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Investigation of Selected Biochemical Parameters of Local Chickens with Different Age and Sex in Al-ahsa, Saudi Arabia

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Abstract: In many species of birds, normal values for hematological and biochemical factors were measured and data base was established as their blood-profiles. In local Saudi chicken, measurement of serum biochemical values, which are important for diagnosis of clinical signs and symptoms when affected by diseases, are limited. Therefore, this study was carried out to investigate serum's biochemical values of local Saudi chicken. Therefore, forty chicks (1 month old; 20 males and 20 females) and another forty chicks (3 month old; 20 males and 20 females) were obtained from the farm of the Veterinary Research Station, King Faisal University, Al-Ahsa, Saudi Arabia and used as materials in the study. Blood samples were collected from all birds and the harvested sera were kept frozen at -20°C until the time of analysis. The present findings indicated no significant difference ($p>0.05$) of all examined biochemical parameters between male and female chickens or young and old birds. Interestingly, all investigated biochemical parameters in these chickens were lower than the recorded reference values of other birds except for glucose which exhibited higher values than the reference. The reported lower serum cholesterol and triacylglcerol concentrations might be reflected on their concentrations in meat and protecting human beings from atherosclerosis. Therefore, estimation of lipid profile in these birds is recommended for future study.

Key words: Chicken, biochemical parameters, electrolytes, proteins, lipids

INTRODUCTION

Local Saudi chickens represented an important protein source to people in Al-Ahsa villages in Saudi Arabia. The performance of local Saudi Chickens was recorded as low (Al-Aqil, 1998) while egg production perhaps increased after incrimination of arginine and lysine and in their diet (Najib and Basiouni, 2004). Physiology and chemistry of blood were used as indicators for various diseases in Birds (Harr, 2002; Hauptmanova *et al*., 2006) and animals (Perelman, 1999) however, these values were affected by different factors such as nutrition, age and sex (Fudge 2000; Kececi and Col, 2011). Caution could be taken, as uric acid is the catabolic end product of proteins in birds not blood urea nitrogen as in case of mammals. Uric acid in mammals represents the metabolic end product of nucleic acid. Therefore, appropriate explanation of these parameters used in avian medicine is of great importance (Harr, 2002). In many species of birds, normal values for biochemical factors were measured and a comprehensive data base was established as their blood-profiles. Recently, researches focused on village chickens (Simaraks *et al*., 2004; Pampori and Iqbal, 2007; Ladokun *et al*., 2008; Melesse, 2011) industrial and commercial hybrid chickens (Meluzzi *et al*., 1992; Talebi *et al*., 2005; Abdi-Hachesoo *et al*., 2011) have been developed. However, there is no information about blood profile of local Saudi chicken. Therefore, this study was carried out to investigate serum's biochemical values of local Saudi chicken.

MATERIALS AND METHODS

Birds: At February 2010, one day old hundred healthy Indigenous Saudi chicken were reared in the farm of the Veterinary Research Station, King Faisal University, Al-Ahsa, Saudi Arabia. One month later, twenty male and twenty female chicks were selected and subjected for blood samples collection. After three months from the start of the experiment, another twenty male and twenty female chicks were selected and subjected for blood samples collection. The Indigenous Saudi chickens were housed in a floor pen. Feed and water were

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provided ad libitum. The chicks received starter diet containing 28% crude protein and 3100 kcal ME kg^{-1} for the first 4 weeks; thereafter, a grower diet containing 22% crude protein and 3100 kcal ME kg^{-1} was given. All animals were placed in a temperature controlled room at 32°C. The temperature of the room was reduced 2°C every week up to 4 weeks of age. After the fourth week, no heating was applied. For the first 4 weeks 24 h and then until the end of the sixth week 22 h of light/day was provided in the room where the animals were placed. After the sixth week daylight was continuous.

Samples collection: Approximately 3 mL blood samples were taken from the wing vein in plain tubes. All samples were collected between the same hours (1000 to 1100) to minimize any variation in blood chemicals caused by the circadian rhythm. The blood collection tubes were kept on ice in cool containers to avoid denaturation of proteins and were taken to the laboratory within 2 h of blood withdrawal.

Biochemical analysis: Sera were stored at -20°C until used for biochemical analysis. Commercial diagnostic kits (United Diagnostic Industry, UDI, Dammam, Saudi Arabia) were used for determination of Glucose (EP37L-660), total proteins (EP56-660), Albumin (EP03-570), alanine aminotransferase, ALT (EP07-500), aspartate amino transferase, AST (EP15-500), alkaline phosphatase, ALP (EP04L-660), acid phosphatase, ACP (EP02-295), blood urea nitrogen, BUN (EP20-420), Uric acid (EP61-620), Creatinine (EP33K-660), creatin kinase, CK (EP28-310), triacylglycerol, TAG (EP59-660),cholesterol (EP24-660), Calcium (EP22-660), Phosphorus (EP46-660), Magnesium (EP50-660), Chloride (EP27-500) on ELIPSE full automated chemistry analyzer (Rome, Italy). Concentration of the biochemical constituents was calculated according to the manufacture instruction.

Statistical analysis: Data for parameters were grouped and expressed as Mean±SD. The means obtained in the different age groups in the Indigenous Saudi chicken were subjected to analysis of variance (SAS, 2002). Statements of statistical significance are based on $p<0.05$.

RESULTS

The results of the present study indicated that serum glucose values of males young (490±35 mg dL^{-1}) and adult (542.8±25 mg dL^{-1}) were comparable ($p>0.05$) to that of females young (502±25 mg dL^{-1}) and adult (513.5±19 mg dL^{-1}) (Table 1). However, the values of glucose in these Saudi chickens were higher than the reference values recorded in other birds. The data summarized in Table 1 indicated that, the values of total proteins (3.4±0.8; 3.8±0.9 g dL^{-1}), Albumin (1.6±0.3; 1.9±0.5 g dL^{-1}), globulins (1.9±0.7; 1.9±0.4 g dL^{-1}) and albumin/globulin ratio (0.9±0.5; 1±0.4) in young and adult males, respectively were not significantly ($p>0.05$) differed than that of young and adult females, respectively (3.6±1; 3.3±0.5 g dL^{-1}), (1.8±0.3; 1.7±0.3 g dL^{-1}), (1.8±0.9; 1.6±0.4 g dL^{-1}) and (1.3±0.9; 1.2±0.4). Similarly, as shown in Table 1 the determined values of triglycerides (60.5±16; 74.1±14 mg dL^{-1}), Total cholesterol (75.2±26; 82.8±35 mg dL^{-1}) and VLDL-c (12.1±5; 16.8±6.8 mg dL^{-1}) were not significantly ($p>0.05$) differed than that of young and adult females, respectively (55.18±22; 68.3±20 mg dL^{-1}), (63.4±15; 71.8±16 mg dL^{-1}) and (11±4.4; 13.7±3.8 mg dL^{-1}). However, these values were lower than the reference values observed in other birds. The present findings (Table 2) indicated that, the examined serum enzymes, ALT (3.5±2.4; 3.4±1.6 IU L^{-1}), AST (180±10; 190±11 IU L^{-1}), ALP (786±20; 843±32 IU L^{-1}), ACP (3.9±1.6; 3±0.7 IU L^{-1}) and CK (1044±60; 1124±40 IU L^{-1}) in young and adult males were not significantly ($p>0.05$) differed than that of young and adult females, respectively (3.7±2.5; 5.5±3.7 IU L^{-1}), (190±18; 183.9±16 IU L^{-1}), (782.7±45; 770±40 IU L^{-1}), (4.33±1; 3.83±0.9 IU L^{-1}) and (1170±30; 1139±100 IU L^{-1}). In addition, the values of these enzymes were lower than the reference values observed in other birds except for ALP

Table 1: Glucose, protein and lipid profiles of indigenous Saudi chicken with different age and sex

	Male		Female	
Parameters	Young	Adult	Young	Adult
Glucose (mg dL^{-1})	490±35	542.8±25	502.5±25	513.5±19
Total proteins (g dL^{-1})	3.4±0.8	3.8±0.9	3.6±10	3.3±0.5
Albumin (g dL^{-1})	1.6±0.3	1.9±0.5	1.8±0.3	1.7±0.3
Globulins (g dL^{-1})	1.9±0.7	1.9±0.4	1.8±0.9	1.6±0.4
Albumin/globulin ratio	0.9±0.5	1±0.4	1.3±0.9	1.2±0.4
Triglycerides (mg dL^{-1})	60.5±16	74.1±14	55.18±22	68.3±20
Total cholesterol (mg dL^{-1})	75.2±26	82.8±35	63.4±15	71.8±16
VLDL-c (mg dL^{-1})	12.1±5	16.8±6.8	11±4.4	13.7±3.8

Value are Mean±SD of 20 chicks, VLDL-c: Very low density lipoprotein cholesterol

Table 2: Liver function biomarkers of indigenous Saudi chicken with different age and sex

	Male		Female	
Parameters (IU L^{-1})	Young	Adult	Young	Adult
Alanine transaminase	3.5±2.4	3.4±1.6	3.7±2.5	5.5±3.7
Aspartate transaminase	180±10	190±11	190±18	183.9±16
Alkaline phosphatase	786±20	843±32	782.7±45	770±40
Acid phosphatase	3.9±1.6	3±0.7	4.33±1	3.83±0.9
Creatine kinase	1044±60	1124±40	1170±30	1139±100

Value are Mean±SD of 20 chicks

Table 3: Kidney markers of Indigenous Saudi chicken with different age and sex

	Male		Female	
Parameters (mg dL^{-1})	Young	Adult	Young	Adult
Blood urea nitrogen	0.6±0.3	0.6±0.2	0.70±0.2	0.80±0.3
Creatinine	0.2±0.1	0.2±0.1	0.20±0.1	0.20±0.1
Uric acid	5.2±1.9	5.1±2.3	3.67±1.0	4.83±1.3

Value are Mean±SD of 20 chicks

Table 4: Electrolytes profile of indigenous Saudi chicken with different age and sex

	Male		Female	
Parameters	Young	Adult	Young	Adult
Calcium (mg dL^{-1})	7.7±2.1	10.26±2.4	9.02±1.4	9.5±1.4
Phosphorus (mg dL^{-1})	4.4±2.0	3.13±1.5	4.20±1.9	2.9±1.0
Magnesium (mg dL^{-1})	2.7±2.3	3.20±1.6	3.10±1.2	3.0±1.9
Chloride (meq L^{-1})	78.0±16.0	85.90±20.0	80.00±18.0	75.7±13.0

value are Mean±SD of 20 chicks

which was within the reference range. As presented in Table 3, the values of BUN (0.6±0.3; 0.6±0.2 mg dL^{-1}), Uric acid (5.2±1.9; 5.1±2.3 mg dL^{-1}) and creatinine (0.2±0.1; 0.2±0.1 mg dL^{-1}) in adult and young males were not significantly ($p>0.05$) differed than that of young and adult females, respectively (0.7±0.2; 0.8±0.3 mg dL^{-1}), (0.2±0.1; 0.2±0.1 mg dL^{-1}) and (3.67±1; 4.83±1.3 mg dL^{-1}). In addition, the level of Uric acid and BUN were lower than the reference range of other birds whereas creatinine values were within that range. Data shown in Table 4 demonstrated that, the investigated electrolytes, Calcium (7.7±2.1; 10.26±2.4 mg dL^{-1}), Phosphorus (4.4±2; 3.13±1.5 mg dL^{-1}), Magnesium (2.7±2.3; 3.2±1.6 mg dL^{-1}) and chloride (78±16; 85.9±20 meq L^{-1}) in young and adult males were not significantly ($p>0.05$) differed than that of young and adult females (9.02±1.4; 9.5±1.4 mg dL^{-1}), (4.2±1.9; 2.9±1 mg dL^{-1}), (3.1±1.2; 3±1.9 mg dL^{-1}) and (80±18; 75.7±13 meq L^{-1}), respectively and were lower than the reference range of most of birds.

DISCUSSION

The normal values of blood chemistry of different species of birds have been reported (Woodard *et al*., 1983; Kececi and Col, 2011). However, only few studies on blood biochemistry for the local Saudi chicken were available. Different types of stresses were determined in birds via estimation of biochemical parameters (Hauptmanova *et al*., 2006; Spinu *et al*., 1999; Quintavalla *et al*., 2001). Age, sex, species and nutrition affected birds biochemical parameters greatly (Fudge 2000; Islam *et al*., 2004). Biochemical parameters of Native chickens of the world differ from place to other. Therefore, it is important to investigate blood profiles of Local Saudi birds to estimate the health condition of the birds (Abdi-Hachesoo *et al*., 2011). The information gained from the present study may help in different studies aims to select a new genetically strains (Shlosberg *et al*., 1996; Ladokun *et al*., 2008). The main objective of this study was to determine normal baseline values for selected biochemical parameters in male and female, young and old local breed chicken reared in Eastern region, Al-Ahsa, Saudi Arabia.

Glucose of young chicks is mainly lower than that of mature chickens (Ritchie *et al*., 1994) and the glucose levels of female (109 g dL^{-1}) are almost lower than that of male (114 g dL^{-1}) chickens (Sturkie, 1965). This is not the case of the present study (Table 1). The findings of present study were different than previous findings (Homswat *et al*., 1999) which compared glucose level of male pheasant (218.52±22.32 mg dL^{-1}) with that of females (266.4±21.60 mg dL^{-1}). In the present study, the overall mean values of glucose content (500±10 mg dL^{-1}) was similar to the upper limits of normal reference values (200-500 mg dL^{-1}) that reported for poultry serum glucose (Coles and Campbell, 1986; Dein, 1986; Abdi-Hachesoo *et al*., 2011). Significance in glucose values were not observed in males and females.

Total protein of female local Saudi chicken birds was comparable to males and young ages of old one (Table 1). This result was disagreeing with previous results (Meluzzi *et al*., 1992) demonstrating that total protein of female was higher than males in broilers chickens. Total protein of female Thai indigenous bird was higher than in males (Simaraks *et al*., 2004). This confliction between present and previous results might be attributed to environment, season or the condition of the experiment (Ritchie *et al*., 1994). Female local Saudi chickens were not reached to laying period as such of the previous experiment (Ritchie *et al*., 1994). Total proteins of local Saudi chickens were lower than the normal range of the domestic turkey (4.9-7.6 mg dL^{-1}) and pheasant (male = 5.65 mg dL^{-1}; female = 6.06 mg dL^{-1}) but at the same normal range of the guinea fowl (3.5-4.4 mg dL^{-1}) and common quail (3.4-3.6 mg dL^{-1}) (Ritchie *et al*., 1994).

Triglycerides of local Saudi chicken were not significantly different between sexes and ages, which disagree with the other results (Kececi and Col, 2011) which reported that triglyceride levels were significantly higher in young Pheasants than in the adult. The serum triglyceride levels of the local Saudi chickens were lower than the ranges previously described in various avian species such as Pheasants (Kececi and Col, 2011), Broiler (Arslan *et al*., 2001), turkey (Bounous *et al*., 2000) and Ostrich (Levi *et al*., 1999). Cholesterol of local Saudi chickens was not significantly different between sexes, similar to the report in pheasant (Homswat *et al*., 1999). The serum cholesterol of local Saudi chickens was lower than the reference range of most of birds (129-297 mg dL^{-1}) (Clinical Diagnostic Division, 1990) and in broilers (140 mg dL^{-1}) (Meluzzi *et al*., 1992). Lower content of cholesterol may be resulted from high body activity and high need of energy in local Saudi chickens (Almeida *et al*., 2006). Low level of cholesterol in local Saudi chickens is of great benefits to human beings (Ademola *et al*., 2009).

Although a measurement of enzyme activities in serum is very important diagnostic tool of bird diseases, the wide range of activity make it difficult to interpret (Harr, 2002; Perelman, 1999). AST is a very sensitive, nonspecific biomarker of liver disease in birds. Conversely, ALT is of poor diagnostic value in birds due to its existence in many tissues (Harr, 2002; Perelman, 1999). In this study, the mean plasma AST, ALT and ALP concentrations of local Saudi chicken were lower than the ranges previously described for broilers (Arslan *et al*., 2001), canaries, ducks, partridges and pigeons (Harr, 2002). On the other hand, there were no significant differences in AST, ALT, ALP, ACP and CK activities among the age-related groups and different sex of the local Saudi chicken in the present study. Previously Meluzzi *et al*. (1992) reported that plasma ALP in males (2,427 IU L^{-1}) was significantly higher than in female broilers (2,070 IU L^{-1}) (normal range between 568-8,831 IU L^{-1}), which was different from that reported in laying hens (Ritchie *et al*., 1994) and pheasants (Sturkie, 1965). However, serum ALP of this study was not different between sexes (Table 1). The serum ALP of Saudi chickens was within the reference range reported by Meluzzi *et al*. (1992).

Uric acid in birds is the major nitrogen metabolic end product. Many factors such as age, diet and lying period affect the concentration of uric acid (Simaraks *et al*., 2004; Ritchie *et al*., 1994). It has been reported that serum uric acid of mature females (5.40 mg dL^{-1}) was higher than that of males (2.86 mg dL^{-1}) and serum uric acid of laying birds (0.76 mg dL^{-1}) was lower than that in non-reproductive females (1.80 mg dL^{-1}) (Sturkie, 1965). However, in the present study serum uric acid levels of local Saudi chicken were not significantly different between sex and ages. Creatinine, the biomarker of protein metabolism, derived from phosphocreatin in muscle is normally low in birds and its high level is associated with high level of activity (Harr, 2002). The values determined in this study were within the range recorded in partridges (Rico *et al*., 1977), pigeons (Harr, 2002) and ostriches (Quintavalla *et al*., 2001) and did not differ significantly among all chicks. Creatinine along with BUN, are excellent indicators of protein metabolism and kidney function. In the present study, the levels of BUN were lower than reference values for Ostrich (Quintavalla *et al*., 2001) and Pigeons (Harr, 2002). There was no significant difference between male and female and also between young and old chicken. Levels of serum calcium in laying hen were higher (18.10+2.64 mg dL^{-1}) than in broilers (6.25-13.75 mg dL^{-1}) (Ritchie *et al*., 1994; Rico *et al*., 1977). In this study the serum calcium levels in local Saudi chickens were not different between the sexes and this was almost similar to that of broiler (Meluzzi *et al*., 1992) and Thai Chick (Simaraks *et al*., 2004). The serum calcium of local Saudi chickens was lower than in domestic turkey (11.7-38.7 mg dL^{-1}), domestic fowl (13.2-23.7 mg dL^{-1}) and bobwhite quail (14.1-15.4 mg dL^{-1}) (Ritchie *et al*., 1994). Serum chloride levels in local Saudi chicken birds were lower than the reference range (108-124 mg dL^{-1}) and that of pheasant and Thai chicken (Simaraks *et al*., 2004) and were not significantly different between sexes (Table 4). Serum Phosphorus levels in local Saudi birds were lower than those of broiler (Ritchie *et al*., 1994) and were not significantly different between sexes (Table 4).

CONCLUSION

The present study can conclude that the investigated biochemical values of examined local Saudi chickens were lower than reference values and not affected by age and sex. The reported lower serum cholesterol and triacylglcerol concentrations might be reflected on their concentrations in meat protecting human beings from atherosclerosis. Therefore, estimation of lipid profile in these birds is recommended for future study.

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