



Original Research

Genetic Study on Biochemical Constituents in Blood Serum of Indian Native Uttara Fowl

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Abstract

The averages of blood glucose, TC, TG, LDL, HDL and VLDL in Uttara were 221.43 ± 2.55 , 119.26 ± 1.89 , 255.16 ± 15.52 , 26.43 ± 2.74 , 42.45 ± 1.50 and 44.83 ± 5.58 mg/dl respectively. The means of AST and ALT were 53.50 ± 0.59 and 15.48 ± 0.58 IU/L. The means of ACP and ALP were 4.05 ± 0.51 and 27.22 ± 0.45 μ mole/min./mg protein. The means of TP, albumin and globulin were 5.18 ± 0.51 , 1.97 ± 0.05 and 3.20 ± 0.50 g/dl respectively. The mean of A: G ratio was 0.618 ± 0.12 . Activities of acid phosphatase (ACP) increased with the reduction of alkaline phosphate (ALP) activities at 32 weeks. The means of creatinine and uric acid were 0.168 ± 0.12 and 4.16 ± 0.53 mg/dl, respectively. Estimate of heritability and ranged from low to high in magnitude.

Key words: Biochemical Constituents, Heritability, Uttara Fowl

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Introduction

A native chicken population from Uttara Khand, named as "Uttara", a distinctive bird with rich black plumage, feathered shank and crest or crown type structure or bunch of feathers on head has recently been identified. This germ plasm has a number of desirable characters such as hardiness, adaptability to the wide agro-climatic variability ranging from alpine zones to subtropical areas of India, disease tolerance, and flavor of meat and eggs (Singh *et al.*, 2016). Blood bio-chemical parameters have been reported to provide valuable information on immune status of animals. Concentrations of biochemical variables are used to diagnose illness in domestic animals and blood biochemicals are of major value particularly in view of the significance for survival, production and behaviour of the birds under present study since they give an adaptive value to Uttara fowl in cold climate. Lipid blood levels in hens are high, triglycerides being the



highest, 59.7% of the total lipids, during the laying period (Fernandez *et al.*, 1994). There are large variations due to egg formation (Griminger, 1986). Enzyme activities in birds are variable and originate from different organs. In fowls, aspartate transaminase (AST), alanine transaminase (ALT), are synthesized in muscle, skeletal and cardiac, and in second order in the liver. The ALP activity in blood is commonly used as an aid to the diagnosis of bone diseases and obstructive jaundice. In poultry, the main objective for the study of this enzyme was to find out the possible relationship between enzyme activity and various economic traits.

Certain biochemical parameters like total plasma protein, cholesterol and triglycerides play a major role in enzyme production as they are directly related to cell metabolism (growth) (Malarmathi *et al.*, 2009). The enzyme activity can be useful in the selection of cocks for improved fertility and or hatchability of fertile eggs (Orunmuyi *et al.*, 2007). Genetic research is now-a-days directed towards the investigation of the relationship between physiological, biochemical and metabolic products/ markers to the productive efficiency of farm animals and birds. The present investigation was carried out to estimate the genetic variation in certain plasma biochemical parameters in Uttara fowl, in order to incorporate this information in the selection process for the production of meat and egg with desirable quality in future.

Materials and Methods

The present study was carried out on Uttara fowls at the Instructional Poultry Farm (IPF), of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar. The place is located between 28° 53' 23" to 30° 27' 50" N and 77° 34' 27" to 81° 02' 22" E at 243.84 m MSL (mean sea level) in the Tarai region of Uttarakhand State (India). The climate is humid sub-tropical. Winters are very severe and summers are hot and humid. Temperatures may rise to a maximum of 44°C in the summer and fall to a minimum of 1°C in the winter. Relative humidity ranges between 15 to 95 % (Singh *et al.*, 2015). The pedigreed population under present study descended from 25 sires and 200 dams using 25 pullets which were raised under uniform farm conditions. All chicks were vaccinated following standard vaccination schedule. All the experiments were conducted strictly in accordance with the guideline of Institutional Animal Ethics Committee (IAEC). The biochemical constituents of blood serum were measured at 32 weeks by collecting blood samples (2mL) from all the birds through wing vein. ACP was estimated by using the method as described by Andersch and Szcypinski (1947). ALP was examined by method of Bessay and Lowry (1946). All other biochemical characteristics were determined calorimetrically (Span Diagnostics Ltd(R), Surat, India). The genetic and phenotypic parameters of traits were estimated using the following statistical model-

$$Y_{ij} = \mu + s_i + e_{ij}$$

Where,



Y_{ij} = observation on j^{th} individual of i^{th} sire

μ = population mean,

s_j = random effects due to j^{th} sire ($j = 1, 2, \dots, S$),

e_{ij} = random error associated with each j^{th} observation with mean 0 and variance σ_e^2

Statistical Analysis

The least-squares means of heritability estimates of traits under study were estimated from sire component of variances and co-variances using MMLSM computer programme of Harvey (1990).

Results and Discussion

Least-squares means and estimates of heritability of biochemical constituents of blood serum (32th wk) in Indian native Uttara fowl have been summarized in the (Table 1). The means for blood glucose was comparable with results of Khawaja *et al.* (2013) and Pushkar (2013).

Table 1: Least-squares means and estimates of heritability of biochemical constituents of blood serum (32th wk) in Indian native Uttara fowl

Traits	Mean \pm SE	Heritability
Glucose and Lipid Profile (mg/dl)		
Blood glucose	221.43 \pm 2.55	0.25 \pm 0.28
Total cholesterol	119.26 \pm 1.89	0.57 \pm 0.26
Triglycerides	255.16 \pm 15.52	0.14 \pm 0.25
Low density lipoprotein	26.43 \pm 2.74	0.39 \pm 0.30
High density lipoprotein	42.45 \pm 1.50	0.75 \pm 0.31
Very low density lipoprotein	44.83 \pm 5.58	0.04 \pm 0.06
Enzyme Profile		
Aspartate transaminase (IU/L)	53.50 \pm 0.59	0.87 \pm 0.23
Alanine transaminase (\cup)	15.48 \pm 0.58	0.09 \pm 0.07
Acid phosphatase (μ mole/min./mg protein)	4.05 \pm 0.51	0.24 \pm 0.25
Alkaline phosphatase (\cup)	27.22 \pm 0.45	0.64 \pm 0.24
Serum Protein and Health Status Related Profile		
Total protein (g/dl)	5.18 \pm 0.51	0.26 \pm 0.12
Albumin (g/dl)	1.97 \pm 0.05	0.61 \pm 0.19
Globulin (g/dl)	3.20 \pm 0.50	0.22 \pm 0.11
Albumin-Globulin ratio	0.618 \pm 0.10	0.61 \pm 0.19
Creatinine (mg/dl)	0.168 \pm 0.12	-
Uric acid (g/dl)	4.16 \pm 0.53	-

Simaraks *et al.* (2004) observed lower blood glucose level. However, Kaur (2007) observed higher blood glucose level. The means for total cholesterol was comparable with results of Sharma (2009), Singh (2009), Pushkar (2013). Simaraks *et al.* (2004) and Azeke *et al.* (2009) observed lower total cholesterol level. However, Khawaja *et al.* (2013) and Imasuen (2012) observed higher total cholesterol level. It was noted that there was no difference in serum cholesterol level among types of chickens at laying stage, as was also reported by Bhatti *et al.* (2002). They explained that serum cholesterol levels in different strains (Desi,

Fayoumi, Crossbred (RIFI) and Naked Neck) during pre- and post-laying periods was the same which implies that laying condition did not exert any extra demand on cholesterol biosynthesis and its release into the blood circulation. Serum cholesterol of these chickens was found within range of reference (Clinical Diagnostic Division 1990). Hassan *et al.* (2008) and Azeke *et al.* (2009) observed lower triglycerides level. However, Ramesh *et al.* (2009), Imasuen (2012) and Khawaja *et al.* (2013) observed higher triglycerides level. The higher triglyceride concentrations in improved high laying RIR breed and relatively lower concentration in Fayoumi chicken is attributable to an increased lipogenic activity of liver stimulated by the endogenous estrogens resulting from selective breeding (North and Bell 1990). These values were lower than the present study and this might be due to difference in chicken strains. Azeke *et al.* (2009), Ramesh *et al.* (2009) and Imasuen (2012) observed lower LDL level. Imasuen *et al.* (2012) in Naked neck layer bird, normal layer bird and Dominant black layer bird observed lower HDL level. However, Azeke *et al.* (2009), Ramesh *et al.* (2009), Yoshida *et al.* (2011) and Imasuen (2012) in Frizzles layer bird observed higher HDL level. Ramesh *et al.* (2009) observed lower VLDL level. However, Yoshida *et al.* (2011) observed higher VLDL level. The means for aspartate transaminase (AST) was comparable with results of Biswas *et al.* (2010). The means for alanine transaminase (ALT) was comparable with results of Biswas *et al.* (2010) in Kadaknath at 30 week. Biswas *et al.* (2010) in Aseel pila observed lower ALT value. However, Biswas *et al.* (2010) in WLH at 30 week observed higher ALT value. The means for acid phosphatase (ACP) was comparable with results of Biswas *et al.* (2010) in Kadaknath at 30 week. However, Biswas *et al.* (2010) in WLH and Aseel pila observed lower ACP value. The means for alkaline phosphatase (ALP) which was comparable with results of Biswas *et al.* (2010) in Kadaknath at 30 week. Biswas *et al.* (2010) in Aseel pila and Khawaja *et al.* (2013) observed higher ALP value. However, Pampori *et al.* (2007) and Biswas *et al.* (2010) in Aseel pila observed lower ALP value. The means for serum total protein was comparable with results of Hassan *et al.* (2008) and Khawaja *et al.* (2013). Kaur *et al.* (2013), Khawaja *et al.* (2013) and Pushkar (2013) observed lower serum total protein. Total protein level in Uttara fowl was higher than the reference range (Clinical Diagnostic Division, 1990). In female birds, a considerable increase in total protein concentration occurs just prior to egg laying, which could be attributed to an estrogen-induced increase in globulins. The proteins were the yolk precursors (vitellogenin and lipoproteins), which were synthesised in the liver and transported via the plasma to the ovary where they were incorporated in the oocytes (Ritchie *et al.*, 1994). The means for serum albumin was comparable with results of Kaur *et al.* (2013) in hill fowl male (feathered shank). Kaur *et al.* (2013) in hill fowl female (feathered shank), observed lower serum albumin. However, Pushkar (2013) observed higher serum albumin protein. Kaur *et al.* (2013) and Pushkar (2013) observed lower serum globulin. This could be attributed to an estrogen-induced increase in globulins just prior to laying. Kaur *et al.* (2013) and Pushkar (2013) observed higher serum albumin-globulin ratio. Pampori *et al.* (2007) observed higher Creatinine. The means for uric acid was

comparable with result of Khawaja *et al.* (2013) in RIR and RIR \times Fayoumi. Pampori *et al.* (2007) and Khawaja *et al.* (2013) in Fayoumi and Fayoumi \times RIR observed higher Uric acid. In birds, uric acid is a major product of the catabolism of nitrogen, being the end product of protein/amino acid metabolism, indicating a similar rate of protein/amino acid metabolism in different bird groups through genetically different. Age and diet may influence the concentration of blood uric in birds. Malarmathi *et al.* (2009) in Japanese quails at 6-13 weeks observed higher blood cholesterol heritability. Malarmathi *et al.* (2009) in Japanese quails at 6-13 weeks also observed lower triglycerides. The heritability estimate of alkaline phosphatase was similar with the findings of Zhon and Zhao (1991). However, higher estimates of heritability were also reported by Ferdoci *et al.* (1992) and Orunmuyi *et al.* (2007) for alkaline phosphatase. High heritability of alkaline phosphates activity suggests that the possibility of changing the level of this enzyme at a rapid rate (Ferdoci *et al.*, 1992). Malarmathi *et al.* (2009) in Japanese quails at 6-13 weeks also observed lower total protein.

Conclusion

It may be concluded that purebred and crossbred chickens possess an identical genetic mechanism for the regulation of glucose, triglyceride, cholesterol, protein and uric acid concentrations in blood like the mechanism found in different commercial broiler strains (Furlan *et al.*, 1999). The heritability estimates have great role in poultry breeding for providing information, selection of superior germplasm, prediction of breeding values and response to selection and management of poultry.

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