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RESEARCH ARTICLE

Growth and some period yield characteristics of Denizli x Leghorn crosses (F_2)

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Özet

Garip M, Nizamlıoğlu M, Kurar E, Yılmaz A, Çağlayan T, Dere S, Bulut Z, Özşensoy Y, Kurtoğlu V. Denizli x Leghorn melezi (F_2) tavuklarda büyüme ve bazı dönem verim özellikleri. **Eurasian J Vet Sci, 2011, 27, 3, 177-182**

Amaç: Bu araştırmada, Denizli x Leghorn F_1 ve F_2 populasyonlarının çıkım ağırlığı, büyüme ve verim dönemine ait canlı ağırlıkları, yumurta ağırlığı ve özgül ağırlıklarının belirlenmesi amaçlamıştır.

Gereç ve Yöntem: Temel populasyonda 10 Denizli horozu ve 30 Leghorn tavuk kullanılmıştır. İlk generasyonda (F_1), 15 erkek, 68 dişi elde edilmiştir. İkinci generasyonda (F_2) ise 475 erkek ve 451 dişi üzerinde 32. haftaya kadar canlı ağırlık ve yumurta verimleri incelenmiştir.

Bulgular: F_2 populasyonunda dişiler yumurtaya girdikten sonra 180 günlük dönemde, yumurta sayıları ve yüzdeleri 99.61 adet ve %56.21 olarak bulundu. Çıkım ağırlıkları F_1 ve F_2 populasyonlarında sırası ile 40.94 ve 30.80 g olarak bulundu. Büyüme döneminde her iki generasyonda canlı ağırlıklar arasında önemli farklılıklar tespit edildi ($p<0.001$). Ayrıca ikinci generasyonda 32. hafta sonunda canlı ağırlıklar dişilerde 1814.60 g, erkeklerde ise 1900.00 g olarak ölçüldü ($p<0.001$). Aynı generasyonda yumurta ağırlığı ve özgül ağırlık değeri 47.81 g ve 1.08 olarak hesaplandı.

Öneri: Yerli gen kaynağımız olan Denizli ırkının melezleme çalışmalarında kullanılabileceği, geliştirilmiş yumurtacı ve etçi ırklarla melezlemelerin ve bu verim yönleri bakımından Denizli ırkının daha detaylı çalışmalarla incelenmesine ihtiyaç olduğu sonucuna varıldı.

Abstract

Garip M, Nizamlioglu M, Kurar E, Yilmaz A, Caglayan T, Dere S, Bulut Z, Ozsensoy Y, Kurtoglu V. Growth and some period yield characteristics of Denizli x Leghorn crosses (F_2). **Eurasian J Vet Sci, 2011, 27, 3, 177-182**

Aim: This study was carried out to determine some production characteristics of F_1 and F_2 Denizli x Leghorn populations including hatching weight, growth performance, live weights of the growing period, egg gravity and egg weight.

Material and Methods: Ten Denizli roosters and 30 Leghorn hens were used for generation of the base population. In the first generation (F_1), 15 males and 68 females were produced. A total of 475 males and 451 females were produced in the second generation (F_2), and whose production data were evaluated based on the 32 weeks of periods.

Results: In F_2 population, numbers and percentages of egg yield were found to be 99.61 and 56.21% in the first 180-day period. Hatching weights were determined as 40.94 and 30.80 g in F_1 and F_2 generations, respectively. Significant differences were observed in weights of F_1 and F_2 animals at the growing period ($p<0.001$). In addition, the second generation live weights were measured as 1814.60 g in females and in 1900.00 g in males at the end of 32nd week ($p<0.001$). Egg weight and specific gravity values were calculated as 47.81 g and 1.08 respectively in the F_2 population.

Conclusion: It was concluded that Denizli breed, a native genetic resource, seems to be suitable and candidate chicken breed for future hybridization studies. Furthermore, there is need for further detailed studies to evaluate Denizli crosses with layer or broiler breeds for this production characteristic.

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Keywords: Denizli, Leghorn, cross, growth, egg.

► Introduction

The rapid development of the poultry industry was initiated by the efforts of poultry farmers. In the course of time, developments achieved in the field of genetics contributed greatly to the advancements in the poultry industry. Through increased trade volume and globalization, both live animals and processed animal products have become purchasable and saleable commodities. High product quality and the application of new nutritional techniques have created a permanent consumer demand for poultry and poultry products. Scientific research and various investigations have demonstrated that, owing to its nutritional value, poultry meat is an important alternative source that would contribute to closing the current deficit in animal protein. As from the mid-twentieth century, developments in this field have occurred very rapidly. Poultry breeding has become an independent sector and standard poultry breeds have been replaced by highly productive commercial hybrids raised for their meat or eggs. The production of autosex chicks and the possibility of performing sexing in day-old chicks have made it possible for hatcheries to trade female chicks to commercial egg holdings. Significant developments achieved in hatching techniques have led to the establishment of large-scale breeder holdings and organizations. Major steps forward in feeding, genetics, vaccination and disease control have enabled significant increase in the variety and production volume of poultry products. Broiler chickens have been developed, which not only reach a carcass weight of 1.5-1.9 kg within approximately 40 days with a feed conversion rate of 1.6-1.8, but also have a high survival rate. The mean egg yield of commercial laying hens has drawn closer to a level of 280 eggs/72 weeks, and new production techniques have enabled egg production to be distributed throughout the entire year. The age of onset of laying, survival rate, egg weight and egg shell quality have been improved and it has become possible to produce 8-10 eggs with approximately 1 kg of feed. Furthermore, progress achieved in the field of veterinary services as well as the use of vaccines and veterinary medicinal products developed for the prevention and treatment of diseases have contributed greatly to the improvement of production quality. Efficient marketing strategies have served for the continuous supply of wholesome, hygienic, fresh and safe processed products on the market, and thereby, for the satisfaction of the demands of the consumer (Anonymous 2004a, Anonymous 2004b, Anonymous 2008).

In the present study, the hatching weights, body weights in the growth and production periods, and the egg weights and egg specific gravity measurements of the first and second generations were determined in an experimentally established hybrid population.

► Materials and Methods

The present study was conducted at the Poultry Unit of the Research and Practice Farm of Selcuk University, Faculty of Veterinary Medicine. Study protocol was approved by Ethic Committee of Veterinary Faculty, Selcuk University. With an aim to establish the breeder F_0 flock, from which the material of the study was produced, 10 Denizli roosters were obtained from the Denizli Provincial Agriculture Directorate and 30 Leghorn parent breeder chickens were obtained from the Poultry Research Institute in Ankara. Following a period of adaptation feeding, the animals were placed in 10 breeding cages, which measured 1x1x1 m and were made of fence wire, such that one male was accompanied by 3 females. In order to determine the particular animal to which the fertilized eggs belonged to, the animals were identified with wing numbers, and the cages in which they were housed were marked with both wing and family numbers. All of the female animals were housed in the breeding cages in the company of the roosters for a period of 10 days, and were later transferred to individual laying cages, which measured 30x45x50 cm. Each of the females was housed alternately, every 3 days, for 1 day with their breeding partner rooster, which remained in the breeding cage throughout the trial. The fertilized eggs were marked with the cage, chicken and rooster numbers and the date they were laid, using lead pencils. The eggs were recorded into a register with the same numbers, in the same order, and were stored for a period of 1 week in egg storage cabinets adjusted to room temperature (22 ^{0}C) and 75% relative humidity. After fumigation, the eggs were placed in setters and incubated at 37.7 ^{0}C and 65% relative humidity. At the end of the 18th day, the eggs and papers including corresponding records were placed individually into gauze bags. Subsequently, the eggs were transferred to the hatching machine, which was adjusted to a temperature of 37.2 ^{0}C and relative humidity of 70%. The hatched chicks were identified with wing numbers also indicating the numbers of their parents. Next, the chicks were transferred to a brooder, where they were kept for a period of 3 weeks. In the brooder, the chicks were first given 2.5% sugared water, and later, after a fasting period of 3-4 hours, they were provided with feed. The animals were vaccinated against Marek, Gumboro and Newcastle diseases, as foreseen in a standard poultry farm vaccination schedule. Of the 230 chicks (F_1) obtained from the 10 families established, the members of 5 families, including an adequate number of males and females, were used as breeders to establish the F_2 flock. The F_2 flock was established using 15 male and 68 female breeders. An adequate number of female and male animals were kept in reserve at the holding throughout the trial period. As the number of females differed among the families, the F1 females were placed into breeding cages, such that each rooster was accompanied by a minimum of 3 and a maximum of 6 females.

Similar to the F_0 flock, the males were maintained in the breeding cages throughout the trial, and the females, after transferred to the laying cages, were alternately housed, every 3 days, with their breeding partner rooster for a period of 1 day. During this period, the automatic lighting regime was adjusted such that the animals were exposed to 16 h of light and 8 h of dark. Similar to the procedure applied to the parent generation, the females were kept in numbered individual cages, and their fertilized eggs were collected. After a week storage, the eggs were placed into the hatching machine in accordance with the same experimental protocol, later transferred to the brooder and then numbered and weighed using an assay balance sensitive to 0.01 g. The eggs were kept in the brooder for 3 weeks. After weighed and vaccinated, the animals were raised on the floor for a period of 16 weeks. The wing numbers of the animals that died within this period were recorded. The animals were weighed at an interval of 3 weeks during the growth period (at weeks 3, 6, 9 and 12) and at an interval of 4 weeks during the laying period. During the growth period, the animals were exposed to 12 h of light daily, in total, including daylight. The beginning of the production period was determined as the age at which the animals reached 5% of the total egg production. Starting from the beginning of the production period, the duration of the daily light period was automatically increased 1 h each week until the end of the production period, such that the final light-dark cycle was 16 h of light and 8 h of dark. The amount of feed given to the groups and the amount of leftover feed of each group were weighed to determine the feed conversion rates. During the laying period, the chickens were housed in apartment-type cages and were provided with drinking water and feed by automatic drinkers and feeders. Litter was removed by means of automatic bands running under each cage. Ventilation was ensured by automatic fans adjusted to the environmental temperature. The pullets, which were transferred to the cages as from the 16th week, were continued to be weighed on a monthly basis. The egg production data of laying pullets were recorded until the 32nd week. At certain intervals, egg samples were taken and their shape indices and specific gravity measurements were determined. Blood samples were collected from each generation for biochemical and genetic analyses, such that each animal was sampled only once throughout its life span. Tissue samples were taken from animals that died during the growth period and were sent to the laboratory for examination. To achieve the objectives of the study, 475 males and 451 females were raised under the F_2 generation. Statistical analyses were performed using the chi-square test, after calculated data were assessed by the *t-test* and percentile values were corrected by arc-sin transformation. Analyses were performed using the SPSS 16.0.0 (2007) software package.

► Results

• *Hatching weights*

The hatching weights of the F_1 and F_2 chicks were determined as 40.94 and 30.80 g, respectively.

Table 1. The hatching weights of the F_1 and F_2 generations.

	Generation	N	Mean	±	SE	P
Hatching weights	F_1	230	40.94a	±	0.23	***
	F_2	441	30.80b	±	0.19	

***: p<0.001

• *Body weights during the growth and production periods*

Animals included in the F_1 and F_2 populations were weighed at an interval of 3 weeks during the growth period (at weeks 3, 6, 9 and 12) and at an interval of 4 weeks during the development and laying periods (at weeks 16, 20, 24, 28 and 32). The body weights of the F_1 and F_2 generations at the 3rd and 28th weeks were determined as 83.91 g and 2132.62 g; 125.46 and 1856.17 g, respectively.

Table 2. Body weight alterations in the two gender groups of the generations.

Weeks	Gender	n	Mean	±	SE	P
0	Male	211	30.67	±	0.27	-
	Female	230	30.92	±	0.27	
3	Male	209	127.05	±	0.60	***
	Female	226	124.00	±	0.55	
6	Male	205	319.65	±	1.53	**
	Female	225	313.92	±	1.29	
9	Male	205	617.29	±	3.01	***
	Female	224	596.88	±	3.07	
12	Male	205	889.06	±	7.06	***
	Female	222	842.68	±	6.92	
16	Male	205	1215.71	±	6.34	-
	Female	220	1199.85	±	5.76	
20	Male	204	1483.98	±	6.80	***
	Female	217	1393.02	±	6.04	
24	Male	203	1623.77	±	5.57	***
	Female	215	1523.16	±	6.22	
28	Male	203	1751.64	±	6.46	***
	Female	214	1671.71	±	6.31	
32	Male	201	1900.00	±	5.74	***
	Female	212	1814.60	±	6.58	

-:p>0.05, **:p<0.05,***:p<0.05

Table 3. Body weight alterations in generations.

Weeks	Groups	N	Mean	±	SE	P
3	F_1	227	83.91b	±	0.75	***
	F_2	435	125.46a	±	0.41	
6	F_1	223	293.11b	±	0.99	***
	F_2	430	316.65a	±	1.00	
9	F_1	221	579.58b	±	1.72	***
	F_2	429	606.63a	±	2.21	
12	F_1	218	964.14a	±	2.38	***
	F_2	427	864.95b	±	5.06	
16	F_1	213	1225.43a	±	3.25	**
	F_2	425	1207.50b	±	4.28	
20	F_1	210	1396.60b	±	4.15	***
	F_2	421	1437.09a	±	5.04	
24	F_1	207	1448.23b	±	4.65	***
	F_2	418	1572.02a	±	4.86	
28	F_1	205	1860.26a	±	5.85	***
	F_2	417	1710.62b	±	4.91	
32	F_1	203	2132.62a	±	11.1	***
	F_2	413	1856.17b	±	4.86	

The body weights of the males and females of the F_2 population starting from hatching to the 32nd week are given in Table 3. While males and females did not differ for hatching weight, it was determined that, starting from the 3rd week and until the end of the trial at the 32nd week, males were heavier than females. On 16th week, although males were weighed heavier than females, the two sexes did not statistically differ from each other ($p>0.05$).

The egg yields of the chickens, which were placed into individual cages during the laying period, were recorded daily at the same time of the day and were calculated in number and percentage. The egg production of the females of the F_2 population, throughout the 6-month-period after entering the laying period, was determined as 99.61 eggs and 56.21%.

Table 4. Egg yields of the F_2 population according to the father groups (0-180 days).

Father groups	n	Mean	±	SE	Egg yields %	P
A	16	96.13	±	9.67	51.68	
B	14	107.21	±	9.25	59.83	
C	18	99.67	±	8.26	55.98	-
D	104	97.52	±	3.73	55.52	
E	31	104.97	±	7.04	59.36	
Average	183	99.61	±	2.78	56.21	

-: ($p>0.05$)

The females of the F_2 generation, which were the progeny of different roosters, did not differ from each other for egg yields between 0-6 months: ($p>0.05$).

Table 5. Egg yields of the F_2 population according to the mother groups (0-180 days).

Mother Groups	n	Mean	±	SE	Egg yields %	P
1	8	89.25	±	12.20	47.98	
2	8	103.00	±	15.45	55.38	
3	7	100.86	±	15.32	57.11	
4	7	113.57	±	11.07	62.56	
5	4	102.50	±	16.36	55.11	
6	14	98.86	±	9.84	56.23	
7	3	45.67	±	22.53	30.86	
8	61	97.05	±	4.60	55.34	
9	40	102.13	±	6.19	57.64	
10	5	104.60	±	14.96	63.01	
11	26	105.04	±	8.01	58.65	
Average	183	99.61	±	2.78	56.21	

The females of the F_2 generation, which were the progeny of different hens, did not differ from each other either for egg yields between 0-6 months (Table 5).

- *Egg weight and egg specific gravity measurements*

In the present study, at least 5 egg samples with 4 replicates were taken on consecutive days from each hen in the F_2 population at the 4 different phases of egg production (at weeks 24, 28 and 32), and were weighed on an assay balance. The mean egg weight and egg specific gravity were calculated as 47.81 g and 1.08, respectively (Table 6). The egg weights and egg specific gravity measurements determined in the different phases did not statistically differ from each other ($p<0.05$).

Table 6. Egg specific gravity measurements of the F_2 population determined in different phases of the laying period.

Period	n	Egg Weight		SE	Specific Gravity		SE	P
1	23	48.89	±	0.84	1.08	±	0.00	
2	22	47.29	±	0.61	1.11	±	0.03	
3	32	46.89	±	0.77	1.08	±	0.00	-
4	28	48.40	±	0.68	1.08	±	0.00	
Grand Average	105	47.81	±	0.38	1.08	±	0.01	

-: ($p>0.05$)

► Discussion

- *Chick hatching weights*

The hatching weights of the F_1 and F_2 chicks were determined as 40.94 and 30.80 g, respectively. It has been previously reported that the hatching weights of the Denizli and Gerze breeds were 41.97 and 37.21 g, respectively (Özdoğan et al 2007), and that the hatching weights of Leghorns and White Leghorns were 36.2 g and 39.2 g, respectively (İslam et al 2002).

Hatching weight is affected by several factors, including egg weight, parent weight, season and genotype. It was ascertained that, while the hatching weights of the F_1 population were similar to the values given in previous literature reports, the hatching weights of the F_2 population were lower than the values indicated in previous reports, and this difference was attributed to in-flock breeding, parent weight and phase of laying period.

- *Body weights at different ages*

The body weights of the F_1 and F_2 generations at the 3rd and 32nd weeks were determined as 83.91 and 2132.62 g; 125.46 and 1856.17 g, respectively. In a study conducted in 2006 at the Poultry Research Institute in Ankara, from which the breeder material of the present study was obtained, the body weights of white hybrids at weeks 3, 6, 8, 12 and 16 were determined as 121-130, 311-343, 461-468, 772-778 and 1033-1081 g, respectively. Their sexual maturation age was ascertained as 145.9-148.8 days. The body weight at the sexual maturation age was determined as 1342.8-1391.8 g (Mızrak et al 2007). The Poultry Research Institute in Ankara (Anonym, 2001) reported the body weights of the GH (ATE-K) and GY (ATE-K) lines, raised at the Institute, at the 20th week as 1865- 1870 g and 1860-1865 g, respectively. Bozkurt et al (2001) reported the body weight of laying hens at the 20th week as 1812 g. Furthermore, the body weights of the ATAK, ATAK-S and ATABEY lines at the 8th and 20th weeks have been reported as 550 and 1750 g; 570 and 1800 g; and 490 and 1535 g, respectively (Anonymous 2005). Body weights of the commercial white layer hybrids at the 18th and 20th weeks were determined as 1160 and 1310 g, respectively (Erensayın 1991). On the other hand, the body weights of Lohman laying hens at the 18th and 20th weeks have been indicated as 1264 and 1386 g, respectively (Anonymous 2010).

It is considered that the differences observed between the body weights measured in the present study and the values reported in previously conducted studies may have arisen from differences in genotype, breeding system, age, hybridization, management and feeding.

- *Egg production in the F_2 generation*

In the present study, the daily egg production throughout the 180-day trial period was determined as 99.61 in number (per chicken/day) and 56.21% in percentage. Bozkurt et al (2001) have reported the egg yield of laying hens at the 43rd week as 80%. The egg yields, in number and percentage, of the ATAK, ATAK-S and ATABEY lines at the 30th week were determined as 48.00 and 95%; 51.36 and 96%; 50.00 and 96.71%, respectively (Anonymous 2005). The data obtained in the present study display difference from literature data as they do not correspond with each other in respect to the period and age at which the measurements were performed. The quantitative traits of the hybrids resulting from the crossing of the low-productive Denizli breed and the Leghorn breed are presented in Tables 5 and 6.

- *Egg weight and egg specific gravity measurements*

In the present study, 5 egg samples were taken from each hen of the F_2 population on consecutive days in 3 different phases of the production period (at weeks 24, 28 and 32) and were weighed on an assay balance to determine egg weights. The mean egg weight and egg specific gravity measurements were determined as 47.81 g and 1.08, respectively. The egg weights of laying hens at the 32nd and 35th weeks have been reported as 62.61 and 62.30 g, respectively (İnal et al 1999, Elibol et al 2000). Furthermore, the egg weights of the GH (ATE-K) and GY (ATE-K) lines, raised at the Poultry Research Institute in Ankara, at the 20th week have been stated as 62-63 g and 60-61 g, respectively (Anonymous 2001). İnal et al (2000), in a study conducted in laying hens, has calculated the egg specific gravity at the 32nd week as 1.089. On the other hand, Erkuş and Akbay (2004) have reported the egg weights and egg specific gravity measurements of the BR1 line at the 40th and 50th weeks as 59.69 g and 60.57 g; 1.08 and 1.06, respectively. Şekeroğlu and Sarıca (2005) have reported that the egg weights of white and brown laying hens were 59.24 g and 63.20 g, respectively; whereas their egg specific gravity measurements were 1.099 and 1.088, respectively. Narushin et al (2002) have reported the egg weight and egg specific gravity measurement of White Leghorns as 55.8 g and 1.105, respectively. The differences observed between the data obtained in the present study and the results reported in previously conducted studies may have arisen from several factors, including breed, age, period and hybridization.

► Conclusions

In conclusion, based on the data obtained from the first and second generation hybrids in the present study, it was observed that variations existed for body weight and egg yields. The present study, which is considered to constitute a reference for future research on hybridization with local breeds, has demonstrated body weight and egg yield parameters. Based on the decrease observed in the body weights of the second generation, in comparison to the first, it is suggested that the Denizli breed could be used as the father line in breeding programmes of organic poultry farms established with local gene resources. Furthermore, it is considered that this assumption should be studied in more detail in specific studies on the investigation of quantitative traits of poultry.

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