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Evaluation of Some Blood Parameters of Hajar 1 and Hajar 2 Saudi Chicken Lines Over the First 30 Weeks of Age

[1,2]A.S. Ahmed, [1]J.M. Alhamada and [1]Z.M. Hakami
[1]Department of Animal and Fish Production, College of Agriculture and Food Science, King Faisal University, Saudi Arabia
[2]Department of Animal Production, College of Agriculture, Cairo University, Egypt

Corresponding Author: A.S. Ahmed, Department of Animal and Fish Production, College of Agriculture and Food Science, King Faisal University, Saudi Arabia Tel: +966 567295959

ABSTRACT

One thousand and three hundred chicks were used to describe body weight, hematocrit percentage (HTC), hemoglobin concentration (Hb), total plasma protein (TP) and albumin concentration (Alb) of two recently characterized local Saudi chicken lines Hajar 1 and 2 over the first 30 weeks of age. Three hundred and twenty male plus three hundred and five females of Hajar 1 and three hundred and forty six males plus three hundred and twenty nine females of Hajar 2 lines were used. At hatch, initial body weights were recorded individually, then blood samples were collected and body weight were recorded individually at 2, 4, 6, 8, 10, 12, 14, 16,18, 22, 26 and 30 weeks of age. The results indicated the genetic group effect on the body weight in male birds starting from the second week of age. The genetic group also affected HTC after 12 weeks of age. The sex effect was observable at most of the evaluated parameters. The results showed the effect of line-sex interaction on TP and Alb at late stages of the experiment. The study provides the first set of results to describe some blood parameters for Hajar 1 and 2 chicken lines. The results emphasized the effect of genetic group and sex besides their interaction in different ages on the changes in the selected blood parameters. The results revealed partial explanation to support previous findings about production performance for those lines. The study highlighted the importance of assessment of locally characterized chicken lines to figure out their unique characters.

Key words: Chicken, Hajar 1, Hajar 2, hemoglobin, hematocrit, total protein, albumin

INTRODUCTION

It is well documented that poultry genetic diversity is in an endangered status, one of the main reasons for that is the low level of characterization especially in developing countries (Hoffmann, 2009). Hajar 1 and 2 chicken line have been recently characterized for their phenotypic and some genetic characters (Ahmed and Alabbad, 2014). Understanding the normal physiological values of local lines under local environment are essential for proper management and breeding plans, in addition to providing explanations to interpret the performance and health status (Elagib and Ahmed, 2011). The physiological parameters of local chickens seems to be different than commercial lines, this may be due to changes resulted from their adaptability to the specific local environment (Abdi-Hachesoo *et al*., 2011). Previous studies have been tried to assess some blood biochemical parameters of random local chicken at Al-Ahsa region, Saudi Arabia (Albokhadaim, 2012; Albokhadaim *et al*., 2012) but those studies were using random chicks and

low number of experimental birds, which did not allow us to rely on those results in the specific line characterization. The differences in hematological parameters affected by genetic line and some other non-genetic factors, including age, sex and management system (Etim *et al*., 2014). There are differences in hematological profile among various local chicken lines which may reflect their genetic capacity, the differences also affected by age of the birds (Islam *et al*., 2004). The effect of the age on the serum biochemical values have been reported to be significant (Schmidt *et al*., 2007). Packed cell volume (%) and hemoglobin concentration seems to differ significantly among different Nigerian local chicken with different genotypes (Peters *et al*., 2011). Albumin and total protein concentration were affected by genetic group and genetic group by sex interaction in local lines selected for body weight (El-Gendy *et al*., 2011). While, another report demonstrated that sex of the birds did not affect total protein and albumin concentrations of local indigenous Sudanese chicken (Elagib *et al*., 2012). Different genetic groups of local Nigerian chicken differ significantly in their total plasma protein and globulin values (Ibrahim *et al*., 2012).

According to the different outputs from different studies which reflected the importance of genetic group, sex and age of the birds on blood parameters. In the current study, we used one thousand and three hundred chicks represent both sexes of two chicken lines to assess a reference range of some essential blood parameters over the first 30 weeks of age as a step forward toward line characterization. In addition, to help us for further explanation of the variation in the productive performance between the lines, sexes and ages in the future. We hypothesized that the selected blood parameters will vary considerably according to the genetic lines, sex at different ages.

MATERIALS AND METHODS

Birds and general management: One thousand and three hundred chicks from two recently characterized local Saudi chicken line were used in this experiment. Three hundred and twenty male plus three hundred and five females represent Hajar 1 line. Moreover, three hundred and forty six males plus three hundred and twenty nine females represent Hajar 2 line. All birds were obtained from King Faisal University Research Station, as part of a huge project for genetic conservation of local Saudi chicken lines (Ahmed and Alabbad, 2014). The genetic background and those lines and their establishment is well documented by Ahmed and Alabbad (2014). After hatching, chicks were wing banded then placed in closed house including cage system for brooding and provided with the optimal brooding conditions. Each line randomly divided into four groups in four cages with pan feeders and nipple drinking system. Birds received the regular vaccination program of the poultry unit at King Faisal university research station. At 16 weeks of age, all birds were moved to an individual caging system in a close house system with automatic feeding and nipple drinking system.

Day old chicks were fed a commercial starter diet (20% crude protein and 2800 kcal ME kg^{-1}) for the first six weeks of age. By the end of the 6th week of age till 17weeks of age, they were fed a commercial growing ration (14% crude protein and 2700 kcal ME kg^{-1}) and thereafter, the birds have received a commercial layer diet with 16% protein and ME of 2700 Kcal kg^{-1} feed. Both feed and water were provided *ad-libitum* at all stages. Experimental birds were treated according to the mandatory roles of animal care and ethics guidelines set by the Deanship of scientific research, King Faisal University.

Parameters and data collection: At hatch, all birds were wing banded, day old body weights were recorded individually for all chicks as day zero body weight. Thereafter, body weights were recorded at 2, 4, 6, 8, 10, 12, 14, 16,18, 22, 26 and 30 weeks of age.

Due to the small chicks size, blood sampling started at 2 weeks of age and continued for 4, 6, 8, 10, 12, 14, 16,18, 22, 26 and 30 weeks of age. Blood samples were collected from wing vein into heparinized tubes and kept in refrigerator (2-8°C) for about 2 h prior to processing at the same days of sampling. Hematocrite (HCT) was determined directly 2 h following blood collection by centrifugation of blood samples in heparinized capillary tubes, The HTC percent determined by circular micro-capillary tube reader. Concurrently, Hemoglobin (Hb) concentrations were determined through cyanomethemoglobin method using a commercial kit (Ref. No10751, Human Diagnostics mbH, Germany). Then, blood samples were centrifuged for ten minutes, 3000 rpm and plasma was obtained and stored at -20°C until Total Protein (TP) and albumin (Alb) assays were run simultaneously. TP and Alb were determined using commercial kits (Ref No. 10570 and 10560, respectively, Human Diagnostics mbH, Germany).

Statistical analysis: The data was subjected to a two-way analysis of variance (ANOVA) for the effect of line, sex. Means were separated using Duncan's multiple range tests. Data was analyzed using the general linear model procedure. JMP IN software (Sall *et al*., 2005) was used for statistical analysis. Statistical significance was considered as $p \leq 0.05$.

RESULTS

The body weight curves of male and female birds of Hajar 1 and Hajar 2 lines are shown in Fig. 1. At hatching time there were no significant ($p<0.05$) differences between all birds in body weight. Starting from the 2nd week of age till the 30th week of age Hajar 1 male birds recorded the highest significant body weight values compared to all other birds. At 16 weeks, Hajar 2 male birds ranked the second and recorded higher significant ($p<0.05$) body weight than female lines. Body weight of female birds in both lines did not differ significantly from each other at any measuring point except in the week 14 of age.

Results of hematocrit percentage under the same experimental conditions indicated that there were no significant difference ($p<0.05$) in hematocrit percent between all birds starting from the second week of age till the 10th week of age (Fig. 2). The gap between male and female birds in hematocrit percentage started to show up at week 12. There was a significant ($p<0.05$) trend of superiority in hematocrit percentage of male birds over female birds starting from the 14th week

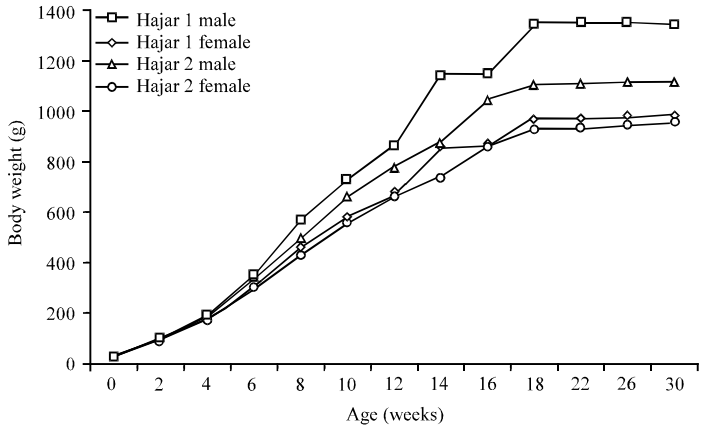

Fig. 1: Body wieght (g) of Hajar 1 and Hajar 2 lines over the first 30 weeks of age

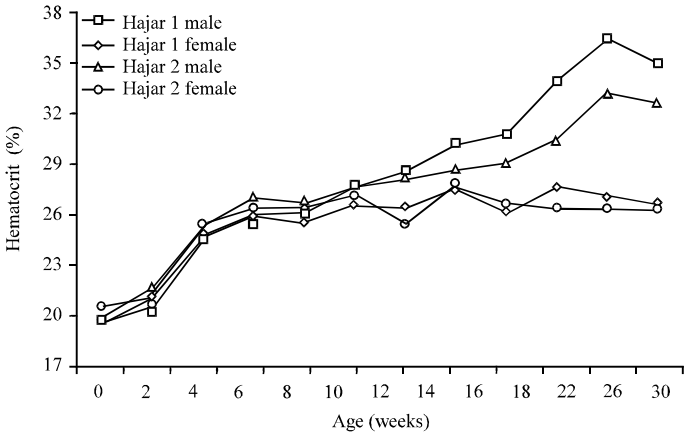

Fig. 2: Hematocrit percentage of Hajar 1 and Hajar 2 lines over the first 30 weeks of age

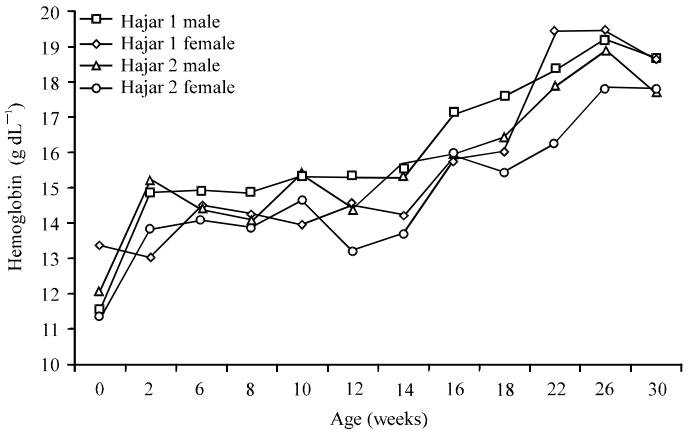

Fig. 3: Hemoglobin concentration of Hajar 1 and Hajar 2 lines over the first 30 weeks of age

of age until the end of the experiment. Hajar 1 female birds recorded the lowest significant ($p<0.05$) hematocrit percent compared to both male lines. No significant differences ($p<0.05$) were observed between female lines starting from 14 weeks of age on. While, Hajar 1 male line birds recorded higher significant hematocrit percent than Hajar 2 male birds (Fig. 2).

No significant differences ($p<0.05$) were recorded between all birds for hemoglobin concentration at 2 weeks of age (Fig. 3). In spite of that male birds of both lines recorded higher values of hemoglobin concentration than female birds during most of the measuring point from 4-18 weeks of age, but there were inconsistent in hemoglobin concentration trend. After 18 weeks of age Hajar 1 female birds recorded higher significant ($p<0.05$) hemoglobin concentration compared to Hajar 2 females, this trend continued till 26 weeks of age. Although, some numerical differences, no significant differences ($p<0.05$) in hemoglobin concentration were recorded between male birds in both lines at any measuring point.

Total plasma protein concentration of different lines shown in Fig. 4. There were not any significant differences ($p<0.05$) between male birds in total plasma protein concentration at any measuring point. Female birds of both lines did not record significant differences in total plasma

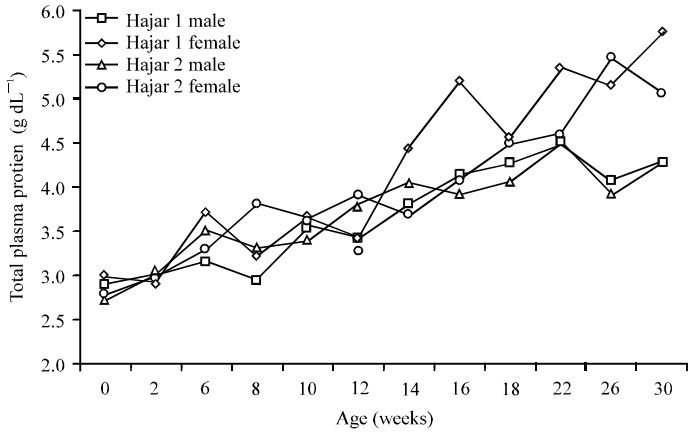

Fig. 4: Total plasma protein concentration of Hajar 1 and Hajar 2 lines over the first 30 weeks of age

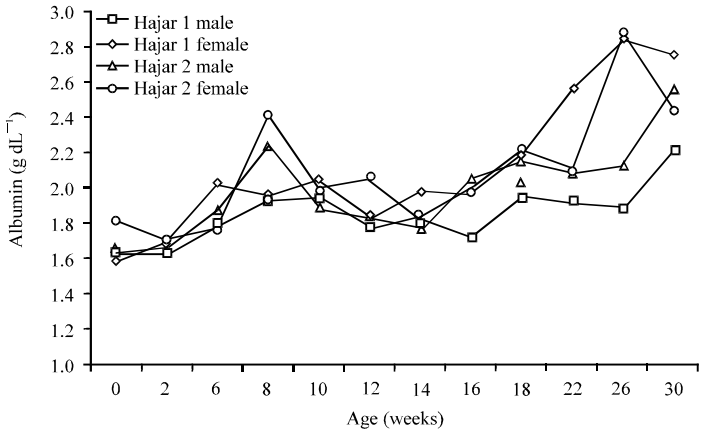

Fig. 5: Albumin concentration of Hajar 1 and Hajar 2 lines over the first 30 weeks of age

protein for the first 10 weeks of age. While, at 14, 16 and 22 weeks of age, Hajar 1 female birds recorded higher significant ($p<0.05$) total protein concentration than Hajar 2 female birds. The significant ($p<0.05$) superiority trend in total protein concentration of female birds of both lines over male birds started from 26 weeks of age.

Albumin concentration results revealed an irregular trend over the first 18 weeks of age (Fig. 5). No significant differences ($p<0.05$) were observed in albumin concentration between male birds of both lines over the first 14 weeks of age. Starting from the 18th week of age, Hajar 1 female birds showed increased albumin concentration, they recorded the highest significant values ($p<0.05$) at 22 weeks of age. At 26 weeks of age, female birds of both lines recorded significantly ($p<0.05$) higher values of albumin concentration than male birds. Hajar 1 female birds continued to be significant ($p<0.05$) superior in albumin concentration over Hajar 1 male birds at 30 weeks of age.

DISCUSSION

The current study emphasized the previous findings of Ahmed and Alabbad (2014) where, male birds of both lines typically were heavier than female birds. In addition, Ahmed and Alabbad (2014)

have partially noticed the superiority of Hajar 1 male line that starting from the second week of age at early ages. The general trend of relatively low body weight of Hajar 1 and Hajar 2 local lines is consistent with the previous survey study in Saudi Arabia (Al-Yousef, 2007). In addition, the results are consistent with what Ahmed *et al.* (2009) reported about local Saudi chicken. Where, the average body weight of control birds recorded 1097.8, 1130.2, 1258.8, 1319.2, 1354.0, 1416.8 and 1438.0 g for male birds and was 786.3, 830.3, 874.15, 913.4, 925.4, 931.4 and 945.5 for female birds in 17, 18, 19, 20, 21, 22 and 23 weeks of age, respectively.

Packed cell volume, which is also known as hematocrit (HTC) and hemoglobin (Hb) concentration, indicated the amount of oxygen and nutrients transportation in addition to their involvement in indicating the carrying of carbon dioxide in his way to be eliminated (Etim *et al.*, 2014). Those blood constituents change in relation to many factors, including physiological condition, genetic and age (Peters *et al.*, 2011; Islam *et al.*, 2004) and sex (Addass *et al.*, 2012). The increase of HTC and Hb values with the advancement of age in the current study is in agreement with previous studies (Khawaja *et al.*, 2012; Islam *et al.*, 2004). The relatively high values of Hb concentration compared to the normal range of commercial chickens reference range are noticeable. The high Hb values suspected to be due to the unique genetic background of the current chicken lines which is consistent with the previous findings of high Hb concentration in other unique local breeds which recorded 18.9 g dL^{-1} in indigenous sudanese chicken (Elagib and Ahmed, 2011). In addition, it reaches 16.37 g dL^{-1} in indigenous dominant black chicken in southern Nigeria (Isidahomen *et al.*, 2012). The increase of HTC and Hb values of male birds starting from the 12-14 weeks of age are consistent with the previous studies (Simaraks *et al.*, 2004; Elagib and Ahmed, 2011; Peters *et al.*, 2011). By maturation stage, the androgen starts to increase in male birds (Whittow, 2000). This increase stimulates erythropoiesis and leads to the increase of erythrocytes and consequently HTC and Hb values (Oladele *et al.*, 2001) which is suspected to be the cause of HTC and Hb values trend for male birds in the current study. While the differences in HTC value between Hajar 1 and Hajar 2 male birds assumed to be affected by genetic differences.

The current results indicated that genetic line and sex effects did not affect the Total Plasma protein (TP) and Albumin (Alb) levels at the earliest ages till the 10th week of age. While, superiority of Hajar 1 female birds recorded starting from the 14th week of age, the genetic effect on TP has been previously demonstrated (Elagib *et al.*, 2012). The findings of Darshan *et al.* (1987) emphasize that age had a greater effect on TP levels in female than in male. Female advantage in TP and Alb levels prior to laying period could be attributed to changing in estrogen level that leads to increase the serum TP to be synthesized in the liver and transported to ovary to be incorporated in the oocytes (Ritchie *et al.*, 1994). The current high level of TP and Alb in Hajar 1 than Hajar 2 female birds in some late, measuring point may be due to the sex-line interaction in addition to sex age interaction. The increased levels of Hajar 1 female TP and Alb could participate in explaining of the previous findings of Ahmed and Alabbad (2014) that demonstrated a higher significant egg production of Hajar 1 than Hajar 2 line.

In conclusion, the current results considered as the first report describing some selected blood parameters for Hajar 1 and Hajar 2 chicken lines. The results emphasized the effect of genetic group and sex besides their interaction in different ages on the changes in the selected blood parameters. Moreover, the results partially infer the association between the selected blood parameter and the previous findings about production performance. Further studies needed to assess the other blood biochemical parameters and their correlation to productive performance.

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