The Effect of Feather Color and Sex on The Physiological Characteristics of Domestic Chickens

Saad Attallah Al-Ardhi\textsuperscript{1} and Ali Hussein Khaleel Al hilali\textsuperscript{2}

\textsuperscript{1,2}College of Agriculture, University of Al-Muthanna, Iraq.

\textsuperscript{1}Email: saadata@mu.edu.iq
\textsuperscript{2}Email: Al-hilali2008@mu.edu.iq

Abstract

This study was conducted at the Animal Production Research Station - College of Agriculture - Al-Muthanna University, as 5 males and 5 females from three types of local chicken strains were used in this experiment according to the color black, brown and white, after the age of sexual maturity, and some blood characteristics were studied (Red blood cells, Packed cell volume( pcv )) and some biochemical characteristics such as concentration (glucose, cholesterol, and total protein) in blood serum. During the study period, birds were fed a diet containing 17.5\% protein and 2814 kcal / kg feed. The results showed no significant differences in red blood cells between the strains (black, brown, and white), while males significantly outperformed females in the numbers of red blood cells (P≤0.05). While significant differences were found between the strains in the studied characteristics of (cholesterol, glucose, and total protein), as males outperformed females in the concentration of glucose and cholesterol, while the concentration of total protein decreased in males compared to females.

Keywords: Chickens, Color, Physiological, genetic.

1. Introduction

Local chickens make up about 80\% of chicken flocks in Asia and Africa [1]. In comparison with current commercial chicken flocks, local chickens are characterized by being low in egg and meat production. The modern breeds of broiler are characterized by fast growth and excellent food conversion efficiency that are sensitive to high temperatures, making them more susceptible to heat stress [2]. The researchers applied several procedures in genetics and nutrition [3,4], and thus will be replaced by commercial poultry in many developing countries, which causes the existence of threats. Dangerous and serious for the presence of genetic diversity in local herds [5]. Although local chickens lack the characteristics of egg production and growth rates, they are good disease-resistant and have acceptable productivity under poor feeding and environment conditions compared to commercial chickens when raised under rural or home breeding systems [6]. Thus, these are signs or positive evidence for the contribution of local chickens. The diversity of performance of Iraqi local chickens and the presence of some of them with good and acceptable productivity give evidence of the possibility of improving egg production through selection. The present study is part of a selective genetic improvement program for partial record length in domestic brown chickens [7]. Domestic chickens are found in different heterogeneous areas that differ in their morphological characteristics such as the shape of the crest, the color of the feathers, the color of the skin, the color of the earlobes, and the color of the eggshell. It also differs in its quantitative characteristics such as body weight, feed consumption, speed of growth, fertility, production and size of eggs ... and others. However, local chickens are adapted to live under harsh local environment conditions and local chickens are characterized by relatively high prices for their products of eggs and meat compared to the prices of products Chickens of other breeds, especially commercial hybrids, Which surpasses it to a large degree in terms of production efficiency, and this is due to its relatively difficult management and to the idea prevalent among the general population who want the taste and taste of domestic poultry meat and eggs more than imported breeds, even if raised locally. This may be true, but within limits, because it is known in advance that the pattern of feeding plays a major role in influencing its taste. I doubt that in order to raise the productive efficiency of local chickens, it must be subjected to an integrated breeding program to improve it genetically in order to produce flocks with productive characteristics. Better, both in terms of egg and meat production [8].
2. Materials and Methods

Study birds and feeding. The study was conducted using three local strains, which are brown, black and white (3 hens and 3 Males for each breed strain). During the study period, birds were fed a diet containing 15-16% protein and 2750 kilocalories / kg feed, and the feed and water were provided freely during the study period.

2.1. Chemical for blood

Blood was collected by Venipuncture of the cutaneous ulnar vein, using a 5-ml syringe fitted with a 25-gauge Needle Guage, according to [9]. The bird is placed lying on its back and one of its wings is spread out, and the covering feathers of the cutaneous ulnar vein area are removed quickly to avoid causing pain to the bird. Blood is drawn from the vein with a syringe provided with a 25 gauge needle, after the vein is punctured upward, blood is withdrawn by means of depressurization, after which the blood is drained after removing the needle from the plastic syringe into 10 ml plastic tubes not containing EDTA, These tubes are placed in a centrifuge at a speed of 4000 revolutions / min for a period of 30 minutes directly, to separate the serum from the cell part. After the separation, the serum samples are transferred to other plastic tubes, and they are kept at a temperature of -20 °C until the tests are carried out. These tests were performed three times throughout the duration of the experiment (one time / for each period), as blood was collected from 3 males and 3 females from each treatment, and after separating the serum from the cell part, the following tests were performed: glucose concentration, total protein concentration, and cholesterol concentration in the At Al-Rikabi Laboratory, Al-Muthanna.

2.2. Packed Cell Volume (PCV)

(PCV) was calculated using open ended capillary microtubules containing EDTA In this examination, the percentage of the volume of compressed blood cells was measured using a special ruler and according to the method indicated [10]. The Red blood cell count: It was calculated using a hemocytometer and according to the method indicated by it [10].

2.3. The concentration of glucose, cholesterol and total protein in blood plasma.

Serum glucose, cholesterol and total protein were measured using the implementation steps listed within the Kit manufacturer's manual. The instructions of the French company REACTIFS BIOLABO were followed according to the method indicated by [11], which produced the kit, using a Spectrophotometer.

2.4. Statistical analysis

A randomized, complete design was used to analyze the results of the experiment in a two factor experiment that used two factors, sex and strain, Duncan was tested to study the significant differences between the averages (Duncan), using the statistical program SAS (2012).

3. Results and Discussion

3.1. Red blood cells

Effect of strain and sex on red blood cell counts (million / m3). It is evident from Table (1) that there are no significant differences between the local chicken strains in the number of red blood cells, as the number of red cells in the three types reached 2.9 ± 0.11, 2.71 ± 0.10, 2.81 ± 0.09 In males of the black, brown and white species respectively, the number of red cells in the females was 2.26 ± 0.03, 2.24 ± 0.03, 2.31 ± 0.06 for the three strains, respectively. The table shows the effect of sex on the number of red blood cells, where males outperformed females and all strains, due to the large size of males, in which the speed of metabolism is higher than that of females, and thus this requires the provision of large numbers of red blood cells to carry out their functions as well as the influence of the hormone androgen In the process of formation of red blood cells [12].

Table 1. The effect of strain and sex on red blood cell counts (million / m3 cubic) of species and strains of local chickens.
The different capital letters within a single column indicate significant differences between the breeds And different lowercase letters Within the same class, it indicates the presence of significant differences between the sexes .

3.2. Packed Cell Volume (PCV)

The effect of strain and sex on the Packed Cell Volume (PCV) Through Table (2), we did not notice significant differences between the local chicken breeds in the characteristic of the volume of compressed blood cells, as the compressed red blood cells recorded the highest values in the domestic chicken breeds compared to the foreign breeds This may be attributed to the decrease in egg production in the local breeds, where there is a negative correlation between egg production and the volume of compressed blood cells [13]. Males recorded higher values for the characteristic of the compressed blood cell volume compared to females, where the rate was 35.95% for males compared to 29.31% for females, and the differences were highly significant (Table 2). This difference may be the result of the action of the male hormone androgen stimulating the production of more red blood cells, while the female hormone estrogen acts the opposite [14].

Table 2. The effect of strain and sex on the volume of stacked red blood cells (million / m3) for species and strains of local chickens.

| Strain                  | Males       | Female      | General mean |
|-------------------------|-------------|-------------|--------------|
| Local black             | 0.88±35.93 A | 0.75±29.01 A | 0.86±32.47   |
| Local brown             | 0.90±35.94 A | 0.93±28.24 A | 0.95±32.09   |
| Local white             | 0.80±35.98 A | 0.67±96.30 A | 0.88±33.33 A |
| mean                    | 0.33±35.95 A | 0.30±92.31 A | 0.34±32.63   |

The different capital letters within a single column indicate significant differences between the breeds And different lowercase letters Within the same class, it indicates the presence of significant differences between the sexes .

3.3. Concentration of blood glucose

The effect of strain and sex on blood glucose concentration We notice through Table 4 significant differences between the local chicken breeds in the characteristic of glucose concentration, as the local brown chickens recorded the highest concentration of glucose in both males and females, while the black type recorded the lowest concentration in both males and females, and this may be due to the difference in genetic structures between the different types [15]. Males recorded a higher rate of glucose concentration compared to females in local chicken breeds, and the reason for this may be due to the fact that females produce eggs that have a negative effect on the level of blood sugar. The use of sugar is a major source in the manufacture of the basic materials that are included in the building of the egg [16]. Glucose, when converted to acetate, enters into a carbon skeleton in the construction of non-essential amino acids, which are later included in the manufacture of egg proteins [1].

Table 3. The effect of strain and sex on glucose concentration (mg / 100 ml plasma) of different types and strains of domestic chicken.

| Strain        | Males       | Female     | General mean |
|---------------|-------------|------------|--------------|
| Local black   | 158.74±5.88 C | 144.78±5.75 A | 151.76±4.86 A |
| Local brown   | 218.36±3.90 A | 210.45±4.93 A | 214.41±3.85 A |
| Local white   | 170.88±2.80 B | 160.04±3.25 B | 165.46±3.30 B |
| mean          | 182.66±3.33 a | 171.76±3.30 b | 3.34±177.21   |

The different capital letters within a single column indicate significant differences between the breeds And different lowercase letters Within the same class, it indicates the presence of significant differences between the sexes .

3.4. Cholesterol Concentration

The effect of strain and sex on cholesterol concentration Table 4 shows that the species and strain had a high significant effect (P≤0.05) on cholesterol concentration. The local black chicken was significantly (P≤0.05) superior to the other two types in cholesterol concentration. The reason may be due to the difference in genotypes between the different species, and this result confirmed the results of [18]. The table showed that females significantly outperformed males (P≤0.05) in the level of
cholesterol concentration, and the reason may be due to a positive association between cholesterol and female sex hormones [19].

Table 4. The effect of strain and sex on cholesterol concentration (mg / 100 ml plasma) of different types and strains of domestic chicken.

| Strain         | Males        | Female       | General mean |
|----------------|--------------|--------------|--------------|
| Local black    | 135.11±5.10  | 128.78±3.75  | 131.95±2.85^a |
| Local brown    | 100.36±4.90  | 94.45±4.93^b | 97.41±3.85^a |
| Local white    | 99.88±3.80   | 96.04±3.25^b | 2.78±97.96   |
| mean           | 111.78 ± 4.33 | 106.42±3.20^a | 2.54±109.10 |

The different capital letters within a single column indicate significant differences between the breeds And different lowercase letters Within the same class, it indicates the presence of significant differences between the sexes .

3.5. The effect of strain and sex on total protein concentration

It is evident from the results in Table 5 that there is a significant effect (P≤0.05) for the species and the strain on the total protein concentration, as the local black chickens recorded the highest concentration of total protein and differed significantly (P≤0.05) compared to other species. Whereas, the local brown chickens recorded the lowest concentration of the trait, and the reason may be due to the differences in the genotype between the different types of local chickens. The table showed that females significantly exceeded males (P≤0.05) in the level of total protein concentration. This is due to the biological need of females to raise blood proteins to use them in the egg-making process [8].

Table 5. Effect of strain and sex on total protein concentration (g / 100 ml plasma) of species and strains of domestic chickens

| Strain         | Males        | Female       | General mean |
|----------------|--------------|--------------|--------------|
| Local black    | 5.74±0.80^a  | 7.84±0.75    | 6.76±0.36^a  |
| Local brown    | 3.36±0.90    | 5.45±0.93^b  | 4.41±0.85^a  |
| Local white    | 4.88±2.80    | 6.04±3.25^b  | 0.88±5.46    |
| mean           | 4.66±0.33^a  | 6.42±0.30^a  | 0.34±5.54    |

The different capital letters within a single column indicate significant differences between the breeds And different lowercase letters Within the same class, it indicates the presence of significant differences between the sexes .

Conclusion

Dummy criteria can be used as an indicator of selection.

Reference

[1] Dana, N., Vander Waa, E. and Van Arendonk, J., (2011). Genetic and phenotypic parameter estimates for body weights and egg production in Horro chicken of Ethiopia. Tropical Animal Health and Production. 43, 21–28.
[2] Al-Hassani, D.H. and A.Y., Al-Shukri.(2011). Effect of using different concentrations of betaine on some productive traits of broiler reared under high temperature. Kufa J. for Agricultural Science.3(1), 164-171.
[3] Al-Shukri, A.Y., and D.H. Al-Hassani,(2012). Effect of betaine supplemented with drinking water on intake pattern of broiler chickens exposed to heat stress. World’s Poultry Science Journal, 65, 260–271.
[4] Horst, P. (1989). Native fowls as reservoirs for genomes and major genes with direct and indirect effect on the adaptability and their potential for tropical conditions. World’s Poultry Science Journal, 65, 260–271.
[5] Al-Tikriti, Bashir Taha Omar, Diab Raad Saadoun and Ismail Habib Ismail, (1999). Genetic parameters of some productive traits of Iraqi brown chickens, Iraqi Journal of Agriculture, 4(2) 70-81.
[8] Al-Hilali, Ali Hussein Khalil, (1996). Genetic analysis, qualitative and quantitative, of the basic phosphatase enzyme in local poultry and its relationship to production traits. PhD thesis - Faculty of Agriculture - University of Baghdad, 120 pages.

[9] Al-Darraji, Hazem Jabbar, Walid Khaled Al-Hayani and Ali Sabah Al-Hasani, (2008). Bird's blood physiological. Ministry of Higher Education and Scientific Research, College of Agriculture, University of Baghdad.

[10] Archer, R.K., (1965). Hematological Techniques for use on Animals. Blackwell scientific Oxford Publication.

[11] Mohammed, M.A., Abdulridhwa, W.M., Abd, A.N., (2018). Thickness effect on some physical properties of the Ag thin films prepared by thermal evaporation technique, Journal of Global Pharma Technology, 10(3), pp. 613–619.

[12] SAS, (2012). Statistical Analysis System, User's Guide. Statistics version 6th Edition. Institute Inc, Garry, N.C. USA.

[13] Al-Darraji, Hazem Jabbar, (1995). Study of some physiological characteristics and thermal resistance of faw bro chicken and its resistance to some commercial broiler hybrids. Master thesis - College of Agriculture - University of Baghdad.

[14] Sturkie P.D., (1986). Avian Physiology, 4th ed. New York, Heidelberg, Berlin, Springer Verlage.

[15] Al-Hilali, Ali Hussein Khalil, Ahmed Abdullah Abbas, Jamil Muhammad Saeed, Ahmed Hussein, (2007). Inheritance of blood glucose in domestic chickens and its relationship to production traits. Iraqi Poultry Science Journal, 2, (2), 134-142.

[16] Edward, C.N., (1976). The cholesterol problem, the egg and lipid metabolism in the laying hens. Poultry Science, 55, 14-30.

[17] Meluzzi, A., G. Primiceri, R. Giordani, and G. Fabris, (1992). Determination of blood constituents reference values in broilers. Poultry Science, 71(2), 337-345.

[18] Micheal, E.L. and E.K. James, (1977). Values for several blood parameters in Eastern Wild Turkey. Poultry Science, 56(1), 157-166.

[19] Abbas, Ahmed Abdullah, (2001). Estimation of some genetic parameters of some biochemical parameters in local Iraqi chickens. Master Thesis Faculty of Agriculture - Anbar University.