, respectively (Table 4). These values are worse than the values obtained by Mikulski et al (2012) from heavy whites aged 147 days and by Das et al (2018) from bronze turkeys, however better than the values reported by Karki (2005) for turkeys aged 0-28 weeks. While they were found to be consistent with the values reported by Sarıca et al (2009) for bronze turkeys reared in free-range systems, they were contrast with Bashir et al (2012) who found that intensive rearing is better than semi-intensive regarding FCR. In terms of DFC value, it is compatible with Karki's (2005) study, however the FCR value



was found to be lower than the FCR finding. This difference may be due to pasture productivity (Ozer and Ozbey 2013).

Laudadio et al (2009), reported the DLWG, FCR and DFC values of heavy whites at 4-16 weeks of age as 76-80 g, 3.77-4.26 and 222-245 g respectively. The fact that these values were not like the findings of the present study may be due to the difference in genotype (Miah et al 2020). Das et al (2018) reported the FC value under semi-intensive conditions in bronze turkeys as 24.29 g at 21 weeks of age. In this study, the DFC per animal was calculated as 44.07 g in turkeys aged 20-22 weeks reared in semi-intensive conditions. The difference between the two research findings in terms of DFC value may be due to pasture productivity and climatic conditions.

These differences may have arisen due to many factors such as genotype, age, pasture opportunities, ration content (Ozer and Ozbey 2013, Inci 2020, Miah et al 2020, Arslan et al 2022).

Inci (2020) has stated that pasture use improves feed efficiency ( $p < 0.05$ ). It was found to be 4.0 in this study. However, statistical significance could not be calculated at 10-32 weeks of age. In the group with 50% concentrate restriction, Sarica et al (2009) and Ozer and Ozbey (2013) support the view that rangeland-based rearing systems have the potential to be more economical.

Efforts to improve the genetic capacity of animals, developments in nutrition and advances in poultry flock management can lead to rapid growth rates and high feed efficiency in poultry production for meat yield (Duclos et al 2007). The live weights of the turkeys reared in different conditions at the age of 10-32 weeks are given in Tables 5 and 6. The live weight values of turkeys during the rearing and fattening period have been examined by many researchers (Arslan 1999, Karki 2005, Laudadio et al 2009, Mikulski et al 2012, Ozer and Ozbey 2013, Das et al 2018, Nwaodu et al 2018, Inci 2020). In the present study, the live weight values for the females and males at 16 weeks of age were determined as 2.07 kg and 2.51 kg, respectively ( $p < 0.001$ ), and the effect of the rearing system on live weight was found to be significant ( $p < 0.05$ ). The fact that the values obtained were lower than the values in bronze turkeys reported by Arslan (1999) and Ozer and Ozbey (2013) for the relevant weekly age may be associated with the difference in care and feeding (Miah et al. 2020). The live weight values in this study were found higher than those reported by Arslan (1999) and Ozer and Ozbey (2013). However, this is not compatible with the finding of Arslan (1999), who stated that the rearing system affects live weight. The 20th week live weight values stated in Table 3.2.1.4 were found to be higher than the value obtained by Das et al (2018). However, the live weights of the 20-week-old females and males were lower

than the value reported by Karki (2005), at 3.3 kg and 4.5 kg, respectively. This is compatible with males generally being heavier than females. This may be due to environmental and genetic factors (Arslan and Çetin 2022) or the difference in the abilities of the animals to use energy (Rivera-Torres et al 2011). In the present study, the live weights of 22-week-old turkeys in the intensive, semi-intensive and extensive systems were calculated as 4.48 kg, 4.49 kg and 3.68 kg in the males, and 3.25 kg, 3.57 kg, and 3.09 kg in the females respectively. When an overall assessment is made, the different results obtained in similar studies (Mikulski et al 2012, Inci 2020) may be due to differences in genotype, age, care and feeding, climate and pasture.

### Conclusion

Fully exploiting the genetic potential of turkeys, as in other species, will only be possible with proper care and feeding. In the future, examining the fattening performances of American bronzes by providing free roaming opportunities in the fields with enriched quality pastures from the age of 16 weeks may create a more economical production model for this breed. In extensive and semi-intensive rearing systems based on pastures, an ecological and economical rearing model can be developed that can benefit from insect species such as grasshoppers and plants, especially acorns, by reducing feed consumption compared to intensive rearing system. As a result, breeders can choose to turkeys to avoid a possible future nutrient deficiency crisis for humanity and to meet protein needs or to seek a different taste. It can be said that turkeys as an alternative poultry species to chicken.

### Acknowledgements

This article is derived from a part of the first author's doctoral thesis.

### Conflict of Interest

The authors did not report any conflict of interest or financial support.

### Funding

This study was supported by Selçuk University Scientific Research Projects Coordinatorship (Project number: 19102055).

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#### Author Contributions

Motivation/Concept: EA, OC; Study of Design: EA, OC; Control/Supervision: EA, OC; Data Collection: EA, OC; Statistical Analysis and Interpretation: EA, OC; Literature Review: EA, OC; Writing the Article: EA, OC; Critical Review: EA, OC.

#### Ethical Approval

Selçuk University Experimental Research and Application Center, Animal Experiments Ethics Committee 18.10.2019, 2019/84 Number Ethics Committee Decision.