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Heritability, Genetic and Phenotypic Correlations in Three Indigenous Egyptian Chicken Lines

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THE STUDY conducted aimed to examine the heritability, genetic and phenotypic correlations of body weight and egg production traits in Egyptian chickens. These traits are considered crucial in chicken production and the improvement of these traits through crossbreeding and selection programs is important for maximizing production. The data used in this study were obtained from three generations of three different chicken strains: Tanta G-1, Tanta G-2 and Mamourah. The researchers used the MCMC glmm package of R software to estimate the genetic parameters for these economically important traits in Gimmizah Station native chickens. After three generations of selection, the genetic correlations among body weight traits ranged from 0.78 to 0.96, 0.57 to 0.91 and 0.82 to 0.93 for Tanta G-1, Tanta G-2 and Mamourah chickens, respectively. The phenotypic correlation among different body weights ranged from 0.26 to 0.95, 0.17 to 0.96 and 0.38 to 0.97 for Tanta G-1, Tanta G-2 and Mamourah lines, respectively. These correlations increased from one generation to another. For the heritability of body weight traits, they ranged from 0.16 to 0.34, 0.15 to 0.33 and 0.13 to 0.19 for Tanta G-1, Tanta G-2 and Mamourah lines, respectively. In conclusion, the study suggests that simultaneous selection for both growth and egg production traits may result in a reduction in egg number but an increase in egg weight. This finding highlights the need for careful consideration when selecting for these traits to attain a balanced and optimal outcome in chicken production.

Keywords: Genetic correlations, Heritability, Native chicken, Phenotypic correlations.

Introduction

Chicken is the most important cheap source of animal protein in Egypt [1]. Genetic improvement programs for chicken breeding in Egypt will be of great economic importance. There are about 15 local chicken breeds and strains that are favorites among consumers in Egypt. Egyptian chickens have small bodies and a dual purpose for meat and egg production.

In chicken breeding programs, crossbreeding is used in genetic improvements to enhance the production of meat and eggs. Crossbreeding may create a new genotype and the advantages of applying crossbreeding will increase the heterosis and hybrid vigor which will improve performance traits [3,4]. Crossbreeding between local and exotic chicken breeds was made to create Egyptian local strains [5]. They are selling at a higher price than commercial breeds. Local chickens have moderate growth rates and egg production; however, they are more tolerant to heat stress and illness resistance as compared to commercial strains [6-9]. Mamourah strain was developed by

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Abd El-Gawad et al. [10] by crossing between the Alexandria strain and Dokki- 4.

In the companies of poultry breeding, the grandparent of broiler breeds involves female and male lines. These lines were selected for increasing body weight and meat production [11,12]. Broiler chickens over the last 70 years has been accompanied by large phenotypic changes [13]. Commercial chicken's genetic makeup is significantly influenced by breeding plans and genetic gain, although it is unclear what the genetic diversity of these chickens would be a purely commercial line [11]. This proves the significance of indigenous chickens for future requirements to promote genetic variety. In 2003, a selection improvement program started at the Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt, to develop the Cairo B-2 line as a local broiler female line. The live body weight of the Cairo B-2 line, which has been subjected to intensive selection for eight generations, was compared with the RBC line at the age of six weeks. The results indicate that, the Cairo B-2-line males exhibited higher live body weight (average = 1135 g) compared with males from the RBC line (average = 781 g). A similar trend was also observed in the Cairo B-2 line females (average = 943 g) compared with the random breed control (RBC) line females (average = 718 g). The live body weight of the Cairo B-2 line, at six weeks of age, compared with the RBC line, was significantly higher (45.3% for males and 31.3% for females) due to the selection that had been done for six generations [14-16].

Genetic parameters of performance traits in chickens are affected by direct genetic effects and maternal effects [17,18]. In chicken strains undergoing selection, both sires and dams contribute towards productive performance traits, but selection must be done with greater emphasis on dams to improve live body weight and the performance of reproductive traits [19]. Therefore, evaluating and understanding the genetic parameters, such as heritability and genetic correlation of improve live body weight and reproductive traits are of prime importance in providing females for mating and consequently improving these traits [19] Many studies indicated different heritability values for improving live body weight at 42 days of age. These were 0.22 [20], 0.43 [21], 0.24 [22], 0.15 [23] and 0.31 [24]. Although there is ample evidence that the production of local chickens has a significant impact on rural households, little has been done to increase the productivity of local chickens. Native breeds' output must be increased by paying attention to factors of nutrition, breeding, health and management [25]. Genetic advancement via selection within local chickens appears to be a desirable alternative from a breeding perspective [26]. Therefore, as the aim of the current study, we used phenotypic information from 3 consecutive generations of Tanta G1, Tanta G2 and Mamourah local chicken to estimate heritability, phenotypic and genetic correlations of the recorded traits in these chicken breeds.

Experimental

The study was conducted, at the Native Chicken Breeding Station of a Poultry Farm in Gimmizah, Animal Production Station, Animal Production Institute, Agriculture Research Centre, Dokki, Giza, Egypt. The station has been established for a significant period with two main objectives: genetic improvement through crossing and selection programs, as well as the dissemination of indigenous native chicken birds.

The history of the Tanta G-1, Tanta G-2, and Mamourah line as a broiler breeder male line began with a selection improvement program at the poultry farm. The aim was to develop the Tanta G-1 line as a local broiler male line and the Tanta G-2 line as a local broiler female line. The produced crossbreeds were reared until maturity and housed in individual cages. A hundred males and two hundred females were randomly selected based on their high body weight at 8 weeks from the base generation and were mated at a ratio of one male to every 8 females. Artificial insemination was used to obtain pedigreed fertile eggs. Fertile eggs were collected for 15 days and hatched to produce the F1-selected Tanta G-1 line and Tanta G-2. Additionally, fertile eggs were collected again for 15 days from the Mamourah random breed control line (RBC) without any breeding program. All the produced chicks were wing-banded to maintain their pedigree. The selected line was reproduced through an out-breeding program, with no mating between full or half-siblings allowed. The best broiler breeders with high body weight at 8 weeks were selected as parents for the next generation in the Tanta G-1 line. Tanta G-1 is a local chicken line specializing in meat production in Egypt.

The present study used three strains of chickens (500 birds for parent for each strain50 male and 450 female, and 1200 birds for progeny for each strain), which are as follows:

1. Local Egyptian strain: Mamourah chickens (RBC).
2. Crossbreeding program between Indian River male lines (grandparent stock) and Mamourah females to produce the first cross (F1), named Tanta G-1.
3. Crossbreeding program between Indian River male pure line grandparent females' line (grandparent stock) and Mamourah females to produce the first cross (F1), named Tanta G-2.

Throughout the generations, live body weights (LBW) at hatch, 14, 28, 42 and 56 days were individually obtained using a digital scale from the Tanta G-2, Tanta G-1 and Mamourah lines. Additionally, body weight at sexual maturity (BWSM), average egg weight (EW), egg numbers (EN) and first egg weight (FEW) were recorded for each female in Tanta G-1, Tanta G-2 and Mamourah [27,28]. The following mixed model is considered in representing each observation:

Where represents the observation (weight traits) for kth offspring of jth animal for ith sex, is the constant inherent to data, S is the sex effect, u is the vector of random animal effect, u ~ N(0,), being G the additive genetic relationship matrix and e represents the residual error term, e ~ N(0,). The matrice Z represents the incidence matrices for u. and are the variance components related to animal and environment effects, respectively. For other traits, same model was used without sex effect.

The Bayesian approach is considered and computations were performed using Markov Chain Monte Carlo (MCMC) technique [29] (Robert and Casella, 2004). Analyses were performed using the MCMC glmm package of R software [30]. Each trait was analyzed separately. A single chain of length 65,000 was run for each trait and after discarding the first 15,000 iterations and saving every 50th sample, 1,000 posterior samples were stored for each parameter.

Results and Discussion

Genetic and phenotypic correlation among body weight traits

The data shown in Tables (1, 2 and 3) were the data of genetic and phenotypic correlations for the (1st, 2nd and 3rd) generations, respectively among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens. Where, Genetic correlations (above diagonal), and phenotypic correlations (below diagonal), among hatching weight, 2, 4, 6, 8 and 22 weeks for each of the Tanta G-1, Tanta G-2 and Mamourah chickens.

Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 1st generation among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens in the 1st generation were shown in Table (1), genetic correlation among body weights ranged between 0.60 to 0.92, 0.17 to 0.89 and 0.49 to 0.87 for Tanta G-1, Tanta G-2 and Mamourah chickens, respectively. While phenotypic correlation among different body weights ranged from 0.20 to 0.75, 0.20 to 0.76 and 0.39 to 0.96 for Tanta G1, Tanta G-2 and Mamourah lines, respectively. All types of low, medium and high phenotypic correlations appeared in this generation.

Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 2nd generation among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens in the 2nd generation were shown in Table (2). The genetic correlation ranged between 0.18 to 0.90, 0.11 to 0.81 and 0.52 to 0.87 for Tanta G-1, Tanta G-2 and Mamourah chickens, respectively. While phenotypic correlation among different body weights ranged from 0.40 to 0.91, 0.01 to 0.78 and 0.40 to 0.96 for Tanta G1, Tanta G-2 and Mamourah lines, respectively. All types of low, medium and high phenotypic correlations appeared in this generation.

Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 3rd generation among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens in the 3rd generation were shown in Table (3). The genetic correlation among body weight traits ranged between 0.78 to 0.96, 0.57 to 0.91 and 0.82 to 0.94 for Tanta G-1, Tanta G-2, and Mamourah chickens, respectively. While phenotypic correlation among different body weights ranged from 0.26 to 0.95, 0.17 to 0.96 and 0.38 to 0.97 for Tanta G1, Tanta G-2 and Mamourah lines, respectively. All types of low, medium and high phenotypic correlation appeared in this generation.

The genetic correlations and the phenotypic correlations among body weights increased from one generation to another. The highest values were at the third generation for Tanta G1, Tanta G-2 and Mamourah lines of chicken.

AT three generations, the highest genetic correlation values among body weights were for Tanta G1, followed by Mamourah chicken and Tanta G-2 line, respectively. While the phenotypic correlation values among body weights were the highest for Mamourah chickens at three generations. Followed by Tanta G-1 line and Tanta G-2 line, respectively.

The study conducted by Nasser [31] compared the phenotypic correlations between low birth weight (LBW) at 6 weeks of age and other traits in two different chicken lines - Cairo B-2 and RBC. They found that the Cairo B-2 line had higher phenotypic correlations between LBW and all other traits studied across multiple generations. Specifically, the phenotypic correlations between LBW and BWSM ranged from 0.37 to 0.45 for the Cairo B-2 line and from 0.32 to 0.34 for the RBC line. The correlations between LBW and EN during the first 36 weeks of age were negative and ranged from -0.12 to -0.15 for the Cairo B-2 line and from -0.13 to -0.17 for the RBC line. The correlations between LBW and EW ranged from 0.41 to 0.46 for the Cairo B-2 line and from 0.25 to 0.32 for the RBC line, across the last four generations studied.In another study by Peertile et al. [32], the genetic correlations between carcass traits and different live weights were estimated and found to range from 0.64 to 0.97. Carcass weight showed a genetic correlation of 0.72 with breast yield relative to slaughter weight and a correlation of 0.82 with leg weight. These results indicate that selecting for body weight at 30 or 38 days of age can effectively indirectly select for these carcass traits instead of relying on slaughter weight, as it allows for earlier selection by approximately 12 days. A study by Manjula [33] focused on estimating genetic parameters for body weight gain and growth curve parameter traits in Korean native chicken. They found that the genetic correlations between weight gain traits ranged from -0.527 to 0.993, indicating both positive and negative relationships between these traits. The genetic correlations between growth curve parameters and weight gain traits ranged from -0.968 to 0.987. Overall, these studies provide insights into the genetic and phenotypic correlations between live body weight, body weight, carcass traits and growth parameters in different chicken lines. These correlations can help in understanding the potential for indirect selection of desirable traits and guide breeding strategies to improve chicken performance and carcass quality.

Heritability of body weight estimates

The heritability for body weight at age hatching weight, 2, 4, 6, 8 and 22 weeks for three generations of the Tanta G-1 strain, Tanta G-2 and Mamourah are shown in Table (4). The heritability estimates for body weight traits in the first generation ranged from low to moderate. The heritability for body weight traits in the first generation for Tanta G-1 line ranged from 0.1 to 0.28, ranged from 0.1 to 0.27 in the Tanta G-2 line, while in the Mamourah line, it ranged from 0 .1 to 0.16. The heritability estimates of body weights 2, 4, 6, 8 and 22-weeks values were higher in the Tanta G-1 line followed by the Tanta G-2 line than those in the Mamourah line.

In the second generation, the heritability for body weight traits for Tanta G-1 line, the Tanta G-2 line and the Mamourah line ranged from 0.13 to 0.28, 0.12 to 0.26 and 0 .11 to 0.18, respectively. The same trend in the first generation, the heritability estimates of body weight values were higher in the Tanta G-1 line followed by the Tanta G-2 line than those in the Mamourah line. The heritability estimates of body weight values were higher in the second generation than those in the first generation.

In the third generation, the heritability for body weight traits for Tanta G-1 line, the Tanta G-2 line and the Mamourah line ranged from 0.16 to 0.34, from 0.15 to 0.33 and from 0 .13 to 0.19, respectively. The highest heritability estimates of body weight values were in the third generation followed by the second generation, while the lowest value was in the first generation. The heritability estimates for body weight gain traits varied from low to high, ranging from 0.057 to 0.458.

The study conducted by Niknafs et al. [34] found that heritability estimates for body weight at different ages ranged from 0.24 to 0.47. The heritability values were lower for traits related to body weight at 8 and 12 weeks compared to body weight at 1 week. Additionally, there were moderate to high positive genetic correlations between the different body weight traits, ranging from 0.36 to 0.91. Body weight at 8 and 12 weeks showed a strong genetic correlation of 0.91 and there was also a moderate environmental correlation between them (0.47).

Zhao et al. [35] reported that many studies have found positive and significant correlations between live weight and body dimensions. This suggests that the dimensions of an animal›s body can be used to predict its body weight. In another study by Nassar [31], it was observed that the Cairo B-2 line had higher heritability for 6-weeks LBW (low birth weight) compared to the RBC line across all generations. The heritability calculated using both the sire and dam components (h2 (S+D)) for the Cairo B-2 line and RBC showed that the heritability for LBW at 42 days of age, calculated using the sire component (h2S), was higher than that estimated from the dam component (h2D) for both lines. The expected result was for the selected line to have lower heritability values compared to the RBC line, as selection increases the homogeneity and reduces variability. With reduced variance, the heritability calculated from different variance components is also reduced. It is important to note that no selection was imposed on the RBC line, which could explain the difference in heritability between the two lines.

Genetic and phenotypic Correlation among Egg Traits

The data shown in Tables (5, 6 and 7) were the data of genetic and phenotypic correlations for the first generation, the second generation and the third generation, respectively among egg traits for Tanta G-1, Tanta G-2 and Mamourah chickens. Where, genetic correlations (above diagonal) and phenotypic correlations (below diagonal), among BWSM, FEW, Egg 42 and Egg 90 for each of the Tanta G-1 strain, Tanta G-2 and Mamourah chickens.

Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 1st generation among egg traits for Tanta G-1, Tanta G-2 and Mamourah chickens in the 1st generation were shown in Table (5). The genetic correlation among different egg traits ranged between -0.72 to 0.79, -0.58 to 0.82 and -0.88 to 0.96 for Tanta G-1, Tanta G-2 and Mamourah chickens, respectively. While phenotypic correlation among different egg traits ranged from -0.63 to 0.83, -0.73 to 0.76 and -0.65 to 0.94 for Tanta G1, Tanta G-2 and Mamourah lines, respectively. All types of low, medium and high phenotypic correlations appeared in this generation. There are negative correlations among body weights and egg numbers.

Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 2nd generation among egg traits for Tanta G-1, Tanta G-2 and Mamourah chickens in the 2nd generation were shown in Table (6). The genetic correlation ranged between -0.81 to 0.68, -0.71 to 0.95 and -0.87 to 0.95 for Tanta G-1, Tanta G-2 and Mamourah chickens, respectively. While phenotypic correlation among different body weights ranged from -0.77 to 0.59, -0.73 to 0.95 and -0.63 to 0.96 for Tanta G1, Tanta G-2 and Mamourah lines, respectively. All types of low, medium and high phenotypic correlations appeared in this generation. There are negative correlations among body weights and Egg numbers.

Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 3rd generation among egg traits for Tanta G-1, Tanta G-2 and Mamourah chickens in the 3rd generation were shown in Table (7). The genetic correlation ranged between -0.81 to 0.65, -0.84 to 0.74 and -0.85 to 0.95 for Tanta G-1, Tanta G-2 and Mamourah chickens, respectively. While phenotypic correlation among different egg traits ranged from -0.63 to 0.83, -0.73 to 0.74 and -0.65 to 0.94 for Tanta G1, Tanta G-2 and Mamourah lines, respectively. All types of low, medium and high phenotypic correlations appeared in this generation.

AT three generations, the highest genetic correlation values among egg traits were for Tanta G1, followed by Mamourah chicken and Tanta G-2 line, respectively. On the other hand, the phenotypic correlation values among body weights were the highest for Mamourah chickens at three generations. followed Tanta G-1 line and Tanta G-2 line, respectively.

The genetic correlations and the phenotypic correlations among egg traits enhanced from one generation to another. The highest values were at the third generation for Tanta G1, Tanta G-2 and Mamourah lines of chicken. There are negative correlations among body weights and Egg numbers. There were high positive correlations among body weights and egg weights.

Heritability of egg traits

The heritability for egg traits at three generations of BWSM, FEW, Egg 42 and Egg 90 for Tanta G-1, Tanta G-2 and Mamourah chickens, are shown in Table (8). The heritability estimates for egg traits in the 1st generation ranged from low to moderate. The heritability for egg traits in the 1st generation for Tanta G-1 line ranged from 0.11 to 0.43, ranged from 0.13 to 0.28 in the Tanta G-2 line and 0 .11 to 0.53 in Mamourah line. The heritability estimates of EN values were higher in the Mamourah line followed by Tanta G-1 line than those in the Tanta G-2 line.

In the 2nd generation, the heritability for egg traits for Tanta G-1 line, the Tanta G-2 line and the Mamourah line ranged from 0.11 to 0.35, 0.11 to 0.38 and from 0 .12 to 0.54, respectively. The same trend in the first generation, the heritability estimates of egg number values were higher in the Mamourah line followed by Tanta G-1 line than those in the Tanta G-2 line.

In the 3rd generation, the heritability for egg traits for Tanta G-1 line, the Tanta G-2 line and the Mamourah line ranged from 0.21 to 0.48, 0.16 to 0.44 and 0 .12 to 0.52, respectively. The highest heritability estimates of egg traits were in the third generation, selection for three generations enhanced the heritability. The study by Haq et al. [36]. focused on the phenotypic correlations between BWSM and EW in two different breeds of chickens, namely Fayoumi and Dokki. The results showed that the correlation coefficient between BWSM and EW for Fayoumi breed was 0.333, while for Dokki breed it was 0.325. Another study conducted by Dana et al. [23] examined the phenotypic correlation between LBW at 6 weeks of age and EN. The results showed that the correlation coefficient between LBW and EN ranged between 0.16 and 0.24. In a separate study by Niknafs et al. [34], the focus was on native chickens that had been selected for low body weight at 8 weeks LBW and high EP over 15 generations. The phenotypic correlations were analyzed between LBW and two egg-related traits, namely EW and EN. The results showed a correlation coefficient of 0.4241 between LBW and EW, indicating a positive relationship. However, the correlation coefficient between LBW and EN was -0.0474, suggesting a weak negative relationship. Furthermore, the correlation coefficient between MEW and EP was -0.2084, indicating a weak negative correlation as well. Overall, these studies provide insights into the phenotypic correlations between body weight and egg-related traits in different breeds of chickens. These findings can be valuable for breeding programs and selection strategies aimed at improving both body weight and egg production in poultry farming.

Conclusions

In conclusion, this study focused on estimating the genetic correlations, heritability and phenotypic correlations of body weight and egg production traits in Egyptian chickens. The results showed that there were positive correlations among body weight traits and egg weights, indicating that chickens with higher body weights tend to produce heavier eggs. However, there were negative correlations between body weights and egg numbers, suggesting that chickens with larger body weights may produce fewer eggs.

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Conflicts of interest

There are no conflicts to declare.

Funding statement

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Author`s contributions

The authors contribute equally in this work.

TABLE 1. Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 1st generation among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	Lines	Traits	BW0	BW2	BW4	BW6	BW8	BW22
G1	Tanta G-1	BW0	-	0.91	0.92	0.83	0.68	0.60
		BW2	0.39	-	0.92	0.87	0.83	0.83
		BW4	0.40	0.62	-	0.91	0.80	0.85
		BW6	0.33	0.22	0.72	-	0.84	0.69
		BW8	0.33	0.20	0.57	0.75	-	0.70
		BW22	0.25	0.08	0.51	0.74	0.56	-
	Tanta G-2	BW0	-	0.80	0.35	0.17	0.62	0.48
		BW2	0.52	-	0.65	0.23	0.89	0.63
		BW4	0.42	0.60	-	0.61	0.82	0.61
		BW6	0.42	0.41	0.61	-	0.30	0.61
		BW8	0.29	0.44	0.75	0.61	-	0.73
		BW22	0.20	0.36	0.65	0.67	0.76	-
	Mamourah	BW0	-	0.66	0.62	0.68	0.49	0.70
		BW2	0.52	-	0.87	0.71	0.79	0.76
		BW4	0.52	0.78	-	0.82	0.76	0.77
		BW6	0.39	0.63	0.88	-	0.78	0.81
		BW8	0.40	0.69	0.85	0.96	-	0.75
		BW22	0.46	0.64	0.88	0.96	0.94	-

Gen. = generation; G1= generation 1; BW0, BW2, BW4, BW6, BW8 and BW22 = body weight at ages hatch, 2, 4, 6, 8 and 22 weeks.

TABLE 2. Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 2nd generation among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	Lines	Traits	BW0	BW2	BW4	BW6	BW8	BW22
G2	Tanta G-1	BW0	-	0.76	0.30	0.18	0.20	0.28
		BW2	0.74	-	0.90	0.70	0.80	0.70
		BW4	0.64	0.87	-	0.48	0.54	0.69
		BW6	0.51	0.66	0.80	-	0.78	0.68
		BW8	0.59	0.75	0.83	0.91	-	0.75
		BW22	0.40	0.58	0.73	0.89	0.85	-
	Tanta G-2	BW0	-	0.33	0.39	0.21	0.21	0.11
		BW2	0.73	-	0.81	0.24	0.57	0.52
		BW4	0.48	0.63	-	0.49	0.78	0.52
		BW6	0.38	0.43	0.60	-	0.79	0.16
		BW8	0.48	0.53	0.78	0.61	-	0.45
		BW22	0.41	0.29	0.76	0.62	0.66	-
	Mamourah	BW0	-	0.67	0.65	0.69	0.52	0.72
		BW2	0.55	-	0.87	0.71	0.79	0.75
		BW4	0.54	0.79	-	0.82	0.76	0.78
		BW6	0.40	0.65	0.87	-	0.78	0.82
		BW8	0.42	0.68	0.86	0.96	-	0.76
		BW22	0.47	0.65	0.89	0.96	0.95	-

Gen. = generation; G2= generation 2; BW0, BW2, BW4, BW6, BW8 and BW22 = body weight at ages hatch, 2, 4, 6, 8 and 22 weeks.

TABLE 3. Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 3rd generation among body weights for Tanta G-1, Tanta G-2 and Mamourah chickens.

Gen.	Lines	BW0	BW2	BW4	BW6	BW8	BW22
G1	Tanta G-1	0.10±0.10	0.24±0.13	0.21±0.09	0.22±0.07	0.28±0.19	0.12±0.04
	Tanta G-2	0.10±0.05	0.17±0.11	0.17±0.10	0.20±0.01	0.27±0.11	0.12±0.09
	Mamourah	0.16±0.16	0.12±0.11	0.10±0.04	0.13±0.09	0.12±0.08	0.10±0.06
G2	Tanta G-1	0.17±0.05	0.28±0.03	0.22±0.05	0.23±0.09	0.28±0.07	0.13±0.03
	Tanta G-2	0.18±0.05	0.24±0.07	0.19±0.06	0.21±0.11	0.26±0.10	0.12±0.04
	Mamourah	0.18±0.16	0.14±0.11	0.13±0.05	0.14±0.08	0.13±0.09	0.11±0.05
G3	Tanta G-1	0.30±0.14	0.28±0.09	0.34±0.10	0.24±0.08	0.28±0.08	0.16±0.06
	Tanta G-2	0.33±0.13	0.18±0.08	0.22±0.08	0.20±0.08	0.27±0.05	0.15±0.05
	Mamourah	0.19±0.10	0.17±0.10	0.15±0.09	0.15±0.10	0.15±0.07	0.13±0.07

Gen. = generation; G1= generation 1; G2= generation 2; G3 = generation 3; BW0, BW2, BW4, BW6, BW8 and BW22 = body weight at ages hatch, 2, 4, 6, 8 and 22 weeks.

TABLE 4. Heritability ± SE at three generations of body weights for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	Lines	Traits	BW0	BW2	BW4	BW6	BW8	BW22
G3	Tanta G-1	BW0	-	0.95	0.96	0.86	0.93	0.92
		BW2	0.60	-	0.92	0.89	0.91	0.91
		BW4	0.51	0.74	-	0.90	0.85	0.89
		BW6	0.32	0.56	0.85	-	0.82	0.79
		BW8	0.34	0.60	0.85	0.95	-	0.78
		BW22	0.26	0.50	0.79	0.95	0.94	-
	Tanta G-2	BW0	-	0.77	0.76	0.91	0.82	0.82
		BW2	0.53	-	0.90	0.79	0.80	0.57
		BW4	0.35	0.62	-	0.93	0.77	0.67
		BW6	0.23	0.48	0.91	-	0.67	0.70
		BW8	0.24	0.52	0.92	0.95	-	0.82
		BW22	0.17	0.41	0.88	0.96	0.96	-
	Mamourah	BW0	-	0.93	0.89	0.92	0.91	0.95
		BW2	0.63	-	0.93	0.82	0.92	0.92
		BW4	0.54	0.62	-	0.94	0.92	0.93
		BW6	0.47	0.53	0.92	-	0.90	0.92
		BW8	0.38	0.60	0.89	0.91	-	0.90
		BW22	0.38	0.57	0.90	0.92	0.97	-

Gen. = generation; G3= generation 3; BW0, BW2, BW4, BW6, BW8 and BW22 = body weight at ages hatch, 2, 4, 6, 8 and 22 weeks.

TABLE 5. Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 1st generation among BWSM, FEW, Egg 42 and Egg 90 for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	lines	Traits	BWSM	FEW	Egg 42	Egg 90
G 1	Tanta G-1	BWSM	-	0.17	-0.72	-0.17
		FEW	0.67	-	-0.21	0.01
		Egg 42	-0.69	-0.58	-	00.79
		Egg 90	-0.83	-0.77	0.58	-
	Tanta G-2	BWSM	-	0.20	-0.29	-0.08
		FEW	0.72	-	-0.58	-0.46
		Egg 42	-0.65	-0.79	-	0.82
		Egg 90	-0.55	-0.72	0.79	-
	Mamourah	BWSM	-	0.68	-0.76	-0.88
		FEW	0.55	-	-0.88	-0.77
		Egg 42	-0.61	-0.22	-	0.96
		Egg 90	-0.63	-0.37	0.95	-

Gen. generation; G1= generation 1; BWSM= body weight at sexual maturity; FEW= weight of first egg; Egg 42 = Egg number at 42 wks and Egg 90 = Egg number at 90 wks.

TABLE 6. Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 2nd generation among BWSM, FEW, Egg 42 and Egg 90 for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	lines	Traits	BWSM	FEW	Egg 42	Egg 90
G 2	Tanta G-1	BWSM	-	0.14	-0.03	-0.12
		FEW	0.54	-	-0.47	-0.81
		Egg 90	-0.61	-0.77	-	0.68
		Egg	-0.31	-0.81	0.59	-
	Tanta G-2	BWSM	-	0.76	-0.71	-0.58
		FEW	0.58	-	-0.69	-0.69
		Egg 42	-0.73	-0.67	-	0.95
		Egg 90	-0.69	-0.69	0.95	-
	Mamourah	BWSM	-	0.69	-0.74	-0.87
		FEW	0.54	-	-0.86	-0.76
		Egg 42	-0.63	-0.20	-	0.95
		Egg 90	-0.61	-0.36	0.96	-

Gen. generation; G2= generation 2; BWSM= body weight at sexual maturity; FEW= weight of first egg; Egg 42 = Egg number at 42 wks and Egg 90 = Egg number at 90 wks.

TABLE 7. Genetic correlations (above diagonal) and phenotypic correlations (below diagonal) at 3rd generation among BWSM, FEW, Egg 42 and Egg 90 for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	lines	Traits	BWSM	FEW	Egg 42	Egg 90
G 3		BWSM	-	0.32	0.04	0.07
		FEW	0.47	-	-0.81	-0.75
	Tanta G-1	Egg 42	-0.43	-0.63	-	0.65
		Egg 90	-0.19	-0.54	0.83	-
		BWSM	-	0.68	-0.59	-0.53
		FEW	0.74	-	-0.84	-0.78
		Egg 42	-0.66	-0.71	-	0.74
	Tanta G-2	Egg 90	-0.61	-0.73	0.76	-
		BWSM	-	0.69	-0.75	-0.87
		FEW	0.55	-	-0.85	-0.76
	Mamourah	Egg 42	-0.65	-0.22	-	0.95
		Egg 90	-0.62	-0.38	0.94	-

Gen. generation; G3= generation 3; BWSM= body weight at sexual maturity; FEW= first egg weight; Egg 36 = Egg number at 36 wks Egg and 42 = Egg number at 42 wks.

TABLE 8. Heritability±SE at three generations of BWSM, FEW, Egg 42 and Egg 90 for Tanta G-1, Tanta G-2 and Mamourah chickens

Gen.	lines	BWSM	FEW	Egg 42	Egg 90
	Tanta G-1	0.11±0.08	0.19±0.07	0.43±0.22	0.26±0.03
G1	Tanta G-2	0.13±0.06	0.17±0.08	0.12±0.06	0.28±0.11
	Mamourah	0.11±0.12	0.18±0.16	0.53±0.20	0.52±0.22
	Tanta G-1	0.11±0.09	0.19±0.08	0.23±0.09	0.35±0.12
G2	Tanta G-2	0.38±0.17	0.11±0.10	0.11±0.10	0.18±0.12
	Mamourah	0.12±0.12	0.17±0.16	0.54±0.20	0.50±0.22
	Tanta G-1	0.21±0.11	0.28±0.13	0.23±0.12	0.48±0.15
G3	Tanta G-2	0.31±0.13	0.16±0.13	0.44±0.14	0.40±0.14
	Mamourah	0.12±0.12	0.18±0.16	0.52±0.20	0.51±0.22

Gen. generation; G3= generation 3; BWSM= body weight at sexual maturity; FEW= first egg weight; Egg 42 = Egg number at Egg 90 = Egg number and at 90 wks 42 wks.

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العمق الوراثي، الارتباطات الوراثية و الظاهرية في ثلاث سلالات دجاج مصرية

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تهدف الدراسة التي أجريت إلى دراسة العلاقات الجينية والعمق الوراثي والارتباط المظهري بين وزن الجسم وصفات إنتاج البيض في سلالات الدجاج المصري. تعتبر هذه الصفات حاسمة في إنتاج الدجاج، وتعتبر تحسين هذه الصفات من خلال برامج التهجين والانتخاب هامة لتعظيم الإنتاج. تم الحصول على البيانات المستخدمة في هذه الدراسة من ثلاثة أجيال من ثلاثة سلالات دجاج مختلفة طنطا G-1 و طنطا G-2 والمعمورة. تم استخدام حزمة MCMC glmm فى برنامج R لتقدير الاقتصادية الهامة في دجاج محطة الجميزة. بعد ثلاثة أجيال من عمليات الانتخاب، كانت الارتباطات الجينية بين صفات وزن الجسم تتراوح بين ٠,٧٨ و ٠,٩٦ لطنطا G-1، ٠,٥٧ و ٠,٩١ فى طنطا G-2، و ٠,٨٢ و ٠,٩٣ فى المعمورة. كما تراوحت الارتباطات الظاهرية بين وزن الجسم المختلف من ٠,٢٦ إلى ٠,٩٥ لطنطا G-1، ٠,١٧ إلى ٠,٩٦ لطنطا G-2، و ٠,٣٨ إلى ٠,٩٧ للمعمورة ، وزادت هذه الارتباطات من جيل إلى آخر. بالنسبة لوراثة صفات وزن الجسم، تراوحت بين ٠,١٦ و ٠,٣٤ لطنطا G-1، ٠,١٥ و ٠,٣٣ لطنطا G-2، و ٠,١٣ و ٠,١٩ للمعمورة. تشير الدراسة إلى أن الانتخاب لصفات النمو وإنتاج البيض قد يؤدي إلى تقليل في عدد البيض ولكن قد يتم تعويض ذلك بزيادة وزن البيض لذلك تلقى هذه النتيجة الضوء على الحاجة إلى دراسة متأنية عند الإنتخاب لهذه السمات لتحقيق نتيجة متوازنة ومثالية في إنتاج الدجاج.

الكلمات الدالة: الارتباط الوراثي - الارتباط المظهرى- العمق الوراثي - الدجاج المحلي.