Genetic study for some body weight and egg traits in Domyati and Khaki-Campbell ducks.

Amira soliman EL-Deghadi (✉ amira872002@gmail.com)

Animal Production Research Institute, Agriculture Research Center, Dokki, Cairo, Egypt

<https://orcid.org/0000-0002-8736-8451>

Wael Ali Ali

Anmi. Prod. Res. Inst., Agric. Res. Center, Dokki, Giza, Egypt

Mahmoud Gharib Gharib

Anim. Prod. REs. Inst., Agric. Res. Center, Dokki, Egypt

Research Article

Keywords: Mean, heritability, genetic correlations, phenotypic correlations, sire breeding value

Posted Date: January 27th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1258413/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Genetic study for some body weight and egg traits in Domyati and Khaki-Campbell ducks.
Amira Soliman El-Deghadi; Wael Ali Hassan Ali and Mahmoud Gharib Gharib¹.

¹ Animal Production Research Institute, Agriculture Research Center, Dokki, Cairo, Egypt (APRI).
(A.S., amira872002@gmail.com), (M.G., mghreeb95@yahoo.com)

Corresponding author's Email: amira872002@gmail.com; ORCID: 0000-0002-8736-8451

ABSTRACT

The duck industry makes an important contribution to the availability of animal protein sources in Egypt, however little known about the genetic factors, particularly the heritability and genetic correlations of body weight and egg production in ducks. Body weight is the most essential feature for genetic improvement due to its ease of selection, high heredity, and large impact on meat production costs. The target of this study was to evaluate and explain genetic traits such as the heritability, the genetic and phenotypic correlations, and sire breeding value in Domyati (local) and Khaki-Campbell (foreign) ducks in order to improve body weight and egg traits. A total of 160 (80 Domyati and 80 Khaki-Campbell ducks utilized to measure body weight (at 16 and 20 weeks g), as well as 7000 eggs (2500 Domyati and 4500 Khaki-Campbell) to measure egg traits (the egg number, egg weight, and egg mass are all measured throughout the first 90 days of laying). In Domyati and Khaki-Campbell ducks, the heritability estimated for body weight was moderate to high, ranged from 0.35 to 0.40, and 0.21 to 0.30 for egg production, and the genetic correlations among body weight and egg traits were all positive and had high values, and among BW16 and BW20 were stronger than between other traits (0.90); (99). The genetic improvement in BW16 could be followed by an increase in BW20 weeks.

Key Words: Mean; heritability; genetic correlations; phenotypic correlations; sire breeding value.

INTRODUCTION

However, little is known about the genetic factors that influence body weight, weight, and egg mass in ducks, including heritability and genetic correlations. Body weight is the most important trait for genetic improvement because of its ease of selection, high heritability, and significant impact on meat production costs. Ducks were individually selected for body weight at eight weeks of age, as individual selection is beneficial for increasing highly heritable traits (Lin et al., 2016). Commercially relevant features like as egg traits are among the duck selection criteria. The availability of information demonstrating an animal's superiority, referred to as breeding value, is the first step in the selection process (Edi, 2009). As a result, in order to construct an accurate breeding programmer in a population. Because genetic characteristics such as heritability and genetic correlation are widely used as the foundation for selection schemes, genetic parameters should be evaluated in each group (Boukila et al., 1987). As well as duck production is one of the branches of poultry production that supplies protein, eggs, and fatty liver. Furthermore, they have natural immunity to certain chicken infectious diseases including as Newcastle, Mark's, and Leucosis. For a decent test, the majority of Egyptian consumers still favor local duck breeds. Many breeders have spent their money in egg production farms during the last two decades. Several workers realized that by crossing with foreign breeds or using selection techniques, egg traits for indigenous breeds may be enhanced.

The target of this study was to evaluate and explain genetic traits such as the heritability, the genetic and phenotypic correlations, and sire breeding value in Domyati (local) and Khaki-Campbell (foreign) ducks in order to improve body weight and egg traits.

MATERIALS AND METHODS

Data and animals

The trial took place at the Animal Production Research Institute of the Ministry of Agriculture in Dokki's El-Serw Waterfowl Research Station. The trial was prolonged for two years.

Birds: A total of 160 (80 Domyati (local) and 80 Khaki-Campbell (foreign) breeds were utilized to measure body weight (at 16 and 20 weeks g), as well as 7000 eggs (2500 Domyati and 4500 Khaki-Campbell) to measure egg traits (the egg number, egg weight, and egg mass are all measured throughout the first 90 days of laying).

The statistical analysis

Data analyze using a multi-trait animal model for the body weight and egg traits developed by **Boldman et al., 1995**. The following general model was used to conduct the analyses.

$$y = Xb + Zs + e.$$

Where y is the vector of observation; X is the incidence matrix of fixed effects; b is the vector of fixed effects (month); Z is the incidence matrix corresponding to the random effect of sire (s) and e = Vector of random errors. The heritability was calculated using the sire random effect ($h^2 s = \sigma^2 s / \sigma^2 p$), where $\sigma^2 s$ and $\sigma^2 p$ are the variances related to the sire random effect and phenotypic, respectively.

Results and discussion

Means

Means for both body weight at 16 weeks (2148.0 VS 1684.0 g), body weight at 20 weeks (2218.0 VS 1667.3 g), body weight at first egg (2171.7 VS 1639.8 g), number of egg (53.9 VS 50.2), egg weight (64.3 VS 61.4) and egg Mass (3187.4 VS 3181.5) were higher on Campbell duck than Domyati (Table 1). This could be owing to Campbell's good genetic makeup and the fact that it is more acclimated to the environmental circumstances in Egypt than the Domyati duck. From these results, the Campbell must be taken in the improvement programs, either by crossing or selection. The coefficients of variation in body weights were very low for both Domyati and Campbell duck, while CV% for egg production was moderate. These results almost agree **Tai et al., (1989)** used Brown Tsaiya ducks that weighed 1,270 g at 16 weeks of age and 1,407 g at 40 weeks of age. Domyati weights were 435.2, 1227.3, 1663.1, and 1752.8 g at 4, 8, 12, and 16 weeks of age, according to **El-Tehiti, (2001)**. He also mentioned that after 14 weeks of age, the body weight of Domyati ducklings had reduced. This could be related to the slower growing rate of Domyati ducklings as a local breed, particularly at maturity. Under Egyptian conditions. At 25 and 32 weeks of age, **Ali, (2000)** reported Domyati eggs weighing 56.7 and 62.7 g respectively, he also observed that the egg mass of Domyati ducks aged 20-32 weeks was 815.75

g/duck. **Abd El-Ghany, (2002)** found a 30-40% increase in Khaki-Campbell and Domyati ducks between 10 and 22 weeks of age, as well as more eggs in Domyati (31.3, 42.0, 36.9, and 110.2 eggs) than in Khaki-Campbell (22.6, 42.0, 34.6, and 99.1 eggs) during 22-30, 30-38, 38-46, and 22-46 weeks of age, during the first 10 eggs, 22-30, 30-38, 38-46, and 22-46 weeks of age, he found greater egg weight in Khaki-Campbell (66.1, 72.2, 71.3, 77.8, and 74.0 g) than Domyati (59.7, 64.7, 63.5, 69.5, and 65.9 g), and during 22-30, 30-38, 38-46, and 22-46 weeks of age, Khaki-Campbell had larger egg mass/duck (1721.0, 2948.0, 2720.0, and 7313.0 g) than Domyati (1687.0, 2797.0, 2567.0, and 6897.0 g). **El-Hanoun, (2003)** found higher corresponding weights of Domyati of 1070.2, 1657.5, 2132.8, 2572.8, and 2975.9 g. In Domyati, the egg/duck ratio was 6.72, 6.83, 7.54, 7.75, 5.52, and 0.73 throughout the 0-2, 2-4, 4-6, 6-8, 8-10, and 10-12 weeks of laying, according to **Awad, (2004)**, during the intervals 0-2, 2-4, 4-6, 6-8, 8-10, and 10-12 weeks of laying, he found Domyati eggs weighing 61.2, 61.7, 61.5, 61.6, 62.9, and 62.8 g, respectively and during the intervals 0-2, 2-4, 4-6, 6-8, 8-10, and 10-12 weeks of laying, Domyati produced 412.08, 421.68, 464.45, 477.81, 347.29, and 45.72 g/duck egg mass, respectively. **Ghonim, (2005)** found 4.7, 14.7, and 10.7 egg/duck in Domyati between the ages of 20-24, 24-28, and 28-32 weeks, he also observed that Domyati eggs weighed 58.8, 62.4, and 67.1 g when they were 20-24, 24-28, and 28-32 weeks old, respectively and during 22-30, 30-38, 38-46, and 22-46 weeks of age, Khaki-Campbell had larger egg mass/duck (1721.0, 2948.0, 2720.0, and 7313.0 g) than Domyati (1687.0, 2797.0, 2567.0, and 6897.0 g). **Ali, (2005)** reported that body weight of Khaki-Campbell ducks was significantly heavier up to 20 weeks of age than Domyati, at 4, 8, 12, 16, and 20 weeks of age, Khaki-Campbell weighed 593.01, 1338.69, 2067.44, 2309.20, and 2359.01 g, at 4, 8, 12, 16, and 20 weeks of age, Domyati weighed 463.22, 1237.97, 1707.91, 1806.95, and 1799.59 g respectively, as well as during the 24-36 week period, Khaki-Campbell produced 59.76 eggs while Domyati produced 37.42 eggs, During their 90-day laying period, Khaki-Campbell ducks laid 25% more eggs than Domyati ducks, also during 0-2, 2-4, 4-6, 6-8, 8-10, and 10-12 weeks of laying, egg/duck was 4.51, 7.29, 8.08, 8.21, 6.31, and 3.02 in Domyati, respectively, he also observed that egg weight for Khaki-Campbell ducks was 72.69 g, as well as Khaki-Campbell eggs had a significantly larger egg mass/day than Domyati eggs. During the intervals 0-2, 2-4, 4-6, 6-8, 8-10, and 10-12 weeks of laying, egg mass values in Domyati were 18.73, 30.67, 34.10, 34.81, 27.31, and 13 correspondingly. **Hassan and El-Sheikh (2010)** found that the live body weight of Muscovy ducks at marketing age was 3097g. Duck body weights increased by more than 100 g between Domyati 110 days (1,269 g) and 300 days (1,381 g), the egg weight increased from 65.0 g to 67.0 g, and the average number of eggs laid up to 300 days was 161 g, animals laid their first egg on average at 109.5 days of age, with a very low coefficient of variation (1.7 percent), and the egg weight increased from 65.0 g to 67.0 g according to **Lin et al. (2016)**. **Damayanti et al., (2019)** found that an Alabio duck's mean body weight at 16 weeks of age was 1291.33 g, which was similar to the Mojosari duck's 1299.0 g. However, the Alabio duck's mean body weight at first egg was 1612.40 g, which was greater than the Mojosari duck's 1544 g. Pke in ducks had the largest coefficients of variation (CV %) (12.14 percent) and the mean body weight was 2496 g at 42 days, according to **Yaxi Xu et al., (2018)**.

Table 1: The body weight and egg traits (Mean±SE); of Domyati and Khaki-Campbell ducks, as well as.

Traits	Mean	SD	CV%
<u>Domyati duck</u>			
Body weight at 16 weeks (g)	1684.0	23.7	1.4
Body weight at 20 weeks (g)	1667.3	21.9	1.3
Body weight at first egg (g)	1639.8	16.9	1.0
Number of egg	50.2	12.2	24.2
Egg weight (g)	61.4	6.5	10.7
Egg Mass (g)	3181.5	752.2	23.6
<u>Khaki-Campbell duck</u>			
Body weight at 16 weeks (g)	2148.0	15.9	0.74
Body weight at 20 weeks (g)	2218.0	15.9	0.72
Body weight at first egg (g)	2171.7	14.2	0.65
Number of egg	53.9	10.1	18.8
Egg weight (g)	64.3	3.4	5.3
Egg Mass (g)	3187.4	754.4	23.7

Heritability

Tables 2 and 3 indicate heritability estimates for body weight and egg traits based on a multi-trait animal model. The heritability estimate for body weights was moderate to high, ranged from 0.35 to 0.40, and the heritability estimate for egg traits was moderate to high, ranged from 0.21 to 30 in Domyati and Khaki-Campbell ducks, according to these calculations. My results are similar to those reported by **Tai et al. (1989)**, who found that heritability values for Brown Tsaiya ducks at 16 and 40 weeks of age were 0.47 for both body weights. **Pingel (1990)** discovered higher values in Pekin ducks, with heritability for the number of eggs laid ranging from 0.23 to 0.32. as well as **Cheng et al., (1995)** obtained moderate heritability values of 0.33, 0.33, 0.35, 0. 0.16, 43, and 0.50. Thus according **Lin et al., (2016)**, the heritability of egg weights ranged from 0.43 to 0.61, number of eggs laid ranged from 0.38 to 0.43, and age at first egg was high for egg weights ranged from 0.43 to 0.61, intermediate for number of eggs laid ranged from 0.38 to 0.43, and low for age at first egg 0.13. In addition, body weight heritability values ranged from low to high, ranged from 0.345 for BW110 to 0.540 for BW300. Body weight heritability levels at Alabio ducks 0.63 and Mojosari ducks 0.88 had the highest age at 16 weeks, according to **Damayanti et al., (2019)**, the heritability of the Alabio duck for body weight at first egg was 0.55, whereas the heritability of the Alabio duck was 0.44. Estimates of heredity for egg number from months 1-3 and 1-6, with values ranging from 0.30 to 0.46, according to Duck Mojosari. From months 1 to 12, the Alabio duck had a high egg number heredity (0.62) while the Mojosari duck had a moderate egg number heredity (0.46). In contrast, for the number of eggs laid up to 280 days of age, **Tai et al., (1989)** found heritability values of 0.15. For egg weight at 40 weeks/body weight at 40 weeks, egg weight at 40 weeks, egg weight at 30 weeks, number of eggs laid up to 280 days of age, body weight at 20 weeks, and body weight at 40 weeks. At 10 and 18 weeks of age, **Hu et al., (1999)** found that

heritability estimates of body weights for Muscovy ducks were 0.07 and 0.10, respectively. **Ali, (2005)** found that body weight at 0, 4, and 8 weeks of age had a low heritability (ranging from 0.014 to 0.175), with h^2 slightly greater in Khaki-Campbell ducks than in Domyati ducks. Heritability estimates for body weight at 12, 16, 20, sexual maturity, 20%, and 50% laying production were from 0.325 to 0.449 in Khaki-Campbell weights and 0.302 to 0.431 in Domyati weights, respectively. In Khaki-Campbell weights, all values were greater than in Domyati weights. Pekin ducks, **Xu et al., (2011)** found that the heritability of body weight at 7 weeks is 0.53. Our findings were in line with those of these investigations. As well as in Pekin ducks, the heritability of body weight at 6 weeks was 0.32 to 0.64 (**Li et al., 2006, Deng et al., 2019**). In Pekin ducks, **Yaxi Xu et al., (2018)** showed that body weight at 42 days had the highest heritability of 0.48. **Guang-Sheng Li et al., (2020)** the estimated heritability of body weight at 21 days (0.29) and body weight at 42 days (0.48) were relatively high; thus, they could be improved by direct phenotypic selection in Pekin ducks.

Table 2: shows the heritability estimates (on diagonals), the genetic correlations and their standard error (above diagonals) and phenotypic correlations (below diagonal), of body weight and egg traits in Domyati ducks.

Traits	BW16	BW20	BWF1	NE	EW	EM
Body weight at 16 weeks ,g (BW16)	0.37 ± 0.004	0.90 ± 0.002	0.79 ± 0.011	0.52±0.090	0.57 ± 0.088	0.50 ± 0.019
Body weight at 20 weeks, g (BW20)	0.93 ± 0.001	0.40 ± 0.04	0.78 ± 0.016	0.57±0.084	0.50 ± 0.089	0.58 ± 0.013
Body weight at first egg, g (BWF1)	0.80 ± 0.006	0.840 ± 0.004	0.37 ± 0.04	0.57±0.088	0.52 ± 0.102	0.50 ± 0.019
Number of egg (NE)	0.85 ± 0.009	0.88 ± 0.008	0.88 ± 0.007	0.24 ± 0.09	0.69 ± 0.141	0.82 ± 0.065
Egg weight, g (EW)	0.88 ± 0.008	0.83 ± 0.010	0.85 ± 0.010	0.92 ± 0.009	0.21 ± 0.08	0.72 ± 0.048
Egg Mass, g (EM)	0.83 ± 0.001	0.88 ± 0.001	0.83 ± 0.001	0.94 ± 0.007	0.90 ± 0.006	0.30 ± 0.08

Genetic correlations

Due to linkage and pleiotropy, the amount and direction of correlated responses play a critical role in designing effective breeding strategies for increased productivity, especially among positively correlated features (**Rajkuma, 2020**). For Domyati and Khaki-Campbell ducks, the genetic correlations between body weight and egg traits were all positive and had high values. the correlations between BW16 and BW20 were greater than the correlations between other traits (0.90), (99). The genetic improvement in BW16 may be followed by a rise in BW20 weeks (Table 2&3). As well as genetic correlations between BW20 and both BWF1; NE; EW and EM were higher than the correlations between other traits for Khaki-Campbell ducks (0.92; 0.82; 0.82 and 0.82). That is, an improvement in BW20 is followed by an improvement in both BWF1; NE; EW and EM. These results are similar to those found by **Cheng et al., (1995)** discovered that egg production traits and EW40/BW40 were relatively negatively correlated, while body weight traits were substantially genetically associated ($r_g = 0.988$) and positively correlated with egg weights. All other variables were negatively correlated with egg production traits except BW40 and EW30 and EW40 ($r_g = 0.979$) and were

195 strongly genetically correlated ($r_g = 0.948$). **Brun and Larzul, (2003)** found that there were
 196 little genetic links between reproductive traits and weights (0.036). The body weight of a male
 197 mule duck at 6 weeks of age is the most closely related feature. **Lin et al., (2016)** found that the
 198 number of eggs laid was genetically correlated with body weight ($r_g = +0.54$), but not with the
 199 age of first egg or egg weight. Egg weight and body weight traits were shown to have strong
 200 positive correlations. He suggested that depending on his observations, an efficient selection
 201 technique may be used to improve the pure Shan Ma duck line's egg production. **Damayanti et**
 202 **al., (2019)** found a high genetic correlation ranged from 0.80 to 0.99 among the egg number
 203 from months 1 to 12 (EN 12) and the egg number from months 1-3 (EN 3) and 1-6 (EN 6).
 204 EN12 had a negative genetic link to body weight and the age of the first egg (between -0.81 and
 205 -0.21). This finding suggests that EN3 could be used as a selection criterion to improve EN12
 206 in Alabio and Mojosari ducks.

207 Table 3: shows the heritability estimates (on diagonals), the genetic correlations and their
 208 standard error (above diagonals) and phenotypic correlations (below diagonal), for
 209 body weight and egg traits in Khaki-Campbell ducks.

Traits	BW16	BW20	BWF1	NE	EW	EM
Body weight at 16 weeks ,g (BW16)	0.36 ± 0.02	0.99±0.010	0.71 ± 0.014	0. 71 ± 0.028	0.70±0.055	0. 87 ± 0.005
Body weight at 20 weeks, g (BW20)	0.99 ± 0.003	0.35 ± 0.03	0. 92 ± 0.004	0. 82 ± 0.018	0.82±0.036	0.82 ± 0.007
Body weight at first egg, g (BWF1)	0.90 ± 0.003	0.94 ± 0.001	0.40 ± 0.03	0.78 ± 0.022	0.77±0.047	0.78 ± 0.009
Number of egg (NE)	0. 89 ± 0.004	0.93 ± 0.003	0.91 ± 0.004	0.29 ± 0.09	0.72±0.119	0.82 ± 0.059
Egg weight, g (EW)	0.93 ± 0.007	0.92 ± 0.005	0.90 ± 0.007	0.91 ± 0.012	0.24 ± 0.10	0.72 ± 0.048
Egg Mass, g (EM)	0.94 ± 0.001	0.92 ± 0.001	0.91 ± 0.001	0.94 ± 0.006	0.90 ± 0.006	0.30 ± 0.07

211 212 Phenotypic correlations

213 Body weight and egg traits had strong phenotypic correlations, with values ranged from 0.80
 214 to 0.99 for Domyati and Khaki-Campbell ducks (Table 2 & 3). These results correspond to those
 215 of Day-old body weight in both breeds was significantly correlated to weight at 4, 8, and 12
 216 weeks of age ($r_p = 0.8, 0.8$, and 0.6 in Khaki-Campbell and $0.8, 0.5$, and 0.7 in Domyati,
 217 respectively), according to **Ali, (2005)**. Furthermore, body weight at 4 weeks in both breeds was
 218 phenotypically associated to weight at 8 or 12 weeks ($r_p = 0.6$ to 0.8), as well as in both breeds,
 219 the phenotypic correlation between weight at 16 weeks and other weights at 20, sexual maturity,
 220 and 20% and 50% laying productivity was quite high (except sexual maturity in Domyati ducks).
 221 **Lin et al. (2016)** indicated that as the duck grew older, phenotypic correlation among egg
 222 weights for two successive ages increased, with values of $+ 0.36$ between egg weight of the 10
 223 first egg and egg weight at 210 day, $+ 0.56$ between egg weight at 210 day and egg weight at 280
 224 day, and $+ 0.72$ between egg weight at 280 day and egg weight at 300 day. In terms of the
 225 quantity of eggs laid, phenotypic correlations increased from $+ 0.75$ between number of egg at
 226 210 day and number of egg at 280 day to $+ 0.97$ between number of egg at 280 day and number
 227 of egg at 300 day.

Guang-Sheng Li et al., (2020) in Pekin ducks, phenotypic relationships between body weight at 42 days, body weight at 21 days, daily body weight gain, daily feed intake, and meal feed intake were shown to be significantly positive.

Sire breeding value

The rate of improvement in the principal trait of selection is determined by the estimated breeding value. Any genetic improvement initiative in livestock and poultry must start with population variability. The response to selection in the primary as well as other correlated qualities of economic value determines genetic progress. For developing breeding programmes for genetic enhancement of desirable traits in chicken, a thorough understanding of the genetic basis, gene activity, and environmental effect is required. The population size, gene frequency, mutation, allelic fixation, random drift, and physiological constraints all influence the trait's selection response (**Falconer .et al., 1996**). As well as individuals' phenotypic value can be determined directly; however, breeding values define their impact on future generations; so, breeding value must be evaluated. The minimum and maximum estimates of sire breeding values (SBV) in Domyati ducks are higher than in Khaki-Campbell ducks, ranging from(-38.09 to 47.6) VS (-15.36 to 14.19)grams, (-222.34 to 292.0) VS (-11.79 to 10.14)grams, (-166.78 to 120.59) VS (-15.13 to 21.36) grams,(-4.49 to 5.96) VS (-5.03 to 3.08), (-3.32 to 5.96) VS (-3.02 to 5.77) and (-392.70 to 498.30) VS (-117.30 to 185.71) for BW16, BW20, BWF1, NE and EM, respectively (Table 4). Furthermore, the range between the minimum and maximum sire breeding values for the same attributes in Domyati ducks is greater than in Khaki-Campbell ducks. The range of sire breeding value estimations between the minimum and maximum values is then the foundation for any planned selection strategy to improve economic features. There is no study available on the evaluation of breeding value in ducks. **Yaxi Xu et al., (2018)** found In Pekin ducks, the generational average breeding value of body weight at 42 days grew to 349.45 g over a 10-generation period. **Guang-Sheng Li et al., (2020)** found that during the selection, the average breeding value of body weight at 21 days increased by 8 g, while improvements in body weight at 42 days and FI were 20 g and 40 g, respectively, in Pekin ducks. **Rajkuma (2021)** observed a growing trend in the average breeding value of egg mass during a 40-week period utilizing Dahlem Red chickens, with a genetic gain of 1.87 eggs each generation. There was no inbreeding and the breeding value for primary and linked traits exhibited linear trends in the intended direction.

Table 4: Sire breeding values (SBV), accuracy and Range for body weights and egg traits of Domyati and Khaki-Campbell ducks.

Traits	Minimum			Maximum			Range
	SBV	S.E	Accuracy	SBV	S.E	Accuracy	
<u>Domyati ducks</u>							
Body weight at 16 weeks (g)	-38.09	0.36	0.80	47.67	0.36	0.80	85.76
Body weight at 20 weeks (g)	-222.34	0.42	0.90	292.00	0.42	0.90	514.34
Body weight at first egg (g)	-166.78	0.28	0.89	120.59	0.28	0.89	287.37
Number of egg	-4.49	0.34	0.86	5.96	0.34	0.86	10.45
Egg weight (g)	-3.32	0.36	0.82	5.69	0.36	0.82	9.01
Egg Mass (g)	-392.70	0.19	0.94	498.30	0.19	0.94	891.00
<u>Khaki-Campbell ducks</u>							
Body weight at 16 weeks (g)	-15.36	0.41	0.90	14.19	0.41	0.90	29.55
Body weight at 20 weeks (g)	-11.79	0.41	0.80	10.14	0.41	0.80	21.93
Body weight at first egg (g)	-15.13	0.43	0.82	21.36	0.43	0.82	36.49
Number of egg	-5.03	0.39	0.76	3.08	0.39	0.76	8.11
Egg weight (g)	-3.02	0.38	0.76	5.77	0.38	0.76	8.79
Egg Mass (g)	-117.30	0.37	0.73	185.71	0.37	0.73	303.01

CONCLUSION

For Domyati and Khaki-Campbell ducks, heritability estimates for body weights and egg traits ranged from moderate to high. For Domyati and Khaki-Campbell ducks, genetic correlations between body weights and egg traits variables were all positive and had high values; the correlations between BW16 and BW20 were stronger than the correlations between other traits (0.90). (99). The increase in BW16 weeks could be followed by a rise in BW20 weeks as a result of the genetic improvement. By selecting based on the results, it is possible to improve body weight and egg production. In order to implement their selection, Breeders need to know about the heritability and genetic correlation of the traits they're interested in in their own breed. Breeders should be able to create successful genetic selection strategies for Domyati and Khaki-Campbell ducks aiming to increase both body weights and egg traits depending on the findings of this study.

Declarations

Funding We would like to thank the Animal Production Research Institute for providing ducks and feeding care to complete this research.

Conflict of interest There are no conflicts of interest declared by the authors.

Ethics approval and consent to participate The Animal Production Research Institute agreed to conduct research on ducks at their El-Serw Waterfowl Research Station.

Consent for publication Not applicable.

298 **Data availability** The writing author declares database availability and sends a request to the
299 related writers for any query. We ask that you contact the author for access to and consultation
300 of supplemental information (databases).

301 **Code availability** Not applicable.

302 **Author contribution** Wael Ali Hassan Ali collated the data, Mahmoud Gharib Gharib
303 performed statistical analysis of the data, and Amira Soliman El-Deghadi prepared and
304 reviewed the research. The final manuscript was read and approved by all contributors.
305

306 REFERENCES

307 **Abd El-Ghany, M.E.A. (2002).** Studies on some managerial aspects affecting the
308 productivity of ducks. Ph.D. Thesis, Fac. of Agric., Mansoura Univ., Egypt.

309 **Ali, K.A.A. (2000).** Effect of some environmental factors affecting ducks performance.
310 M.Sc. Thesis, Fac. of Agric., Ain Shams Univ., Egypt.

311 **Ali, K. A. A (2005).** Studies on some factors affecting duck production. PhD.Thesis, Fac. Agric,
312 Cairo Univ, Egypt.

313 **Awad, L.A.M. (2004).** Physiological and productive studies on ducks. Ph.D. Thesis, Fac. of
314 Agric., Mansoura Univ., Egypt.

315 **Boldman K G, Kriese L A, Van Vleck L D, Van Tassell C P and Kachman S D (1995).** A
316 manual for use of MTDFREML. A set of programs to obtain estimates of variances and
317 covariances [DRAFT]. U.S. Department of Agriculture, Agricultural Research Service,
318 USA.

319 **Boukila, B.; Desmarais, M.; Pare, J. P. and Bolamba, D.(1987).** Poult. Sci.66 1077–84.

320 **Brun, J.M. and C. Larzul (2003).** Inheritance of reproductive traits of female common ducks
321 (*Anas platyrhynchos*) in pure breeding and in inter-generic crossbreeding with muscovy
322 ducks (*Cairina moschata*). Brit. Poult. Sci., 44(1): 40-5.

323 **Cheng, Ys; Rouvier, Rl; Poivey, Jp nd Tai, C (1995):**Genetic parameters of body weight,
324 egg production andshell quality traits in the Brown Tsaiya laying duck. Gentet. Sel.
325 Evol. 27, 459-472.

326 **Damayanti, D.; Maharani and S Sudaryati (2019):**Genetic parameters of egg production trait
327 in Alabio and Mojosari ducks under selection. IOP Conf. Series: Earth and
328 Environmental Science 387.

329 **Deng, M.T. Zhu, F. Yang, Y.Z. Yang, F.X. Hao, J.p. Chen, S.R. Hou, Z.C. (2019).**
330 Genome-wide association study reveals novel loci associated with body size and carcass
331 yields in Pekin ducks. BMC Genomics, 20 , p. 1

332 **Edi, K. (2009).**(Yogyakarta: Graha Ilmu).

333 **El-Hanoun, A.M. (2003).** Data analysis on the performance for three strains of ducks
334 in Egypt. Ph.D. Thesis, Fac. of Agric., Alex Univ., Egypt.

- 335 **El-Tehiti, A.I.A. (2001).** Water pollution and its effect on some productive traits in
336 ducks. M.Sc. Thesis, Fac. of Agric., Ain Shams Univ., Egypt.
- 337 **Ghonim, A.I.A. (2005).** Improving of some productive traits on ducks. Ph.D. Thesis,
338 Fac. of Agric., Mansoura Univ., Egypt.
- 339 **Guang-Sheng Li, Feng Zhu, Fang-Xi Yang, Jin-Ping Huo, Zhuo-Cheng Hou (2020).**
340 Selection response and genetic parameter estimation of feeding behavior traits in Pekin
341 ducks. Poultr Science volume 99 Issues, pages 2375-2354.
- 342 **Hassan, M. M and S. E. El-Sheikh (2010):** Effect of physical of form of diets on the
343 performance of ducks. Poult. Sci. 30: 989-1002.
- 344 **Hu Y.H., J.P. Poivey, R. Rouvier, C.T. Wang and C. Tai (1999).** Heritabilities and genetic
345 correlations of body weights and feather length in growing Muscovy selected in Taiwan.
346 Brit .Poult. Sci., 40(5): 605-12.
- 347 **Falconer DS, Mackay TFC (1996).** Introduction to Quantitative Genetics. Longman, Essex.
- 348 **Lin, R. L.; Chen, H. P.; Rouvier, R. and Marie-Elancelin (2016):** Genetic parameters of
349 body weight, egg production, nd shell quality traits in Shan Ma laying duck
350 (Anasplahynchos). Poultry Science, Volume 95, Issue 11, 1November 2514-2519.
- 351 **Li, Z. Shuisheng, H. Xiaolin, L. Wei, H. Ling, Z. Junying, Y. (2006).** Estimation of genetic
352 parameters on growth traits of peking ducks. Chin. Poult., 3 , p. 005
- 353 **Rajkumar U, Niranjana M, Prince LLL, Paswan C, Haunshi S, Reddy BLN (2020).** Genetic
354 evaluation of growth and production performance and short term selection response for
355 egg mass in Gramapriya female line. Indian Journal of Animal Sciences, 90 (3): 401–
356 406.
- 357 **Rajkumar, U. Leslie Leo PrinceID, L Rajaravindra, .K. S. Haunshi, S. Niranjana, M.,**
358 **Chatterjee, R. N. (2021).** Analysis of (co) variance components and estimation of
359 breeding value of growth and production traits in Dahlem Red chicken using pedigree
360 relationship in an animal model. PLOS ONE
361 <https://doi.org/10.1371/journal.pone.0247779>.
- 362 **Pingel,H. (1990):**Genetics of egg productionand reproduction in waterfowl. In:
363 PoultryBreeding andGenetics (RD Crawford, ed), Elsevier, Amsterdam, 771-780.
- 364 **Tai,C; Rouvier, R; Poivey, JP. (1989):** Geneticparameters of some growth and egg
365 productiontraits in layingBrown Tsaiya(AnasPlatyrhynchos). Genet. Sel. Evol . 21, 377-
366 384.
- 367 **Xu, T. Liu, X. Huang, W., Hou, S. (2011).** Estimates of genetic parameters for body weight
368 and carcass composition in Pekin ducks. J. Anim. Vet. Adv., 10 , pp. 23-28.
- 369 **Yaxi Xu, Jain Hu, Yunsheng Zang Guo, Wei Hang, Ming Xie, Hehe Liu, Chuzhao Lei,**
370 **Shisheng Hou, Xiaolin Liu and Zheng Kui Zhou (2018).** Selection response and
371 estimation of the genetic parameters for multidimensional measured breast meat yield
372 related traits in a long-term breeding Pekin duck line. Asian-Australas J Anim Sci. Oct;
373 31(10): 1575–1580. Published online 2018 Apr 12. doi: 10.5713/ajas.17.