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EFFECT OF LINES (PLUMAGE COLOR) AND SEX ON PERFORMANCE AND CARCASS WEIGHT OF LOCAL QUAIL

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Abstract

Quail raising has gained popularity in Iraq, particularly in Kurdistan, during the past decade due to high demand for meat and eggs. This study examined how three different plumage colours of native quails in Kurdistan, Iraq, affect their performance and certain carcass features. 432 one-day-old quail chicks were divided into three groups based on plumage colour: White (WPC), Black (BPC), and Brown (BrPC). Each group was observed for 42 days. Various characteristics such as live body weight (LBW), weight growth (WG), feed intake (FI), feed conversion ratio (FCR), mortality (M%), and carcass weight (liver and heart) were measured for males and females at various ages. Results showed that the LBW of WPC quails was significantly greater than BPC quails at hatch. However, at 42 days, BrPC quails had significantly higher LBW, WG, FI, and superior FCR compared to WPC quails. Furthermore, female subjects exhibited significantly($p<0.05$) higher body weight, carcass weight, and heart weight at 28 and 42 days of life ($P<0.05$). The interaction effect revealed that female birds of the BrPC line had significantly higher LBW and WG compared to other plumage colour lines (P0.05). Male WPC had considerably higher carcass weight compared to females ($P<0.05$). Females from the WPC line exhibited significantly lower ovary weight compared to the other two lines (P0.05). In conclusion, the data showed variations in weight characteristics among different lineages in comparison to previous research.

Keywords: local quail, plumage colour, performance, Sex

Introduction

Researchers have extensively examined the plumage colour of quails, focusing on issues such as genetic expression, gene mutations, and their effects on performance. Research has explored how plumage colour impacts quail performance, revealing that it can affect characteristics including body weight, feed conversion ratio, and egg production (Ibrahim and Al-Neemy, 2023; Kirrella et al., 2023a, b). Research has evaluated the productive performance of quails selected based on plumage colour to develop hybrid lines with specific performance traits linked to plumage colour (Al-Kaisi, 2022). The findings highlight the importance of plumage colour in quail and its possible implications for breeding and production. Naser et al. (2017) found that white quails had the highest body weight along with superior carcass characteristics and meat quality.

The colour of the plumage and the sex of quails can have a notable impact on their live body weight and carcass weight. Studies have demonstrated that various plumage colour variations and gender can

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impact these characteristics. An investigation conducted in Iraq on Japanese quail contrasted white and grey plumage birds, revealing notable distinctions in live body weight and carcass weight between males and females. The white type exhibited a notably higher relative heart weight compared to the grey variety (Hassan et al., 2015). The study conducted on Japanese quail in Iraq revealed substantial variations between males and females in body weight, dress percentage, gizzard weight, liver weight, and intestinal length. A different research on Japanese quail shown that plumage colour variations had a notable impact on slaughter weight and the distribution of corpse components. Dewanti et al. (2019) conducted a study examining the impact of plumage colour lines and sex on the slaughter weight and carcass parts of Japanese quail. The study concluded that sex had a substantial effect on the carcass parts of Japanese quail.

A study on two different plumage-color lines of Japanese quail found that sex had a substantial impact on live body weight, weight after slaughtering, and weight after de-feathering. Females exhibited considerably greater live body weights and carcass weights post-slaughter compared to males (Elkhaiat et al., 2023b). These studies show that both plumage colour and sex can significantly affect the live body weight and carcass weight of quails. Al-Kafajy and colleagues (2018) Hence, we suggest that breeders produce dark lines for improved meat output and white lines for enhanced egg production. Conversely, the black line displayed lower productivity traits compared to the other two lines across the whole study period.

The search results include data on how Sex and genetic lines impact the performance and carcass of quails. The study examined how selecting for feed conversion ratio (FCR) impacted the genetic enhancement of FCR, body weight (BW), and weight gain (WG) as reported by Varkoohi et al. in 2010. Hussen et al. (2019) discovered that genotype, sex, and their interaction had a substantial impact on all examined variables, except for the influence of sex on giblets. The female quail possesses a greater quantity of breast, drumstick, and wing parts compared to the male quail. Male quail have a greater proportion of thigh muscle compared to female quail. E. Abou-Kassem (2019) determined that Japanese quails, regardless of gender, should be slaughtered at 5 or 6 weeks of age to get increased carcass yields. In 1999, Oguz and colleagues found that female quails had considerably greater body weight and feed consumption levels compared to males, and these values increased with age. Naser et al. (2017) found that white quails had the highest body weight along with superior carcass characteristics and meat quality. The search results indicate that both sex and genetic lines have a substantial impact on the performance and carcass characteristics of quails, such as feed conversion ratio, mortality rate, slaughter weight, and carcass composition.

Quails in Kurdistan, Iraq, have varying plumage colours including white, brown, black, golden, and desert-colored, as reported in different studies. The search results detail the impact of plumage colour on the performance and carcass of quails, particularly in the setting of Kurdistan, Iraq. In 2023, Ibrahim and Al-Neemy studied how plumage colour (white and brown), genetic group (Ukrainian and local), and quail performance are related. In a study by Ibrahim and Al-Neemy (2023b), three different lines of Japanese quails were evaluated, revealing that plumage colour significantly influences productive performance. Chatoo and Al-Barzinji (2022) carried out a comparative analysis of production efficiency in indigenous quails. White quail had average performance in body weight compared to quail of the

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other two hues. A study comparing production performance of local quails revealed that white-colored quails had average body weight performance compared to quails of other colours (Chato, Kurdo & Al-Barzinji, Yousif. (2022). Quails in Kurdistan, Iraq, have varying plumage colours reported in different studies, including white, brown, and desert hues. A study comparing hatchability and fertility rates examined the mortality rate of quails with white, desert, and brown plumage colours by Ahmed & Al-Barzinji (2020). A study conducted by Ibrahim and Al-Neemy in 2023 examined how white and brown feather colours affect quail performance. A study by Fadhil et al. (2018) found that plumage colour plays a major influence in influencing productive performance in three lines of Japanese quails. A comparison research of production performance among local quails revealed that white-colored quails had average body weight performance compared to quails of other colours (Chato, Kurdo & Al-Barzinji, Yousif. (2022). A study comparing two plumage-color lines of Japanese quail indicated that white-feathered quails tended to have greater carcass weight performance compared to other features (Kirrella et al., 2023). The plumage hue of quails in Kurdistan, Iraq includes white, brown, and desert variations. Prior research has shown that the impact of plumage colour on the performance and carcass features of quails varied, particularly among native quails in Kurdistan, Iraq. Additional research is needed to ascertain the impact of quail's line (plumage colour) in this region. This study intends to examine the impact of line plumage colour and sex on the performance and carcass features of local quality.

Material and Methods

A total of 432 one-day-old local quail chicks were used in this study; the chicks were distributed into three group lines according to three plumage colours: white (WPC), black (BPC) and brown (BrPC); each treatment had nine replicates (16 each). The chicks were reared in floor cages (0.5*1) m. The performance traits were carried out weekly to determine live body weight, weight gain, feed intake, feed conversion ratio and mortality at different periods at hatch, 1-28, 29-42 and 1-42 days. At 28 days old, the males and females were weighed for 28 and 42 days, respectively. At 42 days old, ten males and ten females for each plumage colour were individually weighed and sacrificed to determine the carcass, liver, heart, ovary and testicle.

Quail birds were fed ad libitum ration a diet with a crude protein level of 23% and a representative energy of 3100 kilocalories/ kg feed from the age of one day until the end of the experiment, as shown **in Table (1),** the diet formulating according to the NRC (1994).

This study used 432 one-day-old local quail chicks, divided into three group lines based on the colour of their plumage: white (WPC), black (BPC), and brown (BrPC). Nine duplicates of each treatment were used in this study (16 total). The chicks were raised in 0.5*1 m floor cages. To measure live body weight, weight gain, feed intake, feed conversion ratio, and mortality at various times during hatch, 1-28, 29-42, and 1-42 days, performance attributes were measured weekly. The males were weighed at 28 days, and the females were weighed at 42 days. To determine the carcass, liver, heart, ovary, and testicle, ten males and ten females of each plumage colour were individually weighed and slaughtered at 42 days of age.

From the time the birds were one day old until the completion of the trial, quail birds were given an ad libitum diet consisting of 23% crude protein and 3100 kilocalories/kg feed, as indicated in Table (1).

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The diet was formulated in accordance with the NRC (1994).

Table 1. Composition of quail feeds used in the experiment

Ingredient, %	feed (1-42) day
Corn	48.0
Wheat	6.0
Soybean meal	39.5
Vegetable oil	4.0
Dicalcium phosphate	0.5
Limestone	1.0
Methionine	0.2
Lysine	0.1
Salt	0.4
Vitamin + mineral premix[1]	0.3
Calculated value	
Crude protein, %	23
Metabolic energy, kcal/kg	3100

[1] Added per kg: Vit. A - 11.00 IU; vit. D - 32,000 IU; vit. B1- 2.5 mg; vit. B6 - 1.25 mg; vit. B12 - 0.01 mg; α-tocopheryl acetate - 50 mg; biotin - 0.06 mg; vit. K - 2.5 mg; niacin - 15 mg; folic acid - 0.30 mg; pantothenic acid - 10 mg; choline - 600 mg; Mn - 60 mg; Fe - 50 mg; Zn - 15 mg; I - 0.5 mg; Co - 0.5 mg.2.2

Results and Discussion

Effect of lines (plumage colour) on performance of local quails at different periods

Productive performances (live body weight, weight gain, feed intake, feed conversion ratio and mortality percentage) of different plumage-colour in local quail's lines at different ages from first day to 42 days- old were presented in Table (2). The results showed that WPC and BrPC lines were significantly superior and heavier than BPC in LBW at the first day old, while at 42 day-olds, significantly the heavier LBW (231.10g), total WG (223.56g), higher total FI and better FCR were in BrPC compared with the WPC line and BPC was intermediated. The superior growth performance in BPC and BrPC over the WPC was related to higher feed intake and also to the higher rate of egg production of WPC from 35-42 days old compared with BPC and BrPc lines in the present research (data not public). However, there were no significant differences between lines in mortality percentage. The superiority of one line over the other lines and the difference between the researchers' results may be due to several reasons. According to these results, there are different explanations for how the colour of feathers affects different traits in quails; among these explanations is the multisotropic gene effect, in which pigmentation is controlled by genes that regulate the production of melanin and carotenoids. Some of these genes have also been shown to regulate muscle growth and growth in other species, suggesting that there may be a link between feather colour and carcass traits in quails (Kirrella et al., 2023). Rahman et al. (2010), indicating that body weights were notably influenced by various plumage colour mutations or a range of quail breeds. Several studies have included physiological differences

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between these varieties, focusing on differences in body weights, growth rate and other growth-related parameters (Maiorano et al., 2009; Tavaniello et al., 2014; Nasr et al., 2017). The superiority of body weight in a certain line in a period and then the superiority of another line over other lines occurred in previous research, in which Al-Kafajy et al. (2018) also found BrPC to be superior to BPC and WPC at the age of 28 days, while BPC outperformed WPC and BrPC at the age of 42 days, they also observed that after sexual maturity the BrPC to be superior to BPC and WPC in live body weight. Moreover, results of significant heavy body weight in BrPC compared with other lines were also observed by Petek et al. (2004); Menville et al. (2005); Yilmaz and Jaglayayan (2008); Sogut et al. (2015).

The previous findings were in contrast with the results of WPC variety of Japanese quail exhibited greater body weight and improved feed conversion ratio at 4 and 5 weeks of age compared to the BrPC type (Inci et al., 2015). They concluded that quails with WPC are more inclined towards meat production compared to those with BPC and BrPC plumage due to lower FCR of WPC. While in present results indicated that the BrPC tendency for meat production compared with WPC at age 42 days.

Table (2): Effect of different plumage colours on productive performances in local quails at different ages.

Traits	Lines			
	White plumage-colour	**Black plumage-colour**	**Brown plumage-colour**	**Stander error of means**
Live body weight (g) 1 day	7.79a	6.95b	7.54a	0.124
Live body weight (g) 28 day	107.88a	107.36a	110.48a	1.002
Live body weight (g) 42 day	201.80b	224.30ab	231.10a	5.834
Weight gain (g) 1-28 day	100.09a	100.41a	102.94a	0.940
Weight gain (g) 29-42 days	93.92b	116.94a	120.62a	5.209
Weight gain (g) 1-42 day	194.01b	217.35ab	223.56a	5.829
feed intake (g) 1-28 day	276.25a	277.94a	282.15a	1.112
feed intake (g) 29-42 days	178.03b	235.70a	236.38a	9.699
feed intake (g) 1-42 day	688.74b	704.21a	706.39a	2.982
Feed conversion ratio 1-28 day	2.76	2.77	2.74	0.012
Feed conversion ratio 29-42 day	2.18a	2.01b	1.96b	0.041
Feed conversion ratio 1-42 day	3.55a	3.24ab	3.16b	0.061
Mortality (%) 1-42 day	1.12a	1.10a	0.94a	0.040

[a,b] Differences between means in the same row with different letters are statistically significant.

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Lines	**Live body weight (g)**		**Weight gain (g)**
	28 day	**42 day**	**28-42 day old**
White	143.35a	203.70b	60.35b
Black	145.10a	227.80a	82.70a
Brown	147.05a	241.60a	94.55a
Sex			
Male	141.80b	217.80b	76.00a
Female	148.53a	230.93a	82.40a
Interaction plumage colour *sex			
WPC*male	139.80a	205.20bc	65.40cd
WPC*female	146.90a	202.20c	55.30d
BPC*male	141.40a	227.20b	85.80b
BPC*female	148.80a	228.40b	79.60bc
BrPC*male	144.20a	221.00bc	76.80bc
BrPC*female	149.90a	262.20a	112.30a
Stander error of means	1.525	4.618	3.943

Effect of plumage colour and sex on LBW and WG at 28 and 42 days old

The study analysed the impact of plumage colour, sex, and their interaction on the growth performance of quail lines at 28 and 42 days of age. Results from Table 3 indicated a substantial influence of plumage colour on body weight at 42 days and weight gain from 28 to 42 days. The average live body weight was 227.80 g for BPC and 241.61 g for BrPC, with total weight gains of 82.70 g and 94.55 g, respectively, showing superiority over WPC at 42 days of age. Furthermore, females had a substantially higher body weight of 148.53 g and 230.93 g at both time periods due to their sex. The interaction effect between plumage colour and sex displayed substantial differences. At 42 days old, female chickens in BrPC had significantly higher body weight and weight increase compared to all other males and females in other lines, as well as both sexes in BPC. In contrast, females in WPC had significantly lower body weight and weight gain. Previous research have identified the impact of sex on several lines of quails based on plumage colour (Khaldari et al., 2010; Akbarnejad et al., 2015; Al-Kafajy et al., 2018; Chatoo and Al-Barzinji 2022). Chatoo and Al-Barzinji (2022) discovered that there were no notable distinctions among the three lines (white, black, and desert plumage-color) or between males and females at 42 days of life. Al-Kafajy et al. (2018) found a potential connection between sex and plumage colour. The researchers additionally demonstrated that female birds with brown plumage had higher body weight compared to others. Khaldari et al. (2010) and Akbarnejad et al. (2015) found that the body weight of quails was influenced by the birds' sex. Significant differences were observed between male and female quails of the same age in terms of carcass and dressing features (Chatoo and l-Barzinji, 2022). Inci et al. (2015) observed substantial disparities in live weight among the four lines and obese sexes at the age of 28 and 42 days, as well as compared to other lines for both males and females.

Table 3: Effect of plumage colour and sex and their interaction on Live body weight (g) and Weight gain (g)at 28 and 42 days old.

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[a,b] Differences between means in the same row with different letters are statistically significant.

Effect of lines (plumage colour) and sex on carcass weight

Studying live body weight, weight gain, and carcass weight is crucial for promoting obesity in meat production. The amount of meat produced and the weight of the bodies and their main and secondary parts increase directly with body weight (Kosshak et al., 2014; Salih, 2018). At 42-day-old males and females were randomly chosen to measure body weight and carcass characteristics weight as shown in Table (4). When comparing carcass weight, WPC males had significantly higher weights than BPC males, but the weights of other men and females in different lines fell in between. Liver weight was significantly lower in BPC compared to the other lines and sexes, except for males in WPC. Female WPC had significantly lighter ovary weight compared to both BPC and BrPC females. There was no significant difference between the Heard and testicle. The variations in carcass weight were attributed to genetic factors, as indicated by Kumari et al. (2008) and Hamad and Barzanji (2022), who found that the type of strain had a substantial impact on both the amount and quality of the carcass. Previous research have revealed varying results in carcass quantity, possibly due to differing production conditions (Tarhyel et al., 2012; Inci et al., 2015). Nasr et al. (2017) and Al-Kafajy et al. (2018) found that the white line showed higher weight in several organs, whereas there were no variations in carcass and liver weights among the white, black, and brown lines. Hamad and Barzanji (2022) discovered that all carcass attributes were significantly influenced by sex, save for breast %, with females showing advantage over males in carcass weight. Furthermore, they discovered that there was a significant relationship between line crossing and sex, with females exhibiting greater live body and carcass weight. Alkan et al. (2010) discovered a substantial ($P<0.01$) impact of genetic lines on body weight in both sexes, with females exhibiting a higher body weight than men. Additionally, researchers discovered that lineage and gender had a substantial impact on carcass weight, with females exhibiting a higher carcass weight than males. Tarhyel et al. (2012) discovered that sex did not have a substantial impact on carcass weight, while differences were notable in live weight and several body sections. Walita et al. (2017) found significant differences ($P<0.05$) in several body areas between males and females, with females having higher measurements than males. The results indicated that the animals needed to be culled at 5 to 6 weeks of age in order to maximise body mass.

Table 4: Effect of plumage colour and sex and their interaction on Live body weight (g) and carcass weight (g) at 42 days old.

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Lines	Traits					
	Live body weight (g)	Carcass (g)	Liver (g)	Heart (g)	Ovary (g)	Testicle (g)
Plumage-colour						
White	201.800 b	130.900 a	4.100 b	1.800 ab	----------	----------
Black	206.900 b	127.300 a	4.500 ab	1.600 b	----------	----------
Brown	231.100 a	130.500 a	5.000 a	2.000 a	----------	----------
Sex						
1	194.933 b	178.867 b	128.933 a	4.000 b	----------	----------
2	231.600 a	196.533 a	130.200 a	5.067 a	----------	----------
Plumage-colour* Sex						
WPC*male	201.400 c	139.000 a	3.000 c	2.000 a	----------	5.400 a
WPC*female	202.200 c	122.800 ab	5.200 a	1.600 a	5.000 b	----------
BPC*male	180.600 c	118.800 b	3.800 bc	1.600 a	----------	5.800 a
BPC*female	233.200 b	135.800 ab	5.200 a	1.600 a	6.200 a	----------
BrPC*male	202.800 c	129.000 ab	5.200 a	2.000 a	----------	5.400 a
BrPC*female	259.400 a	132.000 ab	4.800 ab	2.000 a	6.000 a	----------
Stander error of means	5.620	4.740	0.218	0.074	0.284	0.215

[a,b,c] Differences between means in the same row with different letters are statistically significant.

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