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Effect of Plumage Colour on The Productive and Physiological Performance of Two Lines of Turkey During Egg Production Period

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Abstract: Using 32 hens from two turkey lines; broad-breasted bronze (BBB) and bourbon red (BR), this study assessed how plumage colour affects egg production and physiological functions during (26-40) weeks of observation. A total of 32 hens, namely 16 hens from the BBB line and 16 hens from the BR line, were bred from 26 weeks up to 40 weeks of age. According to our results, BBB line significantly ($p \le 0.05$) outperformed BR line in terms of body weight at first egg production, feed intake, and yolk diameter during the study period. A significantly ($p \le 0.05$) higher feed conversion ratio, an increased egg mass, a higher production rate of hen-day eggs, and a higher rate of albumen was achieved by the BR line. It is, however, noteworthy that the age at first egg production, the egg weight, the egg mass, the yolk weight, the yolk percentage, the albumen weight, the shell weight percentage, the egg shell thickness, width, and length, the shape index, yolk height and yolk index were not significantly ($p \ge 0.05$) different between the two lines at 24 and 36 weeks of age. The levels of luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were not significantly ($p \ge 0.05$) different between the two lines at 24 and 36 weeks of age when eggs were produced. Both turkey lines presented in the current study can potentially be raised in Iraq, as well as used as hens to produce hatching eggs and for genetic improvement.

Keywords: Egg production performance, Egg quality traits, Turkey hens.

Introduction

Poultry farming projects have been increased to produce meat and eggs to lessen the effect of gaps in animal protein due to growing global dietary requirements for protein in conjunction with the increase in the human population worldwide. Along with chickens, ducks, and guinea pigs, turkeys (*Meleagris gallopavo*) play a significant role globally in meeting the world's demand for protein (Pogodaev *et al*., 2020). Currently, commercial turkeys are descended from a subspecies of turkeys native to southern Mexico, which have undergone hybridisation with wild turkeys from the east (Crawford, 1992). Eight types of American turkey were established with plumage colour as the primary criterion, and as a result, most of the modern commercial varieties have a significant body weight and fast growth rate due to the direct impact of body weight-based selection. Three of the commercial varieties, Beltsville Small White, Bourbon Red (BR), and Royal Palm, were registered in 1951, 1909, and 1971, respectively, while the other five, Broad-breasted Bronze (BBB), Narragansett, White Holland, Black, and Slate, were registered in 1874 (Owens & Sams, 2000; Li & Hsieh, 2004). Thus, lines with various plumage colours were formed due to long-term selection processes and genetic cross-breeding amongst various turkey kinds (Bayyari *et al*., 1997). As egg quantity affects the number of hens for satisfactory egg production performance, therefore, it plays a significant role in the turkey industry. As a result, selection is heavily focused on egg quantity (Adikari *et al.*, 2016). Due to the variations in the plumage colour of different turkey varieties, the egg production period, egg weight, and egg quality results of previous studies vary (Anandh *et al*., 2012; Amao *et al*., 2016; Yenice *et al*., 2016; Pogodaev *et al*., 2020; Yahaya *et al*., 2021). In addition to the lack of information about its genetic potential for egg production and the expansion of projects aimed at producing meat rather than eggs, raising various local turkey lines, such as the Black, BBB, BR, and White turkeys, did not spread widely at the commercial or domestic levels in Iraq (Al-Janabi *et al*., 2019). To develop egg production with genetically improved traits and confirm the degree of adaptation of various turkey lines to environmental conditions, their egg production performance must be evaluated locally. The plumage colour of poultry has been widely used as a morphological genetic marker for selection at an early age. As such, an independent evaluation of each line is necessary to assess their genetic potential and the possibility of improving their egg production performance to create a database of these lines in Iraq (Yang *et al*., 2019; Dodamani *et al*., 2021). Furthermore, by establishing parent stocks, it is possible to assess the reproductive fitness of these lines for economic breeding. The current study set out to assess how plumage colour affects egg production performance of two local turkey lines as well as their physiological health during the egg production period.

Materials & Methods

Experimental location

This study was conducted at the poultry production field, Department of Animal Production, College of Agriculture, University of Basrah. The period of the study lasted from 10/1/2022 up to 10/6/2023.

Source and management of the birds

Two lines of turkeys from the Sulaymani governorate in Kurdistan, Iraq were the subjects of the study. A total of 32 hens, namely 16 hens from the BBB line and 16 hens from the BR line. The initial body weights of the two lines were 3084.03 ± 284.94 g for BBB line and 2300.75 ± 243.08 g for BR line. The birds were bred at 26 weeks before the age of first egg production. Throughout the breeding period, which lasted from 26 to 40 weeks, the hens of each line were randomised distributed into four wire cages (2 metre long, 2 metre wide and 3 metre deep) in a closed hall. Each cage had four hens. Throughout the test period, there was an unlimited supply of water and feed. A basal diet designed to satisfy the nutritional needs of layer turkeys was given to the hens. As per the recommendation of the 1994 nutrient requirements of poultry (NRC, 1994), the feed had 15% crude protein and 2872 $Kcal.Kg^{-1}$ of metabolic energy/kg of feed. The composition and chemical analysis of the diet are shown in table (1). During the test period, a daily lighting schedule of 16 hours of light and eight hours of darkness at a lighting intensity of 4 w/m^2 was implemented. Throughout the test period, the average temperature inside the hall was maintained at 24°C, while the relative humidity was 40%.

Table (1): Ingredients and composition of the dry basal diet fed to turkey hens.

Ingredient	Composition (%)
Yellow corn	58.0
Wheat	10.0
Soybean meal (44%)	17.0
[1]Vitamins and minerals	2.5
Limestone	7.0
Wheat bran	4.0
Vegetable oil	1.0
Sodium chloride	0.5
Total	100
Calculated Chemical Composition	
Crude protein (%)	15
[1]ME (kcal.Kg^{-1}) diet	2872
Calori : protein ratio	191
Ether extract %	3.6
Crude fiber %	33
Lysine %	0.67
Methionine + cysteine %	0.5
Calcium (%)	2.6
Phosphorous available (%)	0.38

[1]Vitamins and minerals: 1 kg of premix contains 400.000 IU vitamin A, 100.000 IU vitamin D3, 2.000 mg vitamin E, 100 mg vitamin k3, 100 mg vitamin B1, 200 mg vitamin B2, 300 mg Pantothenic acid, 200 mg vitamin B6, 1.000µg B12, 1.200 nicotinic acid, 80 mg folic acid, 4mg Biotin, 12000 mg Choline Chloride. [1]ME (kcal. Kg^{-1}) diet = Metabolizable energy

Egg production performance

At the age of the first egg production, the body weights of the hens were measured individually using an electronic weighing scale. During the test period (26 - 40 weeks), the feed intake was measured as the difference between the amount of feed offered and the feed residue. Every day, the eggs from each cage were gathered and recorded. Using the logarithm provided, total egg production and hen-day egg production (%) were computed. The average number of eggs produced in a week was equal to the total number of hens housed in the cage that week. By counting the number of eggs produced each day from 26 to 40 weeks of the study period, the total number of eggs was determined. An electronically sensitive scale was used to weigh the eggs to an accuracy of 0.01 g. The feed conversion ratio was computed by determining how much feed was eaten for every kilogram of eggs. The egg weight multiplied by the egg production rate yielded the egg mass.

Egg quality

Egg quality was assessed at 36 weeks of age. A total of 24 eggs, 12 eggs from each line or three eggs from each cage, were brought to the laboratory of the Department of Animal Production of College of Agriculture and examined 24 hours later. The yolk weight, albumen weigh, and shell weight were measured using an electronically sensitive scale to an accuracy of 0.01 g. The yolk (%), albumen (%), and shell (%) were determined using the average egg weight. Using a specialised micrometre, the average of three measurements, taken at the pointed end, equator end, and broader end of each egg, was used to determine the thickness of the shell. The shape index was calculated by dividing the egg width by the egg length and multiplying the result by 100. The egg length was determined by measuring the longitudinal distance between the narrow and broad ends, while the egg width was determined by measuring the diameter of the widest section of the egg with a Vernier calliper to an accuracy of 0.01 mm. The yolk index was determined by dividing the yolk height by the yolk diameter, while the quality was determined using the techniques outlined by Stadelman (1995) and Peebles & McDaniel (2004).

Hormones

Four hens were randomly selected from each line (one/cage) at 26 weeks before reaching sexual maturity, and at 36 weeks on reaching 50% of egg production. Blood samples were taken from the jugular vein of the wing. Two milliliters of blood per sample were taken. The tubes were centrifuged at 3000xg for five minutes to obtain plasma. For the hormone analyses, the plasma samples were kept in storage at -20°C. Using a commercial ELISA kit (Biomerieux Company, France), the plasma concentrations of the follicle-stimulating hormone (FSH) and luteinising hormone (LH) were measured according to Brady *et al*. (2021).

Statistical analyses

To test the main effects of the lines, the collected data were put through a completely randomized design experiment with four cages and four hens from each line in IBM® SPSS (2012). The least significant difference (LSD) test at ($p < 0.05$) was used to help with the differences between the means (SPSS, 2012). The single observation (Yij), the overall mean (μ), the effect of the ith line (Si), and the random error (eij) were all independently, identically, and normally distributed with a zero mean and constant variance in the statistical model for the data. The data of the effect of lines and age and their interaction on FSH and LH levels were put through a completely randomized factorial design. The least significant difference (LSD) test at ($p < 0.05$) was used to help with the differences between the means (SPSS, 2012). The single observation (Yijk), the overall mean (μ), the effect of the ith line (Si), the effect of jth age (Ej), the effect of line and age interaction (Si Ej) and the random error (eijk) were all independently, identically, and normally distributed with a zero mean and constant variance in the statistical model for the data.

Results & Discussion

Effects of plumage colour on egg production performance

The Broad-breasted Bronze (BBB) line outperformed the Bourbon red (BR) line in terms of body weight at first egg and feed intake during the egg production period (Table 2). However, there was no significant ($p < 0.05$) difference in the age at first egg production between the two lines. These findings might be explained by the fact that, in contrast to the Bourbon Red line, hens of the Board Breasted Bronze are genetically predisposed to high growth during the growth stage until sexual puberty at the first egg. The BBB line consumed significantly ($p < 0.05$) more feed than the BR line as the hens with higher body weights required more feed during the egg production period due to the positive correlation between high body weight and feed intake in turkeys (Willems, 2014). In general, as with broilers and layers, the nutritional needs of various turkey lines in Iraq have not been precisely determined. Adikari *et al*. (2016) compared the growth performance of seven heritage varieties of turkeys with hybrid turkeys. Their findings indicated that the groups had different genetic abilities, with the Narraganset being the heaviest and Royal Palm having the lowest body weight. The results of the current study were consistent with their findings. With reference to the age of the first egg production, earlier research on turkeys found that all hens have varying sexual maturity ages, ranging from 24-55 weeks (Yang *et al*., 1999). The feed conversion ratio of the BBB line was significantly ($p < 0.05$) lower than that of the BR line ($p < 0.05$). The BR line had a significantly ($p < 0.05$) higher egg number and hen- day egg production (%) than the BBB line ($p < 0.05$; Table 2). This could indicate that the BR line had a better feed conversion ratio than the BBB line. The findings concurred with those of a prior study, which discovered that up to 20 weeks of age, BBB line had a numerically lower feed conversion ratio (3.5) than black (4.0) and White turkeys (4.5) (Das *et al*., 2018). This was because their diet had been improved to include all the necessary nutrients, particularly a high protein content. However, earlier reports showed that the average feed conversion ratio for turkeys at 20 weeks was roughly 2.72 (Waibel *et al*., 2000).

Table (2): Effect of plumage colour on the productive performance traits during the egg production period (mean ± SE).

Productive performance Parameters	Line	
	BR	BBB
Body weight at first egg (g)	$3433.67^{b} \pm 178.74$	$3965.95^{a} \pm 59.75$
Age at first egg (day)	$213.50^{a} \pm 2.02$	$219.50^{a} \pm 2.39$
Feed intake (g)	$12670.00^{b} \pm 425.72$	$14810.00^{a} \pm 191.57$
Feed conversion ratio (g/g)	$1.84^{b} \pm 0.01$	$2.55^{a} \pm 0.14$
Egg number	$88.25^{a} \pm 1.79$	$78.25^{b} \pm 2.56$
Hen-day production (%)	$26.26^{a} \pm 0.53$	$23.28^{b} \pm 0.76$
Egg weight (g)	$77.71^{a} \pm 1.73$	$74.57^{a} \pm 3.03$
Egg mass (g)	6857.91 ± 208.61	$5848.09^{a} \pm 279.82$

a,b: Means in the same row with no common superscript are different significantly ($p<0.05$).
BR: Bourbon Red Line. BBB: Broad-breasted Bronze Line.

The plumage colour did not significantly affect the egg weight or egg mass, although the BR line had numerically higher values of both (Table 2) than the BBB line. According to research, the egg weight varies greatly among genetic groups, suggesting that it is a highly heritable trait (Yahaya *et al*., 2021). Additionally, during the egg production period, the BR line outperformed the BBB line in terms of the hen day egg production (%) by a marginal significance ($p < 0.05$).

These findings could have been the result of the hens from both lines having different genetic potentials, which could have been caused by different genotypes and, ultimately, different genetic variations in the egg production performance of both lines from the age at first egg production to the end. Conversely, hens raised on board may possess genes for both faster growth and higher egg production, suggesting that this lineage possesses traits for both types of egg production performance. In this study, the average egg weights of both lines fell within the previously reported ranges.

Özçelik *et al.* (2009) reported that the mean egg weights of turkeys increased with age, ranging from 67.4 - 70.3 g during the early stages of egg production. The findings of the current study diverged from those of Mroz *et al*. (2014), who studied broad-breasted white turkeys and found that their egg weights were higher (89.86 g) in the early laying phase, increasing steadily to 101.4 g at 23 weeks of egg production. This suggested that the egg weights fell into the category of very large eggs, which may be explained by the selection that these breeds underwent, wherein the egg weight was one of the selection criteria. Yahaya *et al*. (2021) discovered that the egg weights (72.63 g) of White turkeys were higher ($p < 0.05$) than that of black turkeys (69.12 g), indicating that the egg weights of both turkeys fell into the small to medium category. This indicated that although the standard coefficient of variation for the egg weight was roughly 6 - 7%, it could be as high as 8 - 9% during the first week of laying. The age at photostimulation, flock age, and strain all affected the egg weight. In terms of the egg production, the layer chickens produced different egg quantities in the early and later stages (Anang *et al*., 2002). According to a prior study on young large White turkey hens, the age at first egg production started at 27 weeks and increased gradually to reach a peak of 36% by 35 weeks, staying roughly the same at 38 weeks after the experiment ended (Siopes, 2010). The variations in the egg production in this study concurred with those of Pogodaev *et al*. (2020), who studied six different turkey breeds and found that the Silver North Caucasian had a higher egg production (45.19%) than the Uzbek fawn, white north Caucasian, and bronze north Caucasian. It also had the highest egg number in the first and middle 20 weeks (50.33 and 64.10 eggs, respectively). However, after 20 weeks of egg-laying, the Blue turkey, from a new gene pool for 2018, produced 49.32 and 59.28 eggs, respectively, for the initial and average layer hens. Brady *et al*. (2020) reported that the primary cause of variations in the egg production is the gonadal axis hormones, as high-producing hens tend to show higher basal levels of the LH messenger ribonucleic acid (mRNA) than low-producing hens. Additionally, Begli *et al*. (2021) used a pedigree-based random regression best linear unbiased predictor (BLUP) model to estimate the variables of egg production over 24 weeks. They found that environmental differences had a significant impact on the egg production, with estimated heritability values for this trait during the first 18 - 20 weeks ranging from moderate to high (0.22). After that, a decrease in heritability values (0.12) was observed during the final four weeks due to a decrease in genetic correlation with longer time intervals between weeks of egg production. Psychologically, the reproductive systems of turkey hens change from an immature non-functional state to a mature functional state 2 - 4 weeks post-photo stimulation of photosensitive hens. Different genotypes of turkey hens may also produce different egg quantities in response to different management conditions (Lewis & Morris, 1998; Renema *et al*., 1998; Buchanan *et al*., 2000).

Effect of plumage colour on egg quality

Table (3) displays the characteristics of the qualities of the 36-week-old eggs of the two lines. Variations in the yolk (%) and shell (%) as well as the yolk weight, albumen weight, and shell weight were not statistically significant ($p < 0.05$). Additionally, insignificant differences in the egg width, egg length, yolk height, and yolk index were noted between the two lines ($p < 0.05$). The yolk diameter of the BBB line was significantly larger than that of the BR line ($p < 0.05$), and the albumen (%) of the BR line was significantly higher than that of the BBB line ($p < 0.05$). It is a known fact that the different egg compositions are significantly influenced by the genotypes of layer chickens and turkeys (Yasmeen *et al*., 2008; Isidahomen *et al*., 2014). Hens from both lines produced proper egg qualities, with no appreciable differences between most of the qualitative characteristics of their eggs. This could be because there were no variations in the egg weights and the egg masses of the two lines. This outcome might point to the potential use of hens from the two lines for both genetic improvement and the production of hatching eggs. However, another factor that affects the external and internal egg quality is the age at which the egg is measured. Reidy *et al*. (1994) showed that variations in the egg weight were related to the albumen amount of the egg. Specifically, hens of the Nicholas breed produced eggs with 3.81 g more albumen than the BUTA breed, resulting in an approximate increase of 4.9 g in egg weight.

Table (3): Effect of plumage colour on egg quality traits during egg production period (mean ± SE).

Characteristics (at 36 wk of age)	Line	
	BR	BBB
Egg width (mm)	$46.94^{a}\pm0.35$	$46.35^{a}\pm0.70$
Egg length (mm)	$63.35^{a}\pm0.60$	$64.76^{a}\pm0.96$
Shape index (%)	$74.12^{a}\pm0.74$	$71.64^{a}\pm1.21$
Yolk weight (g)	$23.53^{a} \pm 0.64$	$23.80^{a}\pm0.43$
Yolk (%)	$30.33^{a} \pm0.81$	$32.20^{a}\pm1.11$
Albumen weight (g)	$44.74^{a} \pm1.48$	$40.44^{a}\pm2.55$
Albumen (%)	$57.50^{a} \pm0.75$	$53.87^{b}\pm1.33$
Shell weight (g)	$9.93^{a} \pm0.16$	$10.32^{a}\pm0.49$
Shell (%)	$12.81^{a} \pm0.25$	$13.91^{a}\pm0.57$
Shell thickness (mm)	$0.92^{a} \pm0.11$	$0.84^{a}\pm0.08$
Yolk diameter (mm)	$41.52^{b}\pm0.85$	$44.08^{a}\pm0.62$
Yolk height (mm)	$25.02^{a}\pm0.78$	$26.06^{a}\pm1.01$
Yolk index	$60.26^{a}\pm0.02$	$59.12^{a}\pm0.022$

a, b: Means in the same row with no common superscript are different significantly ($p<0.05$).
BR: Bourbon Red Line. BBB: Broad-breasted Bronze Line.

The egg length and egg width values of both lines were fairly similar to those reported by Adeyeye (2009) for Ethiopian turkeys (length of 65.0 mm and width of 47.0 mm). Furthermore, the outcomes were in line with the findings of Mroz *et al*. (2014), who discovered that the shape index values of Broad-breasted White turkeys vary from 69.16 - 73.09% during the early laying phase. The findings of this study corroborated those of Isidahomen *et al*. (2014), who discovered a genotype effect on the external and internal egg qualities of layer turkeys. Specifically, the exotic strain had a higher egg length (6.27) and a lower mean egg width (5.85), while the local strain had better albumin weight, yolk length, and yolk weight than the local and crossbred strains. The findings of the current study differed from those of Popoola *et al*. (2015) as the average egg length and egg width of Nigerian turkeys were 62.4 and 46.1 mm, respectively. In the same vein, Uzbek fawn turkeys had a higher SI (69.3%) than Moscow white, bronze north Caucasian, white north Caucasian, Tikhoretskaya black, and silver north Caucasian turkeys (Pogodaev *et al*., 2020). The albumen weights of both lines were 40.44 g for BBB line and 44.74 g for BR line, which were somewhat similar to the findings of Applegate *et al*. (2005). Nevertheless, at 33 weeks of age and two months into laying, the White turkey strain showed a highly significant superiority over the black turkey strain in terms of egg length, albumen weight, yolk weight, shell weight, and yolk diameter ($p < 0.01$). These results were consistent with the findings of a prior study (Yahaya *et al*., 2021). The shape index range of the turkey eggs (70-76%) fell within the normal range, according to the results of this study regarding the shape index of the eggs.

Effects of plumage colour and age on follicle-stimulating hormone (FSH) and luteinising hormone (LH) levels

Table (4) displays the effect of line according to plumage colour and age on FSH and LH levels at 26 and 36 weeks of age. The results demonstrated insignificant differences between BBB and BR lines in FSH and LH levels. Whereas, the results revealed significant ($p < 0.05$) elevation in FSH and LH levels at 36 weeks of age during the egg production period in comparison to FSH and LH levels at 26 weeks of age before the egg production period. This finding was consistent with the notion that the FSH and LH influence the reproductive processes of hens, where the FSH stimulates the development and maturity of the ovum, while the LH aids in the ovulation of the ovum (Barros *et al*., 2020). A significant ($p < 0.05$) superiority was noted in the egg number and hen- day egg production (%) of the BR line compared to the BBB line ($p < 0.05$; Table2), which confirmed that both lines had the genetic potential for egg production, even though there were no significant differences in the FSH and LH levels of both lines at age at first egg production and 36 weeks of age. According to Prastiya *et al*. (2022), the reproductive hormone levels of a hen impact the quality and the quantity of the egg. The ISA brown hens that lay eggs daily have the highest average FSH levels (869.005 pg. mL^{-1}), while hens that lay eggs every two days have lower average FSH levels (429.130 pg.mL^{-1}). The results of this study did not match the published results. The relationship between the age at sexual maturity and FSH and LH levels during the egg production period influences the egg quantities of layer hens (Travel *et al*., 2010; Tumová & Gous, 2012) and turkeys (Brady *et al*., 2020).

According to earlier research on layer turkeys, pre-ovulatory surges in LH are typified by gradually rising plasma concentrations over 2 - 3 hours to reach peak levels, followed by a steadily declining concentration over 4- 6 hours to return to baseline levels (Chapman *et al*., 1994; Yang *et al*., 2000; Liu *et al*., 2001). In pre-pubertal hens, there are no circadian fluctuations in LH, progesterone, and oestrogen concentrations, while three days before initial LH surges, progesterone concentrations will increase and oestrogen concentrations decline slightly (Bacon *et al.*, 2002). These turkey hens were selected for their ability to increase egg production for 38 generations. The study also showed that spikes in progesterone 4 correlated with spikes in the LH hormone, but that oviposition was not always linked to LH-progesterone surges, possibly as a result of internal ovulations. Regardless, Yang *et al.* (1999) concluded that variations in LH plasma and estradiol-17β concentrations are age-related before approximately 24 weeks of age and that a light-dark photoperiod following approximately 20 weeks of age is required to start egg production. Cui *et al.* (2019) reported that in layer ducks, FSH influences the steroidogenesis of small yellow and immature yolk follicles during pre-ovulation, but not large follicles. In pre-hierarchical follicles, FSH not only enhances granulosa cell differentiation but also makes it easier for granular cells to synthesise steroid hormones. Du *et al.* (2020) discovered that ovaries with a high number of follicles typically have high levels of free fatty acids. This information applies to layer chickens as well.

Table (4): Effect of plumage colour and age on the FSH and LH levels of turkey hens (mean ± SE)

Parameters (Hormones)	Line	Age (weeks)		Line Effect
		26	36	
FSH ($ng.ml^{-1}$)	BR	0.467± 0.11	2.027± 0.11	1.247^{A}±0.07
	BBB	0.455±0.10	2.240±0.10	1.348^{A}±0.08
Age Effect		0.461^{b}±0.07	2.134^{a}±0.76	
LH ($ng.ml^{-1}$)	BR	0.757±0.25	2.513±0.15	1.635^{A}±0.95
	BBB	0.655±0.45	2.060±0.49	1.357^{A}±0.87
Age Effect		0.706^{b}±0.34	2.286^{a}±0.41	

a,b: Means in the same row with no common superscript are different significantly ($p<0.05$).
BR: Bourbon Red Line. BBB: Broad-breasted Bronze Line.

Conclusion

The results of this study indicate that plumage colour has a notable effect on egg production and in turkeys. Specifically, the Broad-Breasted Bronze (BBB) line outperformed the Bourbon Red (BR) line in terms of body weight at first egg production, feed intake, and yolk diameter. On the other hand, the BR line showed advantages in feed conversion ratio, hen-day egg production rate, and albumen rate compared to the BBB line.

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Contributions of authors

S.A.A.: Field work, writing and evaluation the manuscript.

Q.J.G., Field work, blood samples collection and suggestion a title of the manuscript.

A.S.K., Field work and evaluation the manuscript.

S.A.A., Field work and blood samples collection.

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Conflicts of interest

The authors state that they don't have any competing interests.

Ethical approval

All applicable national guidelines for the care and use of turkeys were followed.

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تأثير لون الريش على الأداء الإنتاجي و الفسلجي لخطين من الدجاج الرومي خلال فترة انتاج البيض

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المستخلص :هدفت الدراسة الحالية لتقييم تأثير لون الريش على الأداء الإنتاجي و الفسلجي للدجاج الرومي خلال فترة انتاج البيض. استخدم في الدراسة32 انثى من خطين من الدجاج الرومي (16 انثى من خط البوربون الأحمر و 16 انثى من الخط البرونزي). بينت نتائج تقييم الأداء الإنتاجي خلال فترة الدراسة (26–40) أسبوع التفوق المعنوي ($p<0.05$) لإناث الخط البرونزي في وزن الجسم عند انتاج أول بيضة، استهلاك العلف و قطر الصفار مقارنة بخط البوربون الأحمر. كما تفوق خط البوربون الأحمر معنويا مقارنة بالخط البرونزي في معامل التحويل الغذائي، عدد البيض المنتج، انتاج البيض اليومي و نسبة البياض. لم يختلف الخطان معنويا في العمر عند انتاج أول بيضة، وزن البيضة، كتلة البيضة، وزن الصفار، نسبة الصفار، وزن البياض، وزن القشرة، نسبة القشرة، سمك القشرة، عرض البيضة، طول البيضة، دليل الشكل، ارتفاع الصفار، مستويات هرمونات LH و FSH عند عمر 24 و 36 أسبوع (50% من انتاج البيض). يمكن تربية اناث الدجاج الرومي في العراق لغرض انتاج بيض التفقيس و في برامج التحسين الوراثي.

الكلمات المفتاحية: الأداء الإنتاجي خلال فترة انتاج البيض، صفات البيض النوعية، الدجاج الرومي.