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RESEARCH ARTICLE

The effects of breeder age and hatching period on fattening performance and carcass characteristics in geese

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ABSTRACT

This study was carried out to determine the effects of breeding age and hatching period on fattening performance and slaughter characteristics in geese. For this purpose, were fattened 270 geese were fattened which, obtained from three different ages of geese breeder (one, two,three years old) in two different period (April and June), and 54 of them were slaughtered at the age of 16 weeks to evaluate their carcass characteristics. The values of 81.06, 94.15, and 93.37 g for hatching weights, 5275.27, 5590.25, and 5604.90 g for body weights at the 16th week, 24.57, 25.53, and 25.75 kg for total feed consumption and 3592.00, 3814.98, and 3850.6 g for warm carcass weight were determined in the evaluation of carcass characteristics of geese from obtained one, two and three years old breeder geese, respectively. The results of the present study suggested that breeder age had statistically significant effects on hatching weight ($P<0.001$), body weight ($P<0.05$), total feed consumption ($P<0.01$), warm and cold carcass weights ($P<0.01$). The hatching weights of 92.81 and 86.24 g, total feed consumption values of 24.91 and 25.66 kg, feed conversion ratios of 4.57 and 4.80 were calculated in the first and second periods. The difference in the hatching period was detected to have statistically significant effects on hatching weights ($P<0.001$), feed consumption ($P<0.05$), feed conversion ratio ($P<0.01$), and abdominal fat weights ($P<0.001$). In addition, it was suggested that seasonal variations could create differences in themselves depending on the stages of the growth and development process.

Keywords: Breeder age; Carcass; Fattening performance; Gesse; Hatching.

INTRODUCTION

Geese, which belong to the family Anatidae and the genus Anser, are generally believed to be among the first animals to be domesticated. Their domestication took place in Egypt about 3000 years ago. Geese are known for providing delicious and high-calorie meat. The high energy value is because goose meat is quite fatty (Yakan et al., 2012). Goose meat, which has a high degree of nutrition, is an excellent source of protein for developing countries and is also a product consumed with pleasure for consumers in developed countries (Mozdziak, 2014).

There are two options in goose meat production in most countries. One is table goose production with slaughter age of 8 weeks and the other is meat goose production with slaughter after 16 weeks of age. Breast and leg are the most important products of both procedures. Therefore, determination of these products in whole carcass plays an important role in geese rearing. (Ziolecki 1980; Szabone Willin and Bögre 1992).

The main factors affecting the growth of geese are race, feeding, age, sex, hatching weight, feed consumption, and feed utilization, shelter conditions, and diseases (Onk, 2009). The body weight of adult geese varies between 5.0-6.5 kg on average, depending on genotype, nutrition, sex, age, care, and shelter conditions. Geese overgrow, up to 14 days after hatching; It is reported that geese and ducks complete 70-80% of their adult body weight at the age of 8-9 weeks, and this rate is 40% in chickens and turkeys. It has been reported that approximately 10% of the live weight is blood and featherweight, and the carcass is almost 70% of the live weight. (Shalev, 1995).

Breeder age could be also a contributing factor to post-hatch performance of poultry animals. Smaller yolk proportions

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of eggs from a young flock may be associated with low final body weight of their offspring (Ulmer-Franco et al., 2010). Hulet et al. (2007) reported that broilers from old breeders had higher body weight until 35 day compared with broilers from the young breeders. El Sabry et al. determined the feed consumption in young and old flocks of broilers as 3.42 and 3.70 kg, respectively. It is is associated with the correlation between higher body weight and feed consumption, which is the result of increased hatch weight with breeder age. Geese usually laying in between February and July (Eroglu et al., 2021) These months have different environmental conditions such as temperature, humidity and photoperiod. These differences create variance in growth and carcass performances, which affect productivity, especially in the production of table geese.

Tilki et al. (2005), found an average live weight of 733, 1437, 2305, 3332, 3917, 4148, 4256 and 4371 g for 2, 4, 6, 8, 10, 12, 14 and 16 week old male geese and 713, 1346, 1953, 3174, 3468, 3751, 3949 and 4071 g for female geese. Uhlířová et al. (2018), in a study by Eskildsen Schwer hybrid geese, the body weights of male and female geese at 16 weeks were 6550 and 5899 g, respectively, and the carcass yield was 72.1% and 71.8%.

In a study conducted to compare different feeding methods in Zatorska and Beyaz Kolda geese, Zatorska geese consumed 25.6 kg of feed while White Kolda geese consumed 26.6 kg of feed in 14 weeks. The feed conversion ratio was 6.0 and 5.4 in Zatorska and Beyaz Kolda geese (Elminowska-Wenda, 1997).

The present study was conducted to evaluate the effect of different breeder age and hatching period on growth performance and carcass characteristics in geese.

MATERIAL AND METHOD

Animal material

This study was carried out in a privately owned farm with Eskildsen Schwer hybrid breeder geese in Kovancılar district of Elâzığ. Ethics committee approval was obtained for this study with the decision 2018/115 of Fırat University Animal Experiments Local Ethics Committee. In April and June total of 270 Eskildsen Schwer goslings, which were obtained from one, two, and three year old breeders, were taken into the fattening after hatching. At the end of fattening, 54 goose carcasses were slaughtered to determine their characteristics (Graph 1).

Feed material

During the first 4 weeks, the starter feed containing 2900 ME, kcal/kg energy and 20.00% crude protein was used to feed the goslings. In the following weeks, grower feed containing 3000 ME, kcal/kg energy and 15.00% crude protein was given to all geese *ad libitum*. Details of the relevant rations are given in Table 1. Animals always had access to clean and fresh water via drinking nipples.

Fattening performance

Goslings obtained from different breeder aged geese in both hatching periods were weighed at hatching, and the average body weight of the groups were determined. Then, 45 goslings were divided into three subgroups for each breeder age group, representing the average hatching weight of without gender discrimination. All subgroups were fed in a closed shelter with straw-bed compartments, in 5 square meters in the first four weeks than in 15 square meters in the remaining period. The live weights and feed consumption of the geese were weighed and followed during 16 weeks; Live weight gain and feed consumption were determined. A scale sensitive to 1 g (CAS SW-II) was used for weighing.

Vitality and feed conversion ratio were calculated with the following formulas:

Table 1: Ingredients and nutrient composition of experimental diets (%)*

Ingredients %	Starter (0-4 weeks)	Grower (4-16 weeks)
Corn	59.07	60.67
Wheat	1.00	10.50
Wheat bran	3.00	5.00
Corn bran	1.50	4.00
Corn gluten, 43% hp	4.75	3.40
Soybean meal, 44% hp	27.35	12.50
Vegetable oil	0.75	1.21
Dicalcium phosphate	0.93	1.05
Limestone	0.84	0.72
L-lysine hydrochloride	0.06	0.25
Dl-methionine	0.10	0.10
Salt	0.30	0.25
Sodium bicarbonate	0.10	0.10
Vitamin-mineral mix**	0.25	0.25
Total	100	100
Nutritional composition %		
Dry matter, %	89.40	89.40
ME, kcal/kg	2900	3000
Crude protein, %	20.00	15.00
Crude cellulose, %	3.91	3.50
Ether extract, %	2.74	3.46
Crude ash, %	5.16	4.45
Calcium	0.65	0.60
Phosphorus	0.30	0.30
Sodium	0.18	0.17
Lysine	1.00	0.87”

* Calculated
**Vitamin A: 10000 IU, Vitamin D3: 4000 IU, Iron: 30 mg, Iodine: 1.5 mg, Cobalt: 0.5 mg, Copper: 5 mg, Manganese: 80 mg, Zinc: 80 mg, Selenium: 0.3 mg

Vitality = (Number of living goslings/Total number of goslings) x100,

Feed Conversion Rate = Total amount of feed consumed/ Total live weight gain.

Carcass characteristics

At end of the fattening periods, nine geese that were selected to reflect the average group weight without gender discrimination were slaughtered to determine carcass characteristics from each breeder age group. The geese were starved overnight and slaughtered early in the morning. The slaughter weights of the animals were determined just before slaughter. The decapitated geese were weighed again after their blood was shed and their blood weights were determined. Subsequently, geese whose feathers were removed by the wet method were weighed again, and their featherweights were determined. The abdomen of the geese was opened, the internal organs were removed and cleaned, and the gizzard, heart, liver, and intestine were weighed. Then, the hot carcass weights were determined. After the slaughtered geese had been stored at + 4°C for 24 hours, they were weighed again, and their cold carcass weights were determined. The carcasses were dissected according to the method outlined by Jones (1984). Carcass separated from the part where the neck enters the chest, the thighs are from art. coxae, the chest from facies art. sternocostal, wings from art. humeri, the rest was weighed together with the back.

The values related to the carcass characteristics were calculated using the following formulas.

Hot Carcass percentage = (Hot Carcass Weight/Slaughter weight) x 100,

Cold Carcass percentage = (Cold Carcass Weight/Slaughter weight) x 100,

Neck Ratio = (Neck Weight/Cold Carcass Weight) x 100,

Thigh Ratio = (Thigh Weight/Cold Carcass Weight) x 100,

Chest ratio = (Breast Weight/Cold Carcass Weight) x 100,

Back Ratio = (Back Weight/Cold Carcass Weight) x 100,

Abdominal Fat Ratio = (Abdominal Fat Weight/Cold Carcass Weight) x 100.

Head Ratio = (Head Weight/Slaughter weight) x 100,

Blood Ratio = (Blood Weight/Slaughter Weight) x 100,

Feather Ratio = (Feather Weight/Slaughter Weight) x 100,

Liver Ratio = (Liver Weight/Slaughter Weight) x 100,

Heart Rate = (Heart Weight/Slaughter weight) x 100,

Gizzard Ratio = (Gizzard Weight/Slaughter Weight) x 100,

Intestine Ratio = (Intestinal Weight/Slaughter weight) x 100

Statistical analysis

The research was planned as a factorial experimental design in randomized plots of 2 hatching periods (First and Second periods) x 3 ages (1, 2, and 3 years old breeder age geese). Analysis of variance was applied using the General Linear Model procedure to compare the groups in the relevant data. Tukey HSD test was used to post-hoc analysis. The SPSS 21 programme was used to analyze the data. It was taken into account that the difference between the groups was statistically significant when $P<0.05$.

RESULTS

Fattening performance

Body weights depending on different breeder ages and hatching periods are given in Table 2.

According to different breeder ages, the average hatching weight was figured out as 81.06, 94.15, and 93.37 g in geese with breeder ages 1, 2, and 3, respectively, and 5275.27, 5590.25, and 5604.90 g at the 16th week of fattening. According to different breeder ages, no significant statistical difference was observed in weights at 2nd-8th weeks ($P>0.05$). Hatching weight ($P<0.001$), and at 10th-16th weeks. ($P<0.05$), the differences between groups were found statistically significant.

In the groups examined by hatching period, the average hatching weight in the first and second periods was 92.81 and 86.24 g, respectively (Table 2).The average sixteenth-week bodyweight were determined as 5543.71 and 5436.57 g (Table 2). İstatistically, differences were not observed in the groups examined according to the hatching period at the 12 th-16th weeks ($P>0.05$). The differences in hatching and 2nd week ($P<0.001$), 4th -8th weeks ($P<0.01$), 10th week ($P<0.05$) were found statistically significant. The interaction between breeder age and hatching period was statistically significant in hatching weight ($P<0.001$); In the other weeks, there was no statistically significant difference in the interactions ($P>0.05$).

The geese total feed consumption amounts depending to breeder ages and the hatching period are given in Table 3. İn terms of breeder ages, the 12th week ($P<0.01$) and the 10th, 14th, and 16th weeks ($P<0.05$) were statistically significant;

Table 2: Body weights (in g), during the study

Groups	n	Hatching	2nd week	4th week	6th week	8th week	10th week	12th week	14th week	16th week
Breeder Age										
One	90	81.06[b]	734.85	2100.00	3214.52	3991.62	4493.52[b]	4850.82[b]	5114.94[b]	5275.27[b]
Two	90	94.15[a]	790.21	2250.75	3377.71	4170.47	4814.58[a]	5222.50[a]	5449.01[a]	5590.25[a]
Three	90	93.37[a]	789.22	2199.43	3354.79	4199.27	4821.75[a]	5185.74[a]	5456.80[a]	5604.90[a]
Hatching Period										
First (April)	135	92.81	818.30	2288.70	3450.99	4264.23	4819.78	5151.22	5397.90	5543.71
Second (June)	135	86.24	724.55	2078.08	3180.35	3976.68	4600.12	5021.49	5282.60	5436.57
Breeder Age x Hatching Period										
One x First	45	82.80	769.75	2210.73	3397.29	4119.88	4565.99	4890.23	5148.79	5307.57
One x Second	45	79.32	699.96	1989.26	3031.76	3863.37	4421.05	4811.42	5081.09	5242.98
Two x First	45	98.09	817.11	2340.66	3472.18	4271.19	4865.05	5225.46	5460.52	5610.79
Two x Second	45	90.21	763.31	2160.84	3283.24	4069.76	4764.11	5219.55	5437.50	5569.72
One x First	45	97.55	868.05	2314.72	3483.52	4401.64	5028.29	5337.98	5584.38	5712.78
Three x Second	45	89.18	710.39	2084.14	3226.06	3996.90	4615.21	5033.51	5329.21	5497.03
SEM*		0,1	9,34	25,62	35,33	40,74	46,92	47,22	47,77	47,65
P Value										
Breeder Age		<0.001	>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05	<0.05
Hatching Period		<0.001	<0.001	<0.01	<0.01	<0.01	<0.05	<0.05	>0.05	>0.05
Breeder Age x Hatching Period		<0.001	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

[a,b] :Differences in superscript letters within columns represent significant differences between groups.
SEM: Standard error of means

Table 3: Feed consumptions (in kg), during the study

Groups	n	2nd week	4th week	6th week	8th week	10th week	12th week	14th week	16th week
Breeder Age									
One	90	0.97	3.51	6.51	10.38	14.06[b]	17.55[b]	21.09[b]	24.57[b]
Two	90	1.01	3.69	6.80	10.83	14.71[a]	18.53[ab]	22.07[a]	25.53[a]
Three	90	1.06	3.64	6.86	10.76	14.76[a]	18.46[a]	22.10[a]	25.75[a]
Hatching Period									
First (April)	135	1.03	3.70	6.81	10.64	14.34	17.79	21.37	24.91
Second (June)	135	1.00	3.53	6.63	10.67	14.68	18.57	22.14	25.66
Breeder Age x Hatching Period									
One x First	45	0.96	3.65	6.69	10.45	14.00	17.30	20.86	24.33
One x Second	45	0.98	3.37	6.34	10.30	14.12	17.81	21.32	24.81
Two x First	45	1.02	3.80	6.91	10.88	14.65	18.13	21.50	24.90
Two x Second	45	1.0	3.58	6.69	10.77	14.78	18.94	22.64	26.16
One x First	45	1.12	3.66	6.85	10.59	14.38	17.96	21.74	25.51
Three x Second	45	1.01	3.63	6.88	10.94	15.14	18.96	22.47	26.00
SEM*		0,017	,029	,056	,075	,093	,115	,139	,175
P Value									
Breeder Age		>0.05	>0.05	>0.05	>0.05	<0.05	<0.01	<0.05	<0.05
Hatching Period		>0.05	<0.05	>0.05	>0.05	>0.05	<0.01	<0.05	<0.05
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

[a,b] :Differences in superscript letters within columns represent significant differences between groups.
SEM: Standard error of means

the differences in the other weeks were statistically insignificant (P>0.05).

As for total feed consumption in term of hatching period, differences were statistically significant at 12th weeks (P<0.01) and at 4th, 14th and 16th weeks (P<0.05); differences at other weeks were insignificant (P>0.05). There was no statistically significant difference in total feed consumption amounts for the interaction of hatching period and breeder age in all weeks (P>0.05).

Feed conversion rates by week for different breeder ages and hatching periods are given in Table 4. Depending on breeder age, feed conversion ratios were determined as 4.73, 4.65, and 4.67, respectively, in the 16-week total fattening period. It was found that the differences in feed

Table 4: Feed conversion ratio during the study

Groups	n	2nd week	4th week	6th week	8th week	10th week	12th week	14th week	16th week
Breeder Age									
One	90	1.49	1.74	2.08	2.66	3.19	3.68	4.19	4.73
Two	90	1.46	1.71	2.07	2.65	3.12	3.61	4.12	4.65
Three	90	1.54	1.74	2.11	2.63	3.13	3.63	4.13	4.67
Hatching Period									
First (April)	135	1.42	1.69	2.03	2.55	3.04	3.52	4.03	4.57
Second (June)	135	1.57	1.77	2.14	2.74	3.25	3.76	4.26	4.80
Breeder Age x Hatching Period									
One x First	45	1.39	1.71	2.02	2.59	3.13	3.60	4.12	4.66
One x Second	45	1.58	1.76	2.15	2.72	3.25	3.76	4.26	4.80
Two x First	45	1.42	1.69	2.04	2.60	3.07	3.53	4.01	4.51
Two x Second	45	1.51	1.73	2.09	2.71	3.17	3.69	4.23	4.78
One x First	45	1.45	1.65	2.02	2.46	2.91	3.42	3.96	4.54
Three x Second	45	1.62	1.82	2.19	2.80	3.35	3.83	4.28	4.81
SEM*		0,024	0,022	0,021	0,018	0,023	0,029	0,032	0,034
P Value									
Breeder Age		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Hatching Period		<0.01	>0.05	<0.05	<0.001	<0.001	<0.01	<0.01	<0.01
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	<0.05	>0.05	>0.05	>0.05

SEM: Standard error of means

Table 5: Viability rates (%) during the study

Groups	n	2nd week	4th week	6th week	8th week	10th week	12th week	14th week	16th week
Breeder Age									
One	90	98.88	98.88	98.88	98.88	98.88	98.88	98.88	98.88
Two	90	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77
Three	90	100.00	98.88	98.88	98.88	98.88	98.88	98.88	98.88
Hatching Period									
First (April)	135	99.25	98.51	98.51	98.51	98.51	98.51	98.51	98.51
Second (June)	135	98.51	98.51	98.51	98.51	98.51	98.51	98.51	98.51
Breeder Age x Hatching Period									
One x First	45	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
One x Second	45	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77
Two x First	45	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77
Two x Second	45	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77
One x First	45	100.00	97.77	97.77	97.77	97.77	97.77	97.77	97.77
Three x Second	45	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
SEM*		0,64	0,74	0,74	0,74	0,74	0,74	0,74	0,74
P Value									
Breeder Age		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

SEM: Standard error of means

conversion rates for breeder age in all weeks of the study were not statistically significant (P>0.05).

According to the hatching period, the cumulative feed conversion ratio (0-16 weeks) in the first and second periods was determined as 4.57 and 4.80, respectively. The differences in feed conversion rates at 8th and 10th weeks (P<0.001) and 2nd, 12 th -16th weeks (P<0.01) at 6th week (P<0.05) were statistically significant. The differences in other weeks were statistically insignificant (P>0.05). For the feed conversion ratio, there was a statistically significant difference in the interactions between breeder age and hatching period only for the 8th week (P<0.05), and no statistically significant difference was found in the other weeks (P>0.05).

Values of viability by weeks for breeder age and hatching period are given in Table 5. Viability is 98.88% in geese with breeder ages 1 and 3; in the first and second hatching

periods, it was determined as 98.51%. Statistically, there was no statistical difference in any week and total of the 16-week fattening period, neither in terms of breeder age nor in terms of hatching period and hatching period interaction (P>0.05).

Carcass characteristics

The values of slaughter and carcass characteristics of geese according to breeder age and hatching period are presented in Table 6a and 6b. Slaughter weights of geese with 1, 2, and 3 breeder ages were 5276.27, 5588.38, and 5606.38 g, respectively; hot carcass weights 3592.01, 3814.98, and 3850.64 g; cold carcass weights were determined as 3551.90, 3772.93, and 3809.54 g. The statistically significant difference between slaughter, hot carcass weight, cold carcass weight, featherweight, wing and back weights (P<0.01), intestinal weight (P<0.05); There was no statistically significant difference in terms of head

Table 6a: Carcass characteristics and relative weights (in g) in the study

Groups	n	Slaughter weight	Head	Blood	Feather	Liver	Heart	Gizzard	Intestinal
Breeder Age									
One	18	5276.27[b]	215.30	258.55	236.19	115.69	34.52	150.27	348.44
Two	18	5588.38[a]	224.00	268.13	259.19	119.75	34.16	163.91	371.38
Three	18	5606.38[a]	225.75	266.33	259.77	109.94	33.50	164.00	371.74
Hatching Period									
First (April)	27	5545.29	226.44	272.87	250.98	112.68	34.72	155.64	362.13
Second (June)	27	5435.40	216.92	255.81	252.46	117.57	33.40	163.14	365.57
Breeder Age x Hatching Period									
One x First	9	5309.78	221.89	265.50	238.11	117.94	36.33	147.60	350.24
One x Second	9	5242.78	208.72	251.61	234.28	113.44	32.72	152.89	346.64
Two x First	9	5609.22	227.89	275.83	256.56	116,01	33.55	153.11	367.66
Two x Second	9	5567.56	220.11	260.44	261.83	123.50	34.77	174.72	375.11
One x First	9	5716.88	229.55	277.27	258.27	104.11	34.27	166.16	368.50
Three x Second	9	5495.88	221.94	255.38	261.27	115.77	32.72	161.83	374.98
SEM*		41,18	2,10	3,54	2,86	2,97	0,47	2,59	3,63
P Value									
Breeder Age		<0.01	>0.05	>0.05	<0.01	>0.05	>0.05	>0.05	<0.05
Hatching Period		>0.05	<0.05	<0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

[a, b]: Differences in superscript letters within columns represent significant differences between groups.
SEM: Standard error of means

Table 6b: Carcass characteristics and relative weights (in g) in the study

Groups	n	Hot carcass	Cold carcass	Neck	Thigh	Breast	Wings	Back	Abdominal fat
Breeder Age									
One	18	3592.00[b]	3551.90[b]	331.57	751.62	1040.92	548.16[b]	728.47[b]	149.34
Two	18	3814.98[a]	3772.93[a]	348.85	806.82	1104.28	582.87[ab]	774.27[ab]	155.82
Three	18	3850.64[a]	3809.54[a]	350.82	794.38	1095.27	605.13[a]	807.9[a]	155.96
Hatching Period									
First (April)	27	3806.22	3766.23	341.97	793.55	1107.93	595.12	791.00	135.44
Second (June)	27	3698.85	3656.68	345.52	775.00	1052.38	562.32	749.46	171.97
Breeder Age x Hatching Period									
One x First	9	3635.6	3594.7	327.67	762.51	1051.07	566.1	754.46	129.29
One x Second	9	3548.41	3509.11	335.48	740.74	1030.77	530.23	702.49	169.40
Two x First	9	3836.41	3798.28	348.14	796.72	1124.84	595.43	793.71	139.43
Two x Second	9	3793.55	3747.59	349.58	816.93	1083.72	570.32	754.82	172.21
One x First	9	3946.68	3905.72	350.11	821.43	1147.87	623.84	824.83	137.61
Three x Second	9	3754.60	3713.37	351.53	767.34	1042.66	586.43	807.95	174.31
SEM*		30,91	30,78	3,80	9,64	11,36	7,05	8,78	3,15
P Value									
Breeder Age		<0.01	<0.01	>0.05	>0.05	>0.05	<0.01	<0.01	>0.05
Hatching Period		>0.05	>0.05	>0.05	>0.05	<0.05	<0.05	<0.05	<0.001
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

[a, b]: Differences in superscript letters within columns represent significant differences between groups.
SEM: Standard error of means

weight, blood weight, heart weight, liver weight, chest and abdominal fat weight (P>0.05).

In the hatching period, slaughter weight averages were 5545.29 and 5435.40 g, respectively, in the first and second periods; hot carcass weight averages were 3806.22 and 3698.85 g; cold carcass weight averages were determined as 3766.23 and 3656.68 g. Differences in abdominal fat (P<0.001), head, blood, chest, wing, and back weights (P<0.05) between the groups were found statistically significant. There was no statistical difference for slaughter, hot carcass, cold carcass, feather, heart, liver, gizzard, intestinal, neck, and thigh weights (P>0.05).

Percentage values of slaughter and carcass characteristics are given in Table 7a and 7b. Hot carcass percentage of

Table 7a: Carcass characteristics percentages and relative ratios (%) in the study

Groups	n	Head	Blood	Feathers	Liver	Heart	Gizzard	Intestinal
Breeder Age								
One	18	4.08	4.89	4.47	2.18	0.65[b]	2.85	6.60
Two	18	4.01	4.79	4.64	2.14	0.61[ab]	2.94	6.65
Three	18	4.02	4.74	4.63	1.96	0.59[a]	2.92	6.63
Hatching Period								
First (April)	27	4.09	4.91	4.52	2.03	0.62	2.81	6.53
Second (June)	27	3.99	4.70	4.64	2.16	0.61	3.00	6.72
Breeder Age x Hatching Period								
One x First	9	4.18	4.99	4.48	2.22	0.69	2.79	6.59
One x Second	9	3.98	4.80	4.47	2.16	0.62	2.92	6.61
Two x First	9	4.07	4.92	4.58	2.07	0.60	2.74	6.56
Two x Second	9	3.96	4.67	4.71	2.22	0.63	3.14	6.75
One x First	9	4.01	4.84	4.51	1.81	0.59	2.91	6.44
Three x Second	9	4.03	4.64	4.75	2.10	0.59	2.93	6.82
SEM*		0,032	0,043	0,041	0,050	0,008	0,047	0,051
P Value								
Breeder Age		>0.05	>0.05	>0.05	>0.05	<0.05	>0.05	>0.05
Hatching Period		>0.05	<0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

[a, b]: Differences in superscript letters within columns represent significant differences between groups.
SEM: Standard error of means

Table 7b: Carcass characteristics percentages and relative ratios (%) in the study

Groups	n	Hot Carcass percentage	Cold carcass percentage	Neck	Thigh	Breast	Wings	Back	Abdominal fat
Breeder Age									
One	18	68.08	67.32	9.34	21.15	29.30	15.42	20.51	4.19
Two	18	68.23	67.47	9.26	21.36	29.24	15.42	20.56	4.13
Three	18	68.67	67.94	9.21	20.83	28.75	15.87	21.21	4.10
Hatching Period									
First (April)	27	68.62	67.89	9.09	21.04	29.39	15.79	21.04	3.59
Second (June)	27	68.03	67.26	9.45	21.19	28.80	15.36	20.48	4.70
Breeder Age x Hatching Period									
One x First	9	68.48	67.71	9.13	21.18	29.13	15.75	21.01	3.59
One x Second	9	67.68	66.93	9.56	21.12	29.38	15.11	20.02	4.81
Two x First	9	68.34	67.66	9.20	20.94	29.97	15.65	20.95	3.66
Two x Second	9	68.12	67.29	9.33	21.79	28.52	15.20	20.16	4.60
One x First	9	69.03	68.31	8.95	20.99	29.38	15.97	21.16	3.52
Three x Second	9	68.31	67.56	9.47	20.67	28.12	15.77	21.27	4.69
SEM*		0,159	0,156	0,087	0,153	0,190	0,115	0,211	0,074
P Value									
Breeder Age		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05
Hatching Period		>0.05	>0.05	<0.05	>0.05	>0.05	>0.05	>0.05	<0.001
Breeder Age x Hatching Period		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

SEM: Standard error of means

geese with breeder ages 1, 2, and 3 were 68.08%, 68.23%, and 68.67%; cold carcass percentage were determined as 67.32%, 67.47%, and 67.94%. In comparison, the heart ratio in terms of breeder age was statistically significant ($P<0.05$), no statistically significant difference was found in terms of carcass ratio of other parts ($P>0.05$).

In relation to the hatching period, warm carcass percentage were 68.62% and 68.03% in the first and second periods, respectively; cold carcass yields percentage determined as 67.89% and 67.26%. Statistically significant differences were found in blood and neck ($P<0.05$) and abdominal fat ratios ($P<0.001$). Differences between groups to slaughter weight, hot and cold carcass percentages, head, feather, liver, intestinal, wing, breast, and back ratios were statistically insignificant ($P>0.05$).

No statistically significant difference was observed in the interaction between breeder age and the hatching period ($P>0.05$).

DISCUSSION

Fattening performance

It has been reported that the growth rate is higher in the first weeks of the poultry animals. Parallel to this, the rate of growth of geese is rapid in the first few weeks of this study (Peebles et al., 1999; Buzala and Janicki, 2016). The higher average body weight gain in the early weeks of this study is related to this reason. Alsobayel et al. (2013) reported that older breeders obtained chick with higher hatch weight from hatching eggs. Petek et al. (2003) and Nazlıgül et al. (2005) reported that chicks with a high hatching weight reached a higher body weight during their adult period. Hatching weight is the cause for the differences between the groups in terms of breeder age. Additionally, it is assumed that both, hatching weight and seasonal temperature alterations are the reason for the difference between the groups for the hatching period (May and Lott, 2001). Heat stress is thought to reduce protein synthesis by disrupting intestinal structure and increase protein solubility by disrupting mitochondrial function in muscles in the harmful effects of high temperatures on body weight gain (Santos et al, 2015; Zuo et al., 2015; Huang et al., 2015).

In the study, the cumulative feed consumption (25.73 kg) of geese obtained from breeder ages three was higher than the feed consumption (24.57 and 25.53 kg) of geese obtained from breeder ages one and two, and these differences were statistically significant. ($P<0.05$). These findings can be explained by the increasing hatcher weight with the age of the breeder and the high correlation between feed consumption and body weight reported by Scott (2005). In the studies carried out, Biesek et al. (2020), 27.38 and 27.62 kg, and Sisman (2016) determined the feed consumption of domestic Turkish geese as 40.33 kg. The feed consumption values in the study are lower than in these two studies.

Depending on the hatching period, it was found that the total feed consumption amounts were higher in the 1st period for the first 7-week fattening period, and the cumulative feed consumption was higher in the 2nd period. This change is thought to be due to the temperature differences in the relevant periods and the stress caused by this coinciding with different growth stages. This situation was similar to Oliveira et al. (2006) finding on the adverse effects of high ambient temperature on feed consumption in their study on the effects of temperature and relative humidity on the yield performance of broilers.

According to the age of the breeder, the feed conversion ratios in the first 8-weeks period were 2.66, 2.65, and 2.63, respectively; For the 16-week fattening period, cumulatively, it was determined as 4.73, 4.65, and 4.67, respectively. Elminowska-Wenda (1997), the 16-week feed conversion rate in white Italian geese 5.21 and 5.5 in male and female geese; Boz (2015), determined the 16-week feed conversion rate in domestic geese to be 4.68 and 4.60 in intensive and free systems, respectively. According to the hatching period, the feed conversion rate between weeks was 2.55 and 2.74 for the first and second periods in the first eight weeks, respectively; For the total fattening period of 16 weeks, it was determined as 4.57 and 4.80. Donkoh (1989) and Suk

Graph 1. Various pictures from the experiment.

et al. (1995) stated that temperature changes below or above the ideal temperature negatively affect feed conversion rates.

It was observed that all of the deaths during the study occurred within the first four weeks, with a maximum in the second week. The viability of the geese with breeder ages one and two (98.88%) was higher than that of breeder age two (97.77%). It was figured out that it was the same with 98.52% in the first and second hatching periods and the differences were not statistically significant. It is thought that most of the organs and physiological systems of most of the goslings are not fully functional in the first weeks of their lives and that many factors such as environment and care during this period negatively affect the living conditions of the goslings and increase their mortality in the first weeks (Yerpes et al., 2020).

Carcass characteristics

In the study, slaughter weights of one, two, and three geese of breeder age were 54276.27, 5588.38, and 5606.39 g, respectively; the hatching time was found to be 5545.29 g in the first period and 5435.40 g in the second period. In parallel with the live weight, the fact that the live weights of the geese obtained from older breeder are higher than those obtained from young breeder may affect this situation. Uhlílová et al. (2018), in a study on Eskildsen Schwer and Czech breed geese, found the slaughter weight of geese at 16 weeks age as 6550 and 5899 g for Eskildsen Schwer hybrid males and females, respectively, and 5349 and 4119 g for Czech males and females. Boz (2015) determined the slaughter weights as 5280 and 4404 g, respectively, in a study on geese obtained by artificial and natural hatching.

Differences between hot and cold carcass weights were statistically significant ($P<0.01$) for breeder age but statistically insignificant for the hatching period. The differences between hot and cold carcass yields were statistically insignificant for both breeder age and hatching period. These results are similar to the effects of live weight on carcass reported by Narinç et al (2015). Furthermore, the differences between breeder age groups are consistent with the results of Onbaşılar et al. (2008). Uhlílová et al. (2018) determined cold carcass weights of male and female Eskildsen heavy geese of 4410 and 3955 g; cold carcass yield was determined as 72.1% and 71.8%, respectively. Boz (2015) calculated the cold carcass weight of geese obtained from artificial hatching as 3441 g, the cold carcass weight of geese obtained from natural hatching as 2799 g; their yields were found 65.16% and 63.56%, respectively.

Abdominal fat weight was higher in the second period (171.77 g), which this difference among the hatching periods was statistically significant ($P<0.001$). It can be assumed that the high abdominal fat in geese in the second hatching period may be shaped by the increase in feed consumption as the seasonal temperature begins to decrease in last weeks. Biesek et al. (2020), determined the abdominal fat weight as 205.55 and 223.88 g, the rate of 4.73% and 5.13%. Boz (2015) found the abdominal fat weight to be 281.19 g at the 16th week and 8.91%. It is seen that the abdominal fat weights and ratios obtained in this study are lower than the values found by Biesek (2020) and Boz (2015).

The study identified the highest hot and cold carcass, head, feather, gizzard, intestinal, neck, wing, dorsal, and abdominal fat weights in geese with breeder age three; It was determined that the highest blood, liver, heart, leg, and breast weights were from the geese with the breeder age of two. Depending on the hatching period, the highest hot and cold carcass, blood, heart, head, thigh, wing, breast, and back weights are in the first hatched geese; It was determined that the highest feather, liver, intestinal, gizzard, and thigh weights were in the geese obtained in the second hatching period. In general, in both cases, it is seen that the organ and carcass parts of the groups with higher body weight are heavier. It is assumed that this is due to the reflection of the live weight on the carcass and organs. It is assumed that this effect is related to breeder age as the live weights of the offspring obtained from older breeders are higher than those obtained from young breeders. It is thought that the differences in the findings of this study and other researchers regarding the carcass and its parts are due to factors such as race, age, season, care, and feeding.

CONCLUSIONS

According to the findings obtained from the research, the breeder age affects the hatching weight. As a result, it was found that slaughter and carcass characteristics were higher in geese obtained from old breeders. It has been observed that seasonal conditions and hatching weight may cause differences in feed consumption and conversion rates. Also it is considered that it is important to increase studies on breeding and different genotypes about the disadvantages of goose species, such as low thigh and breast ratios, which are desirable meat sources in carcasses.

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Authors' contributions

Mehmet EROGLU: Research hypothesis, methodology and experimental procedures, data collection and analysis, result interpretation, manuscript writing.

Zeki ERISIR: Research hypothesis, methodology and experimental procedures, data collection and analysis, result interpretation.

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