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Comparative Study Of Production Performance And Meat Quality Of Two Different Local Chicks.

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ABSTRACT

This study aimed to compare the production performance and meat quality of two Iraqi local chicken lines. The study was carried out between January 5, 2024, and June 5, 2024, at the Kani-Graw private field, which is 22 kilometers from Erbil City. 300 fertile eggs of two local line Iraqi Chickens (White and Black) were obtained from Agriculture Research Centre-Ministry of Agriculture-Baghdad. The hatchability percentage was 68%. Day old chicks hatched from eggs on 5 January 2024 of each line were divided randomly into four replications. The feeding system and lighting program were used based on ISA-BROWN guidance. The results cleared that, all production performance traits, which included the live body weight at 18 weeks of age, total weight gain, accumulative feed intake, feed conversion ratio, mortality percentage with production index, showed significant differences between the studied chick's line, Black line showed higher total weight gain with lower mortality percentage and then higher production index than white line. The carcass parts, giblets, and inedible parts percentages, as it described that the white line was more significantly recorded on the carcass, thighs, neck, gizzard, skin with subcutaneous fat and Abdominal fat percentages than Black line. Likewise, the Black line was more significantly recorded breast, liver, spleen and Inedible parts than white line. The physical traits of breast meat cleared that the breast of white line recorded more significantly content of drip loss percentage than Black line, while Black line recorded more significantly content of W.H.C. percentage than white line. Furthermore, there were no significant variations in the cooking loss, pH value and breast color. In conclusion, Black line showed higher performance in production than white line.

***Keywords*:** Iraqi local chicken, line, body weight, Feed conversion ratio, meat quality.

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INTRODUCTION

Poultry breeders made every effort to improve poultry production due to the rising demand for poultry products. The performance of chicken is essential for developing breeding plans for further improvement in production characteristics. Birds' growth and production characteristics represent their genetic makeup and level of environmental adaptation [1]. In most developing countries, there are two different parallel poultry sectors. In this way, native farm techniques are based on a rather sustainable production through the use of dual-purpose indigenous breeds, with therefore lower yields, whereas the commercial company uses hybrid species of layers or broilers with high yields. Depending on the country, these two categories representatively vary substantially (2). According to [3], native breeds may account for as much as 90% of the poultry population in low-income countries. Breeding techniques must be improved to increase investment in the production of local chickens. [4]. The mature body weight of rural chickens, which is closely correlated with the quality of the meat and its output capacity, is the basis for productivity. Meat quality is a characteristic that varies throughout chicken genotypes and is influenced by management practices and other environmental factors [5, 6]. Compared to exotic breeds, local consumers prefer local chickens because their meat is delicious and their production is less expensive and time-consuming. According to [7], this makes them the local farmers' preferred option for production. Local chickens are famous for their exceptional meat quality and taste, as well as their resistance to some diseases [8,9]. Therefore, despite their relatively high cost, the use of meat products from local chickens has expanded in East Asian and European countries [10]. According to [11,12], local chickens in various parts of Iraq are a varied population with varying morphological and quantitative traits. When compared to commercial poultry, they are characterized by their small size, delayed growth, more effective feed intake (FI) and feed conversation ratio (FCR), and relatively high prices for their products [13]. Additionally, they are very resistant to endemic diseases and hard weather circumstances due to their genetic origin [14]. Local Iraqi chickens are valued for adapting to hard conditions when produced in non-standard environments. Still, they are also regarded as one of the resources with low genetic value [11]. More research is needed on local chicken breeds to uncover unrealized benefits and produce high-quality breeding stock that can increase productivity and efficiency and open up new prospects [15]. It is easy to increase the production capacity and performance of local chickens because they are

significantly more immune than other breeds in Iraq [16]. The goal of this study was to compare the performance of production and meat quality of two lines of Iraqi local chickens.

Materials and methods

Management and Design of Experiment

This experiment was conducted at the Kani-Graw private field, 22 kilometers from Erbil City, between January 5, 2024, and June 5, 2024. 300 fertile eggs of two Iraqi local line chickens (White and Black) were obtained from the Agriculture Research Centre, Ministry of Agriculture, Baghdad. The hatchability percentage was 68%. On January 5, 2024, day-old chicks from each line's eggs were randomly placed into four replications. The chicks of both lines were kept in replicates as families, and their Production traits included body weight, body weight gain, feed intake, feed conversation ratio and mortality percentages documented at 1 day of their age and every week till 18 weeks. The chicks were under regular management and bred in a hygienic, well-ventilated hall. Antibiotics, vitamins, minerals, and Newcastle vaccinations were administered to each chick as needed. The chicks were given vaccinations against the most common diseases (according to the veterinarian's recommendations), and they seemed healthy throughout the experiment. By ISA-BROWN guidelines, the lighting program and feeding system were used. At 18 weeks, the birds were withdrawn from feed for 3 hours, respectively. The feeding program for birds of various ages is presented in Table 1.

Table 1. Feeding program for birds at different ages.

Ingredients (Kg)	Starter 0 - 4 weeks	Grower 4-10 Weeks	Pullet 10-18 Weeks
Wheat	696	660.25	656.3
Soybean meal	245	190	76
Corn	0	0	0
Wheat Bran	0	90	218
Oil	8.5	9	0
Limestone	8.3	12.5	10
MCP	10.4	8	8
Premix 2.5%	25	25	25
Lysine	1.5	0.75	1.5
Methionine	2.1	1.5	1.5
Sodium bicarbonate	0.5	0.5	0.7
Anti-toxin	2	2	2
Citric acid	0	0	0.5
Enzyme	0.5	0.5	0.5
Total	1000	1000	1000
Protein %	20.5	19	16
Energy Kcal/kg	2950	2850	2750

Production Performance

After the birds were weighed on an electronic scale (Ming Heng Electronic Digital scale MH-777-China) at one day of age, they were weighed every week until they were 18 weeks old (TSC-Electronic platform scale to the nearest one g-China). Feed conversion ratio and weekly feed intake: Every week, the amount of feed consumed by each pen or replicate was documented and measured. At each interval, mortal birds were removed from the feed intake. The ratio of feed intake to body weight gain for each period was used to calculate the feed conversion [17].

Mortality Percentage

To determine the mortality percentage, the mortality percentage was calculated every day for each replicate [18].

Production Index (PI)

The production index for each replicate was calculated using the following formula [19]:

$$\text{Production index} = \frac{\text{Body weight (kg)} \times (100\text{-\% mortality}) \times 100}{\text{Fattening duration (days)} \times \text{feed conversion ratio}}$$

Meat Quality

Carcass Measurements

Slaughter took place at the same time for all birds. The chickens were stunned and slaughtered immediately after being removed from the replications. The inner organs and the abdominal fat pad were removed. Afterwards, carcasses were weighted again to get the eviscerated weight with inner organs. According to [20]. After removing the inedible components (the head, shank, and viscera), the carcass was weighed. After separating the thigh, wing, back, and breast, the proportion of each part was determined by dividing its weight by the bird's carcass weight. The following formula was used to calculate the carcass percentage [21]:

$$\text{Carcass percentage (\%)} = (\text{Carcass weight (g)}) / (\text{Slaughter weight (g)}) \times 100$$

Measurements of the Body Cut Percentage

The percentage of a particular body cut and edible parts, including breast, back, thigh, wing, neck, gizzard, heart, liver, spleen, and skin, were separated and weighed individually. Their percentage was determined by dividing their weight by

carcass weight multiplied by 100, and other parts were determined by dividing their weight by live weight multiplied by 100.

Physical analyses of breast meat

Drip loss(%)

From the carcass, samples of meat were taken out and weighed within 45 minutes of postmortem. Each weighted steak was suspended for an entire day at 4 degrees Celsius in an inflated polythene bag (ensure the samples did not touch the bag's sides) to determine the drip loss. After a day, samples were taken out, gently dried, and weighed. The calculating technique outlined by [22] was used to determine the percentage of weight lost due to drip loss.

Drip loss (%) = ((weight of fresh sample (g) - sample weight (g) after 24 hrs. / Weight of fresh sample (g) × 100

Cooking loss(%)

The procedure described by [23] was utilized to determine cooking loss. Plastic vacuum-sealed bags were used to heat samples in a water bath (HAAKE ® instruments, Woonsocket, USA) at 70ºC for thirty (30) minutes. Following that, the samples were cooled for 30 minutes at room temperature to eliminate any remaining moisture. Samples were weighed before and after being subjected to thermal (heat) treatment. The loss during cooking is represented as the weight loss ratio to the initial weight using the equation below:

$$\text{Cooking loss\%} = \frac{\text{Sample weight before cooking (g)} - \text{Sample weight after cooking (g)}}{\text{Sample weight before cooking (g)}} \times 100$$

Water holding capacity (W.H.C.)(%)

The ability to hold water was established, based on [24]. The samples were wrapped in absorbent cotton, thawed (1 g each), and then placed in a centrifuge tube (Hettich, Zentrifugen, Germany). The sample-containing tubes were placed in a centrifuge separator and rotating at 3000g for ten minutes at 4°C (380R, Rotina, Germany), following that, the samples were all weighed. The water-holding capacity (WHC) of the sample was estimated as the proportion of the weight of the sample after centrifugation to the initial sample weight using the following equation:

$$\text{Water holding capacity (\%)} = \frac{\text{The sample weight after centrifugation (g)}}{\text{The sample weight before centrifugation (g)}} \times 100$$

Color measurement

A Color Flex Spectrophotometer (Shenzhen 3nh Technology Co., Ltd, China) was used to measure the color of the breast meat [25].

Statistical Analysis

General Linear Model (GLM) within the statistical program SAS [26] was used to analyze the studied traits. The model includes the effect of genetic groups on the traits. Duncan's test [27] within the SAS was conducted to diagnose the significant differences between means.

Results and discussion

Production Performance

All production performance traits of this study, which included live body weight at the age of 18 weeks, weekly weight gain, weekly and accumulative feed intake, feed conversion ratio, mortality percentage with production index, showed significant differences between the studied chick's line, and black line showed higher total weight gain with lower mortality percentage and then higher production index than white line (1462.02gm) (12.00%) (21.86), respectively (Table 2). Due to a negative relationship between body weight and egg production in Iraqi genetic strains, local chicks have low body weights [28-29-30]. The production performance in chickens varies by breed [30]. Due to the lack of a genetic enhancement program, local breeds have grown slowly. These findings agree with a study by [32], who observed significant variations in body weight trait between broiler and local breeds. These findings additionally confirmed a study that indicated using local chickens for two purposes in Iran [33] and that they grow more slowly than Ross [34]. The adverse association between body weight and the production of eggs in genetic lines in Iraq might be the reason for the low body weight in native breeds [28-29-30]. Due to the lack of a genetic enhancement program, local breeds have grown slowly. The body weight results of this study did not agree with the findings of [35], who showed that the body weight of Sasso chicken and local fowl koekoek at eight weeks was 601.5 and 970.4 g, respectively. According to [31], the body weight of native poultry from Sinai, Egypt, reached 507.5 grams at seven weeks. Moreover, about accumulative feed intake, Black line consumed more accumulative feed (7100.50gm) than white line (6934.87gm) but the feed conversion ratio for the black line (4.70) was better than the white line (4.74) (Table 2). On the other hand, [36] states that the amount of feed consumed seems to be significantly impacted by genetic background. Local breeds are less efficient than commercial broilers in terms of feed intake and feed conversion ratio [37-38]. Body weight and feed intake fluctuations were the cause of the feed conversion ratio [39]. These findings agreed with those of [36], who found that the amount of feed consumed was significantly influenced by genetic background. In the first and second weeks, Ross ate 0.188 and 0.398 kg more feed than the native breeds (0.138 and 0.103 kg) and Iranians (0.157 and 0.198 kg). Throughout the time of breeding, Ross hybrids, Iranian chickens, and native breeds all consume dramatically different amounts of feed.; for weeks 3, 4, 5, 6, and 7, the Ross hybrids outperformed the others, consuming 0.139, 0.209, and 0.985 kg, 0.150, 0.204, and 0.891 kg, 0.139, 0.209, and 0.985 kg, and 0.142, 0.219, 1.049 kg. The body weight results of this study disagreed with the findings of [35], who showed that the body weight of Sasso chicken and local fowl koekoek at eight weeks was 601.5 and 970.4 gm, respectively. According to [40], there were not significant between the black line and white line chicks of both genetic groups

Table 2. The production performance for two different local chicks.

Traits	Genetic Group	
	White Line	Black Line
Average hatching weight (g)	36.48± 0.02a	40.19±0.05a
Live body weight (g) at 18 weeks old	1325.5±33.7b	1450.94±50.44a
Total body weight gain (g) / chick	1289.02±32.88b	1410.75± 43.66a
Accumulative feed intake (g) / chick	6434.87±40.75b	7980.5±55.87a
Feed conversion ratio (feed intake (kg) / weight gain (kg))	4.992± 0.32b	5.657 ± 0.98a
Mortality percentage (%)	7± 0.1.89a	2± 0.55b
Production index	21.40±0.75b	26.65± 0.55a

Means following various letters in the same row are significantly different (P≤0.05)

Additionally, the results contrary the findings reported by [41], who found that the main factor genotype had a significant (P≤0.05) impact on the productive performance during the two growth phases and the overall phase in an 81-day study including a native Naked Neck (BTNN) type, the commercial Ross 308 (R) chickens genotype, and their crosses. The findings also contrast with the study of [42], which found a significant difference (P<0.01) in body weight at different weeks of age between two pure lines of Super Harco commercial dual-purpose chickens, Kurdish local chickens, and their crosses. Furthermore, [43] found that the feed conversion ratio varied significantly between feeding groups for the various genotypes of local chicken breeds, including crossbreds and purebreds. These results agreed with those of [36], who reported that the study compared the performance of Ross 308, Iranian chickens, and local breeds. Fifteen pens housed a total of 300 one-day-old chicks. According to the results, the native type weighed 0.180 kg at 7 weeks, but the body weight of the Iranian chicken and Ross was 0.291 and 2.763 kg, respectively. Local breed chickens gained an average of 21 grams of weight per week, while Iranian and Ross chicks gained an average of 36 and 338 grams, respectively. The average feed intake (FI) of Iranian chickens (0.199) and Ross chickens (0.704) was higher than that of the local breed (0.132). The local breed's feed conversion ratio (FCR) was 6.327, which was comparatively higher than that of the Ross and Iranian breeds, which were 1.834 and 5.327, respectively. Iranian chickens had a high mortality rate of 10%, whereas local breeds had a rate of 9%, and Ross chickens had a rate of 6%. The current study's findings about FCR between genetic groups were consistent with studies conducted by [44, 45], which found that the FCR in Nigerian chickens was 4.28 and in Fayoumi it was 5.75. Furthermore, Rhode Island Red Chicken had a close result of 6.45 [46]. The variation in FCR between local breeds, Iranian chicken, and Ross is reflected in the genetic disposition for high growth and the outcomes of process of selection. Commercial broilers are more effective in FI and FCR than local breeds [37]. Differences in body weights and feed intake were the cause of FCR [39].

The carcass parts, giblets, and inedible parts

Table 3 displays the percentages of carcass parts, giblets, and inedible parts for two different local chicks at 18 weeks of age. It indicates that the white line and Black line chicks differed significantly (P≤0.05) on various traits, but not on the wings, back, heart, or bursa of Fabricius. Additionally, the white line was more significantly (P≤0.05) recorded on the carcass, thighs, neck, gizzard, skin with subcutaneous fat, and fat percentages in the abdominal region than the black line. Similarly, the black line was more significantly (P≤0.05) recorded than the white line for the breast, liver, spleen, and inedible parts. The current study confirms that of [41], who reported that, except for bursa relative weight, genotype significantly (P≤0.05) impacts carcass and organ yields. According to other research, there were no significant variations in the yield of the carcass components investigated between breeds or strains [47]. In contrast, [48] found no significant differences between the heavier Potchefstroom Koekoek and Ovambo breeds at 18 weeks of slaughter age in terms of live weight, hot carcass weight, cold carcass weight, dressing percentage, and breast and thigh weight. Ovambo is a lighter breed that is known for its disease resistance. Furthermore, [43] reported no significant variations in the complete weights of the carcass, breast, and leg for the various genotypes of crossbreds and purebreds between feeding groups when comparing the slaughtering parameters of local chicken breeds. Additionally, [49] revealed that most of the correlation coefficients between measures of carcass weight and live body weight were positive and very significant for both Kurdish local and ISA brown roosters. These findings were contrary to those of [36], who found no significant variations between Iranian and local breed chickens raised in the same environment regarding the weights of the primary, secondary carcass cuts, and giblets.

The physical traits of breast meat

The quality of chicken meat is influenced by a number of factors, and genetics playing a major role. The physical

Table 3. The carcass parts, giblets, and inedible parts percentages for two different local chicks at 18 weeks old.

Traits	Genetic Group	
	White line	Black line
Live body weight (gm)	1325.50 ± 33.07b	1450.94 ± 50 .44a
Carcass %	68.78 ± 0.44a	64.63 ± 0.38b
Breast %	23.24 ± 0.20b	25.11 ± 0.33a
Thighs %	33.97 ± 0.11a	31.46 ± 0.10b
Wings %	11.67 ± 0.12a	11.92 ± 0.09a
Back %	13.21 ± 0.12a	13.76 ± 14a
Neck %	13.13 ± 0.11a	12.33 ±0.12b
Heart%	0.56 ± 0.01a	0.55 ± 0.02a
Liver%	2.40 ± 0.05a	2.92 ±0.04a
Gizzard%	3.13 ± 0.05a	2.63 ± 0.05b
Spleen %	0.27 ± 0.01b	0.35 ± 0.04a
Skin with subcutaneous fat %	2.13 ± 0.04a	1.03 ± 0.07b
Abdominal fat%	0.23 ±0.01a	0.14 ± 0.04b
Bursa of fabricius %	0.08 ± 0.002a	0.07 ± 0.01a
Inedible parts%*	25.38 ± 0.38b	29.85 ± 0.34a

Means following various letters in the same row are significantly different ($P \leq 0.05$)

* Inedible parts are representing viscera, head, feet, and feather

characteristics of the breast meat for two different local chicks at 18 weeks a higher percentage of drip loss than the black line, while the black line breast recorded a higher percentage of W.H.C. than the White line. This could be due to the black line samples had a higher pH, which higher pH increases water holding capacity and decreases drip loss. In regards to drip loss at 24 and 48 hours and cooking loss of breast muscle, the results did not agree with the findings reported by [50], who found no significant ($P>0.05$) difference in drip loss between Baicheng-You (BCY) and Arbor Acres (AA) broilers. Additionally, BCY chickens had significantly lower ($P < 0.05$) cooking loss of breast muscle than AA broilers. Furthermore, the results indicated that there were no significant variations in the pH value and breast color yellowness (b*); the white line breast showed more yellowness (b*) and less lightness (L*) with redness (a*) than the black line breast (Table 4). In contrast, [49] found that the pH of the breast muscles of Arbour Acres (AA) broilers and Baicheng-You (BCY) chickens varied significantly over time. whereas there was no variation in the 24-hour pH of breast muscle between the strains (6.03 and 5.97). Because birds that grow slowly are usually older, [50] observed that their meat has a redder color than that of fast-growing birds. Adenosine triphosphate hydrolysis and lactic acid accumulation cause the pH of muscles to drop as rigour mortis progresses. According to [52], rapidly growing turkeys had less glycogen in their pectoralis superficialis muscle than slow-growing turkeys. This is typically associated with a less dramatic pH drop. Birds that grow more slowly might be more vulnerable to stress than those that grow more quickly. Additionally, [50] noted that there was no significant ($P > 0.05$) difference in the meat colour (optical density) values of the two strains' relative breast muscles, which may be due to the breast muscle containing higher lactate concentrations. In contrast, [47] found that the Ovambo lighter breed chicken breast meat had significantly higher levels of yellowness (b*) (19.15) and redness (a*) (9.56) compared to the heavier breed Potchefstroom koekoek (14.11) and (5.72), respectively, and that the pH values of the Potchefstroom koekoek chicken breast meat was higher ($P<0.05$) at (5.54) than those of the Ovambo chickens (5.45). Furthermore, [53] found that the pH of the slow-growing birds was lower than that of the fast-growing ones. Additionally, other researchers have observed that slower-growing genotypes have lower pH than fast-growing genotypes [54-55-56-57].

Either crossbreeding or selection can lead to the earlier findings of genetic progress. Genetic selection is responsible for approximately 85 to 90 percent of the change in the growth percentage of broilers during the past forty-five years and contributed greatly to the historical increase in the efficiency of broiler production [58]. In order to produce better chicks for practical breeding, local chicken breeds, which usually grow slowly and feed inefficiently, were initially used directly [9]. To increase the proportion of growth and the quality of the meat while preserving the native chickens' original appear traits, including their plumage, body appearance, comb, skin color, and other characteristics, crossbreeding native breeds with excellent taste and nutritional value with highly-selected lines (exotic breeds) with high growth percentage has been described as "quality chicken breeding" [50-60-61]. The production of chickens with high average daily gain, feed efficiency, reproductive, and carcass characteristics could result from choosing the best-performing crossbreed, which would decrease production costs [62]. Crossbreeding is thought to have significantly enhanced the performance of local chicken breeds.

Table 4. The physical traits of breast meat for two different local chicks at 18 weeks old.

Traits	Genetic Group	
	White line	Black line
Drip loss%	3.59± 0.01a	3.39 ±0.01b
W.H.C.%*	79.00 ±0.14b	80.76 ± 0.13a
Cooking loss%	21.91±0.09a	19.94 ±0.11b
pH	5.85 ±0.08a	5.90 ±0.02a
L* Lightness	53.53 ±0.21b	55.38 ±0.18a
a* Redness	8.71 ±0.03b	9.04 ±0.04a
b* Yellowness	5.96 ±0.04a	5.29 ±0.05a

Means following various letters in the same row are significantly different (P≤0.05) * W.H.C. are water holding capacity.

Conclusion

The current study found that two different local chicks had no significant impacts on the physical characteristics of breast meat and production performance, with the exception of drip loss and W.H.C. percentages, which were significantly variation between the black line and White line chicks. Compared to the white line, the black line's feed conversion ratio was better. Mostly, the results indicated that two different local chicks had significant effects on carcass characteristics. Based on the current findings, and because of its high growth rate and good feed efficiency, we concluded that the black line was better than white line

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دراسة المقارنة الأداء الإنتاجي وصفات الذبيحة لخطين من الدجاج المحلي العراقي.

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الخلاصة
إستهدفت هذه الدراسة إلى مقارنة نوعين مختلفتين من الافراخ المحلية من حيث الأداء الإنتاجي وصفات الذبيحة. أجريت هذه الدراسة في حقل كاني - كراو التجاري - على بعد 22 كم حول مدينة أربيل خلال الفترة من 5 يناير 2024 حتى 5 يونيو 2024. تم أخذ 300 بيضة مخصبة من نوعين مختلفتين من الدجاج المحلية (أبيض وأسود) من مركز البحوث الزراعية - وزارة الزراعة - بغداد. كانت نسبة الفقس 68٪. تم توزيع الافراخ بعمر يوم واحد من كل نوع بشكل عشوائي في أربع مكررات. تم استخدام نظام التغذية وبرنامج الإضاءة وفقًا لإرشادات إيزا براون. أظهرت نتائج هذه الدراسة عدم وجود فروقات معنوية بين كلا النوعين من الافراخ المحلية في الأداء الإنتاجي. سجلت نسبة الهلاكات للنوع الأسود أقل من الافراخ النوع الأبيض. علاوة على ذلك، أظهرت معظم صفات الذبيحة اختلافًا معنويًا، وسجلت نسب الذبيحة والفخذ للنوع الأبيض أعلى معنويًا ($P\leq0.05$) من النوع الأسود، بينما أظهرت نسبة الصدر للنوع الأسود أعلى معنويًا ($P\leq0.05$) من النوع الأبيض. ومع ذلك، كانت هناك نسبة السائل الناضح في الصدر أثناء التبريد أعلى معنويًا ($P\leq0.05$) للنوع الأبيض مقارنة بالنوع الأسود، بينما كانت القدرة على الاحتفاظ بالماء في الصدر أكثر معنويًا ($P\leq0.05$) للنوع الأسود مقارنة بالنوع الأبيض. وفي الاستنتاج، أظهر النوع الأسود أعلى زيادة الوزنية مع نسبة هلاكات أقل وأعلى دليل إنتاجي من النوع الأبيض.

الكلمات المفتاحية: الدجاج المحلي العراقي ، وزن الجسم ، كفاءة التحويل الغذائي، نوعية اللحم .