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Study of correlation coefficients in the productive performance of different groups in feathers color and egg quality characteristics in quail

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Abstract: The study aimed to compare the productive performance and egg characteristics of the different groups with the color of the feathers and to estimate the correlation coefficient between the traits in quail (white, brown, and black). The results of the study showed a significant superiority in live body weight, feed consumption, number of eggs produced, and an improvement in feed conversion efficiency in favor of the 8-week-old brown group compared to the rest of the groups. White and brown outweighed the weight and mass of whites over blacks. As for the qualitative characteristics of the egg, it was noted that the brown and black colors were superior in egg width and shell thickness over the white, a highly significant negative correlation was recorded between the two characteristics of the number of eggs produced/female with the values of feed conversion efficiency -0.92 and the characteristics of egg mass and conversion efficiency diet -0.82. Describe the number of eggs produced, the mass of adult eggs 0.83, the number of eggs produced, the characteristics of egg production, weight of eggs, the mass of eggs 0.21, and the characteristics of the egg mass. And egg production was 0.27 and it had a significant positive correlation between the characteristics of the egg-laying weight and the weight of the egg-laying was 0.73 and the weight of the egg-laying with height. The albedo was 0.69 and the albedo weight and height were. It was 0.72, and there was a highly significant correlation between egg width and height 0.81.

Keywords: quail, phenotypic correlation, plumage color, productive traits.

دراسة معاملات الارتباط في الاداء الانتاجي لمجاميع مختلفة بلون الريش وخصائص جودة البيض في السمان

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المستخلص: الهدف من الدراسة مقارنة الاداء الانتاجي وخصائص البيض لمجاميع مختلفة بلون الريش وتقدير معامل الارتباط بين الصفات في السمان (الابيض والبني والاسود) 270 طائر سمان (*Coturnix coturnix japonica*)بعمر يوم. اظهرت نتائج الدراسة الى وجود تفوق معنوي في وزن الجسم الحي واستهلاك العلف وعدد البيض المنتج وتحسن في معدل كفاءة التحويل الغذائي لصالح المجموعة الثانية البنية اللون عند عمر 8 اسابيع مقارنة بباقي المجاميع. وتفوقت المجموعتي الابيض والبني في وزن وكتلة البيض عن الاسود اما صفات البيضة النوعية لوحظ تفوق البني والاسود في عرض البيضة وسمك القشرة على الابيض ولوحظ تفوق معنوي في وزن الصفار لصالح البني مقارنة بباقي المجاميع. وسجل ارتباط سالب عالي المعنوية بين صفتي عدد البيض المنتج/انثى مع كفاءة التحويل الغذائي بلغت القيم -0.92 ، وصفتي كتلة البيض وكفاءة التحويل الغذائي -0.82 ارتباط سالب بين عدد البيض المنتج ووزن البيض بلغ -0.37 . ارتباط معنوي موجب لصفة عدد البيض المنتج وكتلة البيض بلغ 0.83 وعدد البيض المنتج وصفة انتاج البيض، ووزن البيض وكتلة البيض 0.21 وصفتي كتلة البيض وانتاج البيض 0.27 وارتباط موجب معنوي بين صفتي وزن البيضة مع وزن البياض بلغ 0.73 ووزن البيضة مع ارتفاع البياض 0.69 ووزن البياض وارتفاعه 0.72 وارتباط عالي المعنوية بين عرض البيضة وارتفاع البياض0.81.

الكلمات المفتاحية: طائر السمان، الارتباط المظهري، لون الريش، الصفات الإنتاجية.

Introduction

Quail is considered one of the economic birds due to its low weight and its consumption of fewer feed quantities, as it is suitable for intensive breeding due to its small size as well as short period of generation (3-4) per year and early puberty and its low costs. It is considered a valuable resource for meat and eggs, in addition to its resistance to the harsh environment and resistance to diseases that what made it a suitable animal for experiments in research centers and stations (Jatoi et al., 2013) and (Rabie, 2019).

To improve the productive performance of birds, it is necessary to estimate the strategic methods for improving the productive traits (Vali et al., 2005). The selection program does not only affect the characteristics of egg production, but also affects the color of the feathers, which depends on different genes, and there is a positive correlation between different feather colors and quantitative traits (Delmore et al., 2016). Through the research conducted, it was observed that color is significantly associated with body weight, abdominal fat, and egg characteristics (Minvielle et al., 1999). Therefore, this study was conducted to evaluate the main productive traits and to estimate the phenotypic correlation between traits in the three different lines of feather color in for of body weight, feed consumption, and feed conversion efficiency. Which is the main focus of the current study. In addition, the measurement of egg production and egg quality characteristics.

Materials and Methods

This study was conducted in the animal production farms of the Department of Animal Production / College of Agriculture and Forestry / University of Mosul for the period from 1/6/2022 to 27/7/2022. 270 quail birds (Coturnix coturnix japonica) of white, brown, and black color, aged one day, were used. It was distributed randomly into 3 groups according to the color of the feathers, in each of which there were 3 repetitions of 30 birds, all birds were fed on a diet according to that was formed (N.R.C, 1994) (Table 1).

Table (1) Diet components in this study

Feeding material	Starter	Finisher
Yellow corn	49	41
Wheat	-	21
Protein center	15	10
Soybean meal	32	21
sunflower oil	3	2
Calcium	0.9	4.5
Table salt	0.1	0.5
Total	100	100
Protein Ratio	23.89	20.4
Calculated energy kcal/kg	2971	2834

Feed and water were given freely to the birds, and all the birds were placed in wooden cages. The phenotypic correlation was estimated between three groups of black, brown, and white quails in terms of productive traits. Live body weight (gm), feed conversion efficiency (gm feed: gm eggs), feed consumption (gm), egg weight (gm), eggs produced number (egg), egg weight (gm), egg mass (gm), qualitative characteristics of eggs.

The Statistical analysis

using the completely randomized design (C.R.D). The averages were compared with the Duncan test for all the studied traits at the level of significance (A > 0.05) and using the ready-made program (SAS, 1992). The mathematical model that was relied upon in the statistical analysis

yij = M + ti + Eij, as:

yij = value of any observed in the experiment.

M = overall average of observations.

Gi = the effect of genetic starvation, where i brown, white, and black.

Eij = standard error effect

Results and discussion.

From the results of the statistical analysis (Table 2), there was a significant superiority in the live body weight in favor of the brown-feathered quail group, as it gave a body weight of (217.8) and (266.8) gm in the sixth and eighth weeks for the white and black-feathered quail, as the weight reached (195.3, 197.3) and (213.9, 204.8) gm for the sixth and eighth weeks, respectively. The reason for the difference in weight may be due to the genetic makeup, which has a major role in raising and lowering body weight using selection. The reason is also that black feathers are more mobile, nervous, and aggressive than the birds of the color of brown feathers, which leads to instability of the birds (Al-Eidani, 2014). These results were similar to the results of (Tawfeeq and Hadi, 2021), who mentioned that the brown quail outperformed the white quail at the age of 6 weeks, and similar to what was found by(Al-Kafajy et al., 2018), Where they mentioned that the brown was superior to the white in body weight, while it did not differentiate from the black, and no significant differences appeared in the live body weight in the seventh week between the three groups. Through the results, there was a significant improvement in the efficiency of feed conversion in favor of the white-feathered quail (3.0) gm of feed/gm of eggs for the seventh week compared to the brown and black-feathered quails (3.53 and 3.40) gm of feed/gm of eggs, respectively. While were observed no significant differences. in the efficiency of feed conversion at the age of six and eight weeks among the three groups, These results are similar to what was found by (Al-Muaini et al., 2007), While they did not notice any statistically significant differences between raw and white at the age of six weeks for the efficiency of feed conversion, and (Hassan and Abd-Alsttar, 2016) at the age of six weeks in their studies on white, brown and black quail. In terms of feed consumption, the brown quail consumed more feed (185.5) gm in the sixth week, followed by the white-feathered quail, then the black-feathered quail, with the amount of feed consumption amounting to (175.7, 175.3) gm, respectively. These results were similar to what was found by (Al-Muaini et al., 2007), and the white and brown quails excelled in the consumption of feed over the black quail at the age of seven weeks, was (210.8, 205.5, and 174.2) grams, respectively, but at the eighth week, the white quail was superior to the rest of the groups. They were (210.7, 178.6, and 178.0) grams, respectively. The reason for the difference in feed consumption between the three groups is due to the difference in genotypes.

Table (2) Mean ± standard error of genotype effect on mean live body weight, feed conversion efficiency, and feed consumption during the productive period.

Traits	Periods (Week)	Breeds White	Brown	Black	
average live body weight (g)	6	195.3±5.88	217.8±7.90	197.3±4.73	N.S
	7	210.9±4.79	219.7±5.14	203.1±4.36	N.S
	8	213.9±3.16 b	266.8±1.61a	204.8±2.28 c	*
feed conversion efficiency (g fed/g egg)	5	3.83±0.21	4.93±0.58	4.07±0.15	N.S
	6	3.00±0.22 b	3.53±0.24 a	3.40±0.11 a	*
	7	2.90±0.20	2.53±0.21	2.43±0.12	N.S
feed consumption (g)	6	175.7±1.12 b	185.5±1.20 a	175.3±1.89 b	*
	7	210.8±0.90 a	205.5±1.04 a	174.2±1.10 b	*
	8	210.7±0.54 a	178.6±0.98 b	178.0±1.04 b	*

***Mean with a different letter in the same horizontal indicate a statistical difference (P≤0.05)**

The results in (Table 3) indicated in the productive characteristics of eggs there were significant differences, as the white and brown quails excelled in the number of eggs produced / female at the age of the seventh week over the black quails. The number of eggs was (5.7, 5.2, and 4.5) eggs, respectively, while there were no significant differences in the number of eggs produced for each female in the sixth and eighth weeks. These results were similar to those (Hussen and Saleh, 2019) and contrary to (Al-Kafajy et al., 2018) where it was stated that the brown outnumbered the white and the black at the age of eight weeks. As egg production for the characteristic of significant differences were observed in the production of eggs for the sixth and seventh week for each of the white and black quails compared to the brown-feathered quails, and the ratio was (57.10, 56.30, and 46.30) and (82.00, 83.90, and 74.80) percent for the sixth and seventh weeks, respectively.

At the age of 8 weeks, no significant differences were observed between the quail groups. As for the weight of the eggs, no significant differences were observed between the quail groups at the sixth, seventh, and eighth weeks of the breeding period. These results were similar to (Hussen and Saleh, 2019), as they did not notice any significant differences in the weight of eggs between white, light brown, and dark quails. And (Al-Eidani, 2014) and (Hassan and Abd-Alsttar, 2016). While the results showed significant differences in the mass of eggs in the sixth week in favor of the white-feathered quail, then black-feathered for the brown quail, the egg mass was (47.73 and 43.70) gm compared to (37.67) for the sixth week. The white-feathered quail was superior, as it gave a mass of (70.27) gm over the rest of the groups, while the brown and black-feathered quails had a mass of (58.03, 51.70) gm, respectively. in the seventh week, and this may be due to the existence of a positive and highly significant correlation coefficient between the mass of eggs and the weight of eggs on the one hand, and the number of eggs produced on the other hand (Al-Tikriti, 2010). However, in the eighth week, no significant differences were observed in the mass of eggs produced between the three groups. It was similar to what was found by (Salih and Hussen, 2019), as they noticed that there were no significant differences between the white, light brown, and dark brown feathers of Japanese quail in the average egg mass.

Table (3) Mean ± standard error of genotype effect of the genetic group on the productive characteristics of eggs during the productive

Traits	Periods (Week)	Breeds White	Brown	Black	
Egg N./f	6	4.0±1.73	3.2±1.30	3.9±1.89	N.S
	7	5.7±1.60 a	5.2±1.15 ab	4.5±1.31 b	*
	8	5.9±1.31	6.6±1.62	6.3±2.04	N.S

Traits	Periods (Week)	Breeds White	Brown	Black	
H.D. %	6	57.10±0.57 a	46.30±1.15 b	56.30±1.57 a	*
	7	82.00±1.15 a	74.80±2.31 b	83.90±1.73 a	*
	8	91.70±1.32	93.87±1.76	90.20±1.11	N.S
Egg W .g	6	11.93±0.58	11.76±0.91	11.13±0.16	N.S
	7	12.33±0.85	11.20±0.49	11.53±0.33	N.S
	8	12.43±0.29	11.70±0.21	11.63±0.35	N.S
Egg M. g	6	47.73±3.32 a	37.67±1.21 b	43.70±1.97 ab	N.S
	7	70.27±2.16 a	58.03±2.04 b	51.70±1.69 c	*
	8	73.13±2.16	77.10±3.16	73.20±1.67	N.S

***Mean with different letters in the same horizontal indicate a statistical difference (P≤0.05) where is, Egg N./f = egg number/female, Egg W = egg weight. H.D. %= hen day production, Egg M= egg mass.**

Table 4 shows the qualitative egg characteristics of quail groups, where the results showed that there were significant differences between the groups in the length and width of the egg in favor of the brown and black feathers compared to the white quail Feathers, as the length of the egg was (31.29, 32.88, and 30.65) mm, and the width of the egg was (26.13, 25.65, and 25.18) mm, respectively. The brown one was superior in yolk weight to the white and black feathers

Table (4) Mean ± standard error of genotype effect of the genetic group on the specific characteristics of eggs during the productive period

Traits	Breeds White	Brown	Black	
Egg W .(g)	11.05±0.39	12.16±0.36	11.85±0.21	N.S
Eg. Le (mm)	30.65±0.46 b	31.29±0.67 ab	32.88±0.62	*
Eg. Wi (mm)	25.18±0.27 b	26.13±0.24 a	25.65±0.26 ab	*
Alb. W .(g)	5,57±0.39	6.31±0.39	6.62±0.10	N.S
Yol. W .(g)	3.79±0.67 b	4.21±0.46 a	3.68±0.16 b	*
Sh.W .(g)	1.70±0.15	1.64±0.12	1.43±0.14	N.S
Alb.h (mm)	4.12±0.25	4.10±0.24	4.14±0.38	N.S
Yol. H (mm)	9.79±0.11 b	9.68±0.29 b	10.91±0.37 a	*
Sh.Th (mm)	0.28±0.16 b	0.32±0.13 a	0.34±0.09 a	*

***Mean with different letters in the same horizontal indicate a statistical difference (P≤0.05) where is, Egg W = egg weight, Eg. Le= egg length, Eg. Wi= egg width, Alb. W= albumen weight (g), Yol. W= yolk weight (g), Sh. W= shell weight, Alb. h= albumen high (mm), Yol. h =yolk high (mm),Sh. Th= shell thickness.**

(4.21, 3.79, and 3.68) grams, respectively. As for the characteristic of the yolk height, the black feathered quail was superior to both white and brown feathers, as the yolk height reached (10.91, 9.79, and 9.68) mm respectively, while the shell thickness of brown and black feathers reached (0.32 and 0.34) mm, and the white feathers recorded a lower shell thickness of (0.28) mm. As for the weight of the egg, the weight and height of the white, and the weight of the shell, no significant differences were observed between the three groups. These results were close to what was found by (Al-Neemy, 2017), it was mentioned that there were no significant differences in the weight and length of the eggs and the weight of the shell between the groups of white, black, and brown quail.

Table 5 shows the phenotypic correlations between the productive traits, where a highly significant negative correlation appeared between the two traits, the number of eggs produced/female, with the feed conversion efficiency (-0.92), the two traits of egg mass and the feed conversion efficiency (-0.82), and a negative correlation coefficient between the number of eggs. The product and egg weight amounted to (-0.37), egg weight and egg production amounted to (-0.22), as well as between the characteristics of feed conversion efficiency and egg production (-0.11). Product and egg production recipe (0.39), egg weight and egg mass (0.21), and egg mass and egg production characteristics (0.27). This means that improvement to increase the number of eggs will lead to an increase in the mass of produced eggs with a decrease in the average egg weight. These results are identical to both (Nasser, 2010) and (Al-Tikriti, 2018).

Table (5) phenotypic correlations between productive traits

	egg weight	egg mass	feed conversion efficiency	hen day production Egg
Egg number/female	-0.37	*0.83	**-0.92	0.39
egg weight	-	0.21	0.25	-0.22
egg mass		-	**-0.82	0.27

	egg weight	egg mass	feed conversion efficiency	hen day production Egg
feed conversion efficiency			-	**-0.11**

Table 6 shows the phenotypic correlations between the specific characteristics of the egg, where a significant positive correlation appeared between the characteristics of the weight of the egg with the weight of the white amounted to (0.73) and the weight of the egg with the height of the white (0.69). The correlation of the weight of the egg with the weight of the yolk and shell was positive (0.19 and 0.19). (Respectively, the improvement in egg weight leads to an increase in the internal components of the egg due to the presence of significant correlations. These results were consistent with what I found (Nasser, 2010) and (Hartmann et al., 2000), while non-significant negative correlation appeared between egg weight with yolk height and shell thickness (-0.10, -0.40). A highly significant correlation appeared between the width of the egg with the height of the white (0.81), and a significant correlation between the length of the egg and the height of the yolk. As for the weight of the white, the correlation between it and the weight of the yolk and the shell was negative, while there was a significant positive correlation between the weight of whiteness and the height of whiteness. A positive correlation of yolk weight was also shown between yolk weight and shell weight, as well as between the weight of the yolk, the height of the yolk, and the thickness of the shell, while a negative, non-significant correlation appeared between the weight of the yolk and the height of the white, and a positive correlation appeared between the weight of the shell and the height of the white and the yolk, and a negative phenotypic correlation appeared between the height of the white With the height of the yolk and the thickness of the shell, as well as a negative correlation between the height of the yolk and the thickness of the shell. These results were similar to each of (Olawumi and Christiana, 2017).

Table (6) phenotypic correlations between egg-specific traits

	albumen weight	yolk weight	egg width	egg length	shell weight	albumen high	yolk high	shell thickness
egg weight	**0.73***	**0.19**	**0.77***	**0.32**	**0.19**	**0.69***	**-0.10**	**-0.40**
albumen weight	-	**-0.42**	**0.53**	**0.41**	**-0.42**	**0.72***	**-0.40**	**-0.31**
yolk weight		-	**0.19**	**0.20**	**0.55**	**-0.28**	**0.43**	**0.30**
egg width			-	**0.16**	**0.27**	**0.81****	**0.02**	**-0.09**
egg length				-	**-0.02**	**-0.21**	**0.57***	**-0.24**
shell weight					-	**0.09**	**0.41**	**-0.22**
albumen high						-	**-0.43**	**-0.25**
yolk high							-	**-0.12**
shell thickness								-

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