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RESPONSE OF DIFFERENT BODY WEIGHTS ON BLOOD SERUM CHEMISTRY VALUES IN FOUR CLOSE-BRED FLOCKS OF ADULT JAPANESE QUAILS (*Coturnix coturnix japonica*)

A. S. Jatoi, A. W. Sahota, M. Akram, K. Javed*, J. Hussain, S. Mehmood and M. H. Jaspal

Department of Poultry Production, *Department of Livestock Production, Faculty of Animal Production and Technology, University of Veterinary and Animal Sciences, Lahore, Pakistan
Corresponding Author E-mail: drasultan_jatoi@yahoo.com

ABSTRACT

The present study was conducted to investigate blood serum chemistry values in four close-bred flocks of adult Japanese quails responded by different body weights maintained at Avian Research and Training Centre, University of Veterinary and Animal Sciences, Lahore. A total of 432 adult (12 weeks-old) quails, comprising 108 males and 324 females were randomly divided into 108 experimental units, comprising one male and three females each. These experimental units were randomly assigned to 12 treatment groups having 4 close-bred flocks x 3 female body weights (heavy 300-350g, medium 250-300g and small 200-250g) with randomized complete block design in factorial arrangements having 9 replicates in each treatment. Serum glucose, albumin, total protein, cholesterol and urea were studied. Mean serum glucose level in male and female quails was not significantly different among imported and local flocks. The total serum protein was significantly different in both the sexes, whereas, serum cholesterol and serum albumin levels were only significantly different in female quails of imported and local flocks. Serum urea concentration was only significantly ($p<0.05$) different in male quails. With respect to body size categories, all the biochemical parameters studied were not significantly different in both sexes of quails. The interaction between flocks and body size was significant ($p<0.05$) for serum protein and urea in both the sexes, only significant ($p<0.05$) in male quails for serum cholesterol and was only significant ($p<0.05$) in females for serum albumin.

Key words: Blood serum chemistry values (Serum glucose, total protein, albumin, cholesterol and urea).

INTRODUCTION

Blood biochemical profile may be a useful indicator about the physical condition of individuals, making them a useful tool in differentiating normal and healthy animals from abnormal or diseased states. Japanese quails (*Coturnix coturnix japonica*) are maintained for egg and meat production for human consumption and also as useful laboratory animals. The range of avian species for which biochemical reference values are published is mostly limited to racing pigeons, to the most common psittacine species, and to peregrine falcons (Lumeij, 1997). For those species used as poultry, blood chemistry was established to some extent for quail (Faqi *et al.* 1997), duck (Farhat and Chavez 2000), turkey (Huff *et al.* 2008), and ostrich (Verstappen *et al.* 2002). However, very little information is available on the blood biochemical profile of Japanese quails. The objectives of the present study was to provide reference values for blood biochemical profile in adult Japanese quail and to investigate the variation in these values as influenced by different body weights in both sexes of adult Japanese quails.

MATERIALS AND METHODS

The present study involving 432 adult (12 weeks-old) quails, comprising 108 males and 324 females was conducted as a part of Ph.D. research work by the major author to examine blood biochemical profile of 4 close-bred flocks of Japanese quails with different body weights, at Avian Research and Training (ART) Centre, University of Veterinary and Animal Sciences, Lahore, Pakistan. The birds were randomly divided into 108 experimental units (replicates comprising one male and three females of each) which were randomly assigned to 12 treatment groups having 4 close-bred flocks (imported, local 1, local 2, and local 3) x 3 female body weight with randomized complete block design in factorial arrangements having 9 replicates in each treatment. The body weight categories of heavy, medium and small quails of both the sexes have been presented in Table 1.

Table 1. Different body weight categories (g)

Body weights	♂	♀
Heavy	270-315g	300-350g
Medium	225-270g	250-300g
Small	180-225g	200 -250g

The experimental birds were tagged for their proper identification and maintained in specially remodeled individual compartments each measuring 30x20x15 cm in French made multi-deck cages (equipped with separate nipple drinkers) placed in one of the well ventilated octagonal shape quail houses measuring 10.05x3.65x2.74 meter. The maximum and minimum temperature of the quail house was recorded daily which ranged from 24^{0C} to 32^{0C}. Natural day light was provided to the birds at the start of the experiment and then light hours were increased by half an hour weekly till 16 hours light per day. Fresh and clean drinking water was provided at all the times through automatic nipple drinkers. The birds were fed *ad libitum* a balanced quail breeder ration according to NRC standards (1994), containing Metabolizable energy 2900 kcal/kg, crude protein 20%, calcium 3% and available phosphorus 0.4%.

At the age of 31 weeks, about 5 ml blood sample from Jugular vein of each of the 72 randomly selected breeder quails was collected in sterile test tubes The blood samples were kept until serum samples were extracted from them and put into vaccutainer tubes. The serum samples were then stored at -20°C. The determination of glucose, total protein, albumin, cholesterol and urea (mg/dl) in serum samples was made using standard laboratory procedures by commercial kits.

Statistical Analysis: The data thus collected were analyzed using ANOVA techniques (Steel *et al.* 1997) with Randomized Complete Block Design (RCBD) under factorial arrangement for further interpretation using general linear model (GLM) procedures (SAS 9.1, 2002-03) portable software. The mathematical model was assumed after Jatoi *et al*. (2013). The comparison of means was made using Duncan's Multiple Range (DMR) test (Duncan 1955).

RESULTS AND DISCUSSION

i. Serum glucose (mg/dl): The mean serum glucose differed non-significantly among imported and local quail flocks in both the sexes. Body weight and its interaction with flocks had non-significant effect on mean serum glucose in both sexes (Table 2). The mean serum glucose both in male and female quails of local-1 flock was higher than in other local and imported flocks. Small weight male quails had maximum serum glucose concentration followed by those of medium and heavy size quails. Whereas, medium weight female birds contained maximum serum glucose levels followed by small and heavy size birds.

ii. Total serum protein (mg/dl): Total serum protein concentration differed significantly ($p<0.05$) in both the sexes of imported and local flocks of Japanese quails. Body weight had non-significant effect on serum protein in both the sexes. The interaction between flocks and body weight was found to be significant ($p<0.05$) in both the sexes (Table 2). The mean total serum protein in male imported flock remained on higher side than that of other local flocks. The medium weight category male birds had maximum total serum protein followed by those of heavy and small weight categories. However, female imported flock had higher total serum protein than that of other local flocks. Similarly, female birds of small weight category had maximum total serum protein followed by that of heavy and medium weight quails.

iii. Serum albumin (mg/dl): The mean serum albumin in imported and local female flocks of Japanese quails differed significantly ($p<0.05$), whereas, it was found to be non-significant in male quails. Body weight categories had non-significant effect on serum albumin in quails of both the sexes. The interaction between flocks and body weight was found to be significant ($p<0.05$) in female, whereas, it was non-significant in male quails (Table 2). The mean serum albumin level in local-3 male flock was higher than that of imported and other local flocks. Similarly, small weight category male birds had maximum serum albumin level followed by heavy and medium weight categories. However, imported female flock had higher serum albumin than that of other local flocks. Similarly, heavy weight category female quails had maximum serum albumin level followed by that of medium and small size.

iv. Serum cholesterol (mg/dl): The mean serum cholesterol concentration in imported and local female flocks of Japanese quails differed significantly ($p<0.05$), whereas, male flocks were found to differ non-significantly in this respect. However, body weight categories of both the sexes differed non-significantly in serum cholesterol. The interaction between flocks and body weight was found to be significant ($p<0.05$) in male birds, while, it was non-significant in female quails (Table 3). The mean serum cholesterol level in male local-1 flock remained lower than in imported and other local flocks. Similarly, small weight category male birds had maximum serum cholesterol level followed by that of heavy and medium weight categories. However, female imported flock had higher serum cholesterol than that of other local flocks. Similarly, small weight category female birds had maximum serum cholesterol level followed by that of heavy and medium size categories.

v. Serum urea (mg/dl): The mean serum urea in imported and local flocks of Japanese quails varied significantly ($p<0.05$) in male quails, whereas, it was found to be non-significant in female quails. The body weight categories had non-significant effect on serum urea in both the sexes. The interaction between flocks and body weight was significant ($p<0.05$) in both the sexes (Table 3). The mean serum urea in local-3 male flock

remained higher than that of imported and other local flocks. Similarly, small weight category male birds had maximum serum urea level followed by that of heavy and medium weight birds. However, mean serum urea in local-2 female flock remained higher than that of imported and other local flocks. Similarly, medium weight category female birds had maximum serum urea levels followed by small and heavy size quails.

Table 2. Serum glucose, total protein and albumin concentration (mg/dl) in 4 close-bred flocks of Japanese quails with different body weight categories at 31 week

*CBF Category	Sex	Imported	Local-1	Local-2	Local-3
		---------- (Mean ± **SE; ***GL mg/dl) ----------			
Heavy	Male	123.54±27.95	172.63±52.06	142.70±4.29	116.10±29.46
	Female	114.63±3.07	152.41±84.46	103.94±6.69	104.90±5.82
Medium	Male	147.66±44.67	174.32±81.87	147.66±44.67	108.74±10.85
	Female	189.48±43.44	223.25±62.86	126.16±8.21	122.42±18.40
Small	Male	155.88±46.89	221.05±88.89	116.10±29.46	121.76±10.64
	Female	163.6741.41	141.11±46.98	119.31±6.46	123.55±23.78
		---------- (Mean ± **SE; ****TP mg/dl) ----------			
Heavy	Male	4.70±0.86^{a}	3.03±0.18^{b}	3.36±0.23^{ab}	3.80±0.48^{ab}
	Female	7.28±1.27^{a}	3.98±0.58^{b}	3.40±0.56^{b}	4.23±0.93^{ab}
Medium	Male	4.39±0.05^{ab}	4.02±0.51^{ab}	4.39±0.05^{ab}	4.17±0.59^{ab}
	Female	6.00±0.66^{ab}	5.07±0.37^{ab}	5.35±0.93^{ab}	4.41±1.14^{ab}
Small	Male	4.04±0.83^{ab}	2.88±0.34^{b}	3.80±0.48^{ab}	3.50±0.20^{ab}
	Female	6.21±0.63^{ab}	5.62±1.42^{ab}	6.38±0.65^{ab}	5.06±1.06^{ab}
		---------- (Mean ± **SE; *****AL mg/dl) ----------			
Heavy	Male	1.48±0.11	0.84±0.02	0.94±0.02	1.83±0.62
	Female	1.68±0.29^{a}	0.80±0.21^{b}	1.30±0.28^{ab}	1.62±0.10^{a}
Medium	Male	1.02±0.27	1.03±0.19	1.02±0.27	1.28±0.15
	Female	1.17±0.17^{ab}	0.96±0.18^{ab}	1.47±0.22^{ab}	1.11±0.06^{ab}
Small	Male	1.10±0.15	1.20±0.44	1.83±0.62	1.29±0.17
	Female	1.55±0.21^{a}	1.12±0.36^{ab}	1.41±0.05^{ab}	1.30±0.04^{ab}

Different alphabets on means in a row show significant differences at p<0.05
*CBF = Close-bred flocks, **SE = Standard error, ***GL = Glucose, ****TP = Total Protein, *****AL = Albumin

Table 3. Serum cholesterol and urea concentration (mg/dl) in 4 close-bred flocks of Japanese quails with different body weight categories at 31 week

*CBF Category	Sex	Imported	Local-1	Local-2	Local-3
		---------- (Mean ± **SE; ***CH mg/dl) ----------			
Heavy	Male	198.03±56.53^{ab}	162.28±17.84^{ab}	131.77±7.63^{b}	243.35±19.26^{a}
	Female	225.57±34.16	145.44±6.56	142.90±31.56	138.48±14.30
Medium	Male	171.96±25.17^{ab}	152.14±30.77^{ab}	171.96±25.17^{ab}	141.99±17.00^{ab}
	Female	232.43±64.35	165.88±21.04	174.33±25.94	135.86±17.87
Small	Male	187.69±17.12^{ab}	211.23±60.85^{ab}	243.35±19.26^{a}	163.28±24.43^{ab}
	Female	249.01±49.73	147.31±41.01	192.25±28.37	149.05±17.84
		---------- (Mean ± **SE; ****UR mg/dl) ----------			
Heavy	Male	13.59±1.15^{b}	13.99±4.91^{b}	13.03±4.10^{b}	16.91±5.12^{ab}
	Female	11.84±3.69^{b}	15.22±3.96^{ab}	16.03±1.09^{ab}	18.46±3.10^{ab}
Medium	Male	5.18±0.96^{b}	8.58±4.31^{b}	5.18±0.96^{b}	21.51±4.61^{ab}
	Female	10.49±0.71^{b}	8.16±1.64^{b}	62.84±48.58^{a}	24.86±9.67^{ab}
Small	Male	7.35±1.63^{b}	4.01±0.24^{b}	16.91±5.12^{ab}	36.35±20.27^{a}
	Female	19.40±11.98^{ab}	10.47±2.51^{b}	14.12±3.10^{ab}	19.08±1.49^{ab}

Different alphabets on means in a row show significant differences at p<0.05
*CBF = Close-bred flocks, **SE = Standard error, ***CH = Cholesterol, ****UR = Urea

The results of the present study indicating variation in total protein and cholesterol levels between male and female quails are in line with those of Scholtz *et al.* (2009) who reported variation in total protein and cholesterol levels in both the sexes in adult quails. Blood cholesterol was reported to significantly vary in different birds at different stages (Yeh *et al.* 1996). The plasma cholesterol level (150.72 mg/dl) was found to vary

significantly between sexes in quails (Malarmathi *et al.* 2009). Bahie El-Deen (2009) observed that **c**holesterol concentration in quails was reduced at 13 weeks of age (peak egg production) than during other production periods. This could be due to depression in serum cholesterol during high egg production periods on account of cholesterol shift from the blood to the ovarian tissue for egg yolk formation which seems to be a metabolic phenomenon for meeting a continued serum cholesterol demand to replenish losses during egg formation (Mady 1990). Flora and Sangeetha (2000) observed significant differences in total protein and serum albumin concentration between both the sexes of RIR chickens during different age periods. Breed differences in total blood protein concentration in ducks have also been reported (Makinde and Fatunmbi 1985). The variation in serum urea concentration between different close-bred flocks during this study might be due to variation in metabolism of protein/amino acid in these flocks. Sykes (1971) indicated that urea/uric acid is the end product of metabolism of protein/amino acid.

The results of the present study indicate non-significant difference in serum glucose concentration of different close-bred flocks of quails which could be due to their identical potential to metabolize carbohydrate. Similar observations have been made by Saleem *et al.* (1996) in case of three different strains of broiler chickens.

In the present study, serum protein concentration in different close- bred flocks of quails was found to range between 3.31 to 6.50mg/dl which is quite similar to the values recorded by (Malarmathi *et al.* 2009) in Black strain of Japanese quails. There is reported to be non-significant difference with regard to serum protein, glucose and phosphorus contents between breeds of broilers (Saleem *et al.* 1996) whereas, protein and water contents are reported to differ significantly between breed types but there was no difference in muscles (Fujimura *et al.* 1996).

The findings of this study indicate higher concentrations of serum glucose, total protein, albumin and cholesterol in heavy male quails were detected, whereas, serum urea was higher in medium female parents.

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