

Original Article**Influence of age, sex and different rearing systems on serum biochemical profile in turkeys (*Meleagris gallopavo*)**Irfan^{1*}, Arshad Javid², Muhammad Altaf³, Muhammad Shahbaz³, and Khalid Javed Iqbal⁴¹Department of Zoology, Government College University, Lahore²Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore³Department of Zoology, Women University of Azad Jammu and Kashmir, Bagh⁴Department of Life Sciences, The Islamia University of Bahawalpur, Bahawalpur**(Article history:** Received: November 27, 2016; Revised: May 30, 2017)**Abstract**

Variations in serum biochemical profile with increase in age were analyzed in turkeys (*Meleagris gallopavo*). Gender-wise variations and effect of rearing systems i.e. free range, semi-intensive and confinements were also assessed from 1st to 6th month of age. Total sixty (n = 60) experimental birds were divided in to three groups i.e., poults having age 4-8 weeks (10 ♂ and 10 ♀), growers with age 14-20 weeks (10 ♂ and 10 ♀) and adult birds with age 24-30 weeks (10 ♂ and 10 ♀). Variations were recorded in serum biochemical profile with increase in age. Significantly (P<0.05) higher values of cholesterol 8.39±0.48 mmol/L, globulin 2.71±0.34 g/dL, albumin 3.82±0.58 g/dL, total protein 5.35±0.55 g/L, urea 26.95±0.65 mg/dL, creatinine 0.83±0.01 µmol/L, alanine aminotransferase (ALT) 35.56±1.16iu/L and aspartate aminotransferase (AST) 44.16±1.83 iu/L were recorded for adult birds while alkaline phosphatase (ALP) values were significantly (P<0.05) higher 104.86±16.39 iu/L in grower birds. Similarly, the rearing systems also influenced biochemical parameters of *M. gallopavo* and significantly (P<0.05) higher values for cholesterol 6.18±0.07mmol/L and ALT 31.26±1.67 iu/L were recorded in birds reared under confinement rearing system. Values for globulin 1.92±0.36g/dL and creatinin 0.77±0.08 µmol/L were higher in birds reared under semi-intensive rearing system while significantly higher urea concentrations 33.45±3.39 mg/dL were recorded from the serum of the birds reared under free range rearing system. However, non-significant variations in albumin, total protein, ALP and AST were recorded for all the three rearing systems. Significantly higher values of cholesterol, globulin, albumin, creatinine and ALT were recorded from serum of male *M. gallopavo* while urea and ALP were higher in hens' serum. However, non-significant variations were recorded for total protein and AST among both the genders. It can be concluded from the present study that age, gender and rearing systems strongly influence blood biochemical profile in *M. gallopavo*.

Keywords: Age, Turkeys, Biochemical profile, Total protein, ALP, Rearing systems**To cite this article:** IRFAN, JAVID, A., ALTAF, M., SHAHBAZ, M. AND JAVED, K.I, 2017. Influence of age, sex and different rearing systems on serum biochemical profile in the turkeys (*Meleagris gallopavo*). *Punjab Univ. J. Zool.*, **32**(1): 15-19.**INTRODUCTION**

Farming of turkeys on commercial scales has been started in many parts of the world (Bounous, 2000; Nazifi *et al.*, 2012) and its meat production is increasing as an alternate source of chicken because of higher protein, lower fat contents (Nixey, 1985) and consumers' preference towards turkey meat (Prabakaran, 2003). The captive-bred stock is also helpful in releasing the birds in wild for hunting purposes (Chloupek *et al.*, 2009). In intensive culture systems, bird intensity is higher

and infectious diseases can be easily transmitted from one bird to the other. Proper monitoring of the captive stock is therefore prerequisite for better management of the birds and there is need for clinical chemistry to highlight clinical signs of disease in birds (Nazifi *et al.*, 2012). Behavioral responses observed during physical examinations can be better observed through biochemical examinations (Voslarova *et al.*, 2006). Avian blood differs in cell characteristics from their mammalian counterparts (Smith *et al.*, 2000). The blood chemistry of the birds is influenced by many factors such as physiological (Alodan and

Mashaly, 1999), environmental (Vecerek *et al.*, 2002), dietary contents (Iheukwumere and Herbert, 2002), fasting (Lamosova *et al.*, 2004), age (Seiser *et al.*, 2000), administration of drugs (Khan *et al.*, 1994), anti-aflatoxin treatment (Oguz *et al.*, 2002) and continuous supplementation of vitamins (Tras *et al.*, 2000). Blood chemistry is used as a diagnostic tool and aids in assessing health status of the birds (Schmidt *et al.*, 2007). Lipid is an important parameter to estimate the levels of total cholesterol and triglyceride of an individual (Qulander, 2012). Therefore, serum chemistry is considered as a fundamental medical diagnosis of disease and organ dysfunction in birds (Kececi and Col, 2010). Proper information about serum chemistry of turkeys will aid in better management of these birds. The present study was therefore planned to determine influence of age, sex and different rearing systems on serum biochemical profile in turkeys (*Meleagris gallopavo*).

MATERIALS AND METHODS

The experiment was conducted at Captive Breeding Facilities for Birds, Department of Wildlife and Ecology, Ravi Campus, University of Veterinary and Animal Sciences, Lahore.

On the basis of difference in age, the experimental birds (n=60) were divided in to three groups *i.e.*, poults having age 4-8 weeks (10 ♂ and 10 ♀), growers with age 14-20 weeks (10 ♂ and 10 ♀) and adult birds with age 24-30 weeks (10 ♂ and 10 ♀). The experimental turkeys were reared in free range, semi-intensive rearing systems and in cages. Feed and *ad libitum* water supply was ensured to the

birds. Birds were regularly vaccinated for Newcastle disease, fowl cholera, chronic respiratory disease and turkey coryzaas per recommended schedule. Two ml blood was collected from brachial vein after 12-hours fasting period from all the turkeys in sample tubes without anticoagulant on monthly basis. Blood samples were centrifuged and serum was separated from blood cells and stored at -10°C. Total serum protein was determined by Kjeldahl method following Kohn and Allen (1995), albumin was determined following Doumas (1971). Globulin was calculated by subtracting albumin from total protein. Creatinin and urea were determined following Harrison (1947). ALT and AST were determined through spectrophotometer following Holder and Rej (1984), ALP was determined following King and Armstrong (1934).

Statistical analysis

The collected data was analyzed through statistical software SAS 9.1 and Analysis of Variance (ANOVA) was applied to compare means.

RESULTS AND DISCUSSION

During present study, variations in serum chemistry were recorded with increase in age. Significantly (P<0.05) higher values of cholesterol 8.39±0.48 mmol/L, globulin 2.71±0.34 g/dL, albumin g/dL 3.82±0.58 g/dL, total protein 5.35±0.55 g/L, urea 26.95±0.65 mg/dL, creatinin 0.83±0.01 µmol/L, ALT 35.56±1.16iu/L and AST 44.16±1.83 iu/L were recorded for adult birds while ALP values were significantly higher 104.86±16.39 iu/L in grower birds (Table I).

Table I: Influence of age on serum biochemical parameters in *Meleagris gallopavo*.

Biochemical Indices	Poults	Growers	Adults
Cholesterolmmol/L	4.57±0.89 ^c	7.12±0.25 ^b	8.39±0.48 ^a
Globulin g/dL	1.37±0.17 ^b	1.83±0.21 ^b	2.71±0.34 ^a
Albumin g/dL	2.77±0.39 ^b	2.82±0.18 ^b	3.82±0.58 ^a
Total Protein g/L	4.22±0.48 ^b	5.07±0.33 ^{ab}	5.35±0.55 ^a
Urea mg/dL	21.44±1.56 ^c	24.66±0.50 ^b	26.95±0.65 ^a
Creatinin µmol/L	0.64±0.035 ^b	0.79±0.02 ^a	0.83±0.01 ^a
ALP iu/L	73.95±3.08 ^b	104.86±16.39 ^a	70.50±1.75 ^b
ALT iu/L	16.68±1.18 ^c	30.67±0.88 ^b	35.56±1.16 ^a
AST iu/L	17.54±0.94 ^c	24.65±1.47 ^b	44.16±1.83 ^a

Means with similar superscripts in a row are statistically non-significant

Our findings are in line with the results of Ibrahim *et al.* (2012) who documented decrease in ALP values from 122.50 iu/L to 29.50 iu/L with increase in age. Similar findings have been

reported by Priya and Gomathy (2008). Coles (1986) explained that higher ALP values indicate rapid growth rate and bone activity.

Table II: Effect of rearing systems on biochemical parameters in *Meleagris gallopavo*.

Biochemical Indices	Confinement	Semi-intensive	Free range
Cholesterolmmol/L	6.18±0.07 ^a	5.03±0.21 ^b	4.42±0.39 ^c
Globulin g/dL	1.81± 0.15 ^a	1.92±0.36 ^a	1.33±0.23 ^b
Albumin g/dL	2.81±0.12 ^a	2.83±0.17 ^a	2.57±0.50 ^a
Total protein g/L	4.47±0.42 ^a	4.65±0.18 ^a	4.48±0.23 ^a
Urea mg/dL	22.34±0.98 ^b	24.13±7.31 ^{ab}	33.45±3.39 ^a
Creatinin µmol/L	0.72±0.040 ^{ab}	0.77±0.08 ^a	0.63±0.05 ^b
ALP iu/L	74.12±2.33 ^a	77.29±8.49 ^a	84.18±3.42 ^a
ALT iu/L	31.26±1.67 ^a	29.96±2.69 ^{ab}	26.02±1.43 ^b
AST iu/L	30.24±1.14 ^a	28.83±0.84 ^a	30.63±0.61 ^a

Means with similar superscripts in a row are statistically non-significant.

Table III: Gender-wise variations in serum biochemical parameters of *Meleagris gallopavo*

Biochemical parameters	Gender	
	Male	Female
Cholestrolmmol/L	5.61±0.53 ^a	4.69±0.42 ^b
Globulin g/dL	1.88±0.24 ^a	1.53±0.27 ^b
Albumin g/dL	2.91±0.19 ^a	2.58±0.37 ^b
Total protein g/l	4.61±0.33 ^a	4.34±0.35 ^a
Urea mg/dL	22.77±2.58 ^b	32.53±4.08 ^a
Creatinine µmol/L	0.78±0.05 ^a	0.66±0.045 ^b
ALPiu/L	73.52±2.41 ^b	85.67±2.51 ^a
ALT iu/L	32.25±2.54 ^a	25.59±1.82 ^b
AST iu/L	29.63±1.46 ^a	30.43±1.29 ^a

Similarly, the rearing systems also influenced biochemical parameters of *M. gallopavo* and significantly ($P<0.05$) higher values for cholesterol 6.18±0.07mmol/L and ALT 31.26±1.67 iu/L were recorded in birds reared under confinement rearing system. Values for globulin 1.92±0.36g/dL and creatinin 0.77±0.08 µmol/L were higher in birds reared under semi-intensive rearing system while significantly higher urea concentrations 33.45±3.39 mg/dL were recorded from the serum of the birds reared under free range rearing system. However, non-significant variations in albumin, total protein, ALP and AST were recorded for all the three rearing systems (Table II). Similar findings have been documented by Olaniyiet *al.* (2012) who reported non-significant variations in total protein and albumin among confined and free range reared turkeys.

However, significant increases in cholesterol, uric acid, calcium and AST have

been documented in laying hens of Bronze turkeys during egg laying (Pavlik *et al.*, 2007; Schmidt *et al.* 2010). Forbes (2006) reported that urea is the by-product of nitrogenous reactions and metabolic reactions occur more frequently in free-range as compared to confinement rearing systems as confinements reduce bird activities Castellini *et al.* (2002). Hochleithner (1994) documented that creatinine in blood is derived from the creatine catabolism during muscle activities. Krautwald-Junghanns (2004) described that ALT is not abundant and non-specific to any bird's organ and hence may not useful in disease diagnosis.

Significantly higher values of cholesterol, globulin, albumin, creatinine and ALT were recorded from serum of male *M. gallopavo* while urea and ALP were higher in hens' serum. However, non-significant variations were recorded for total protein and AST among both the genders (table 3). Cholesterol values

recorded during present study from male (5.61 ± 0.53 mmol/L) and female (4.69 ± 0.42 mmol/L) turkeys were higher than the values (3.43 ± 0.13 mmol/L) documented by Chloupek *et al.* (2009). ALP, AST and protein values recorded during present experiment are in line with the findings of Ibrahim *et al.* (2012). Similarly, Simarakset *et al.* (2004) reported significant differences in urea concentrations for both the genders. Ritchie *et al.* (1994) explained that hyperuricemia has been observed in females during ovulation which makes turkey hens to have higher levels of urea than male turkeys.

Conclusion

Serum biochemical profile provides useful information about health of the birds. Therefore, knowledge of serum chemistry in different age groups, reared under different rearing systems and gender-wise variations is necessary to properly manage bird flocks. It can be concluded from the present study that the age, rearing systems and gender have strong influence on serum chemistry of *Meleagris gallopavo*.

REFERENCES

- ALODAN, A.M. AND MASHALY, M.M., 1999. Effect of induced molting in laying hens on production and immune parameters. *Poult. Sci.*, **78**: 171-177.
- BOUNOUS, D.I., WYATT, R.D., GIBBS, P.S., KILBURN, J.V. AND QUIST, C.F., 2000. Normal hematologic and serum biochemical reference intervals for juvenile wild turkeys. *J. Wildlife Dis.*, **36**: 393-396.
- CASTELLINI, C., MUGNAI, C. AND DALBOSCO, A., 2002. Meat quality of three chicken genotypes reared according to the organic system. *Ital. J. Food Sci.*, **14**: 411-412.
- CHLOUPEK, P., VOŠLAROVA, E., SUCHY, P.J.R., BEDANOVA, I., PISTEKOVA, V., VITULA, F., CHLOUPEK, J. AND VECEREK, V., 2009. Influence of presampling handling duration on selected biochemical indices in the common pheasant (*Phasianus colchicus*). *Acta. Vet. Brno.*, **78**: 23-28.
- COLES, G.C., BAUER, C., BORGSTEEDE, F.H.M., GEERTS, S., KLEI, T.R., TAYLOR, M.A. AND WALLER, P.J., 1992. World Association for the Advancement of Veterinary Parasitology (WAAVP) methods for the detection of anthelmintic resistance in nematodes of veterinary importance. *Vet. Parasitol.*, **44**: 35-44.
- DOUMAS, B.T., WATSON, W.A. AND BIGGS, H.G., 1971. Albumin standards and the measurement of serum albumin with bromocresolgreen. *Clin. Chim. Acta.*, **31**: 87-96.
- FORBES, L., AHN, K.Y. AND BHATTACHARYYA, A., 2006. U.S. Patent Application. **11**: 514-558.
- HARRISON, G.A., 1947. Chemical methods in clinical medicine. Grune and Stratton.
- HOCHLEITHNER, M., 1994. Biochemistries. Avian medicine: principles and application. *Wingers.*, pp. 223-245.
- HOLDER, M. AND REJ, R., 1984. Alanine transaminase. In: *Methods of enzymatic analysis*. 3rd Ed. Bergmeyer HU, Bergmeyer J. Gassl M. Weinheim: Verlag Chemie., pp. 380-401.
- IBRAHIM, A.A., ALIYU, J., ABDU, M.I. AND HASSAN, A.M., 2012. Effects of age and sex on serum biochemistry values of turkeys (*Meleagris gallopavo*) reared in the semi-arid environment of Nigeria. *World. Appl. Sci. J.*, **16**: 433-436.
- IHEUKWUMERE, F.C. AND HERBERT, U., 2002. Physiological responses of broiler chickens to quantitative water restrictions: Haematology and serum biochemistry. *Inter. J. Poult. Sci.*, **2**: 117-119.
- KECECI, T. AND COL, R., 2010. Haematological and biochemical values of the blood of pheasants (*Phasianus colchicus*) of different ages. *Turk. J. Vet. Anim. Sci.*, **35**: 149-156.
- KHAN, M.Z., SZAREK, J., KONCICKI, A., KRASNODEBSKI, A. AND DEPTA, A., 1994. Oral administration monensin and lead to broiler chicks: effect on haematological and biochemical parameters. *Acta. Vet. Hung.*, **42**: 11-20.
- KING, E.J. AND ARMSTRONG, A.R., 1934. A convenient method for determining serum and bile phosphatase activity. *Can. Med. Assoc. J.*, **31**: 376.
- KOHN R.A. AND ALLEN, M.S., 1995. In vitro protein degradation of feeds using concentrated enzymes extracted from

- rumen contents. *Anim. Feed Sci. Tech.*, **52**: 15-28.
- KRAUTWALD-JUNGHANNS, M.E., HOFSTETTER, S. AND SCHMIDT, V., 2014. Tierärztliche Betreuung von Taubenbeständen. *Tierärztliche Praxis Kleintiere.*, p. 5.
- LAMOSOVA, D., MALABOVA, M. AND ZEMAN, M., 2004. Effects of short-term fasting on selected physiological functions in adult male and female Japanese quail. *Acta. Vet. Brno.*, **73**: 9-16.
- NAZIFI, S., MOSLEH, N., RANJBAR, V.R. AND KHORDADMEHR, M., 2012. Reference values of serum biochemical parameters in adult male and female ring-necked pheasants. *Comp. Clin. Pathol.*, **21**: 981-984.
- NIXEY, C. AND GREY, T.C., 1985. Recent advances in Prod Turkey Science. *Poult. Sci. Symp.*, **21**: 231-233.
- OGUZ, H.T., KECECI, Y.O., BIRDANE, F. AND KURTOGLU, V., 2002. Effect of clinoptilolite on blood biochemical and haematological aflatoxicosis. *Re.s Vet. Sci.*, **69**: 89-93.
- OLANIYI, O.A., OYENAIYA, O.A., SOGUNLE, O.M., AKINOLA, O.S., ADEYEMI, O.A. AND LADOKUN, A.O., 2012. Free range and deep litter housing systems: effect on performance and blood profile of two strains of cockerel chickens. **15**: 3-7.
- PAVLIK, A., POKLUDOVA, M., ZAPLETAL, D. AND JELINEK, P., 2007. Effects of housing systems on biochemical indicators of blood plasma in laying hens. *Acta. Vet. Brno.*, **76**: 339-347.
- PRABAKARAN, R., 2003. Good practices in planning and management of integrated commercial poultry production in South Asia. *Food & Agriculture Org.*, **159**: 67.
- PRIYA, M. AND GOMATHY, V.S., 2008. Haematological and blood biochemicals in male and female turkeys of different age groups. *Tamilnadu J. Vet. Anim. Sci.*, **4**: 60-68.
- RITCHIE, J., SPENCER, L., BRYMAN, A. AND BURGESS, R.G., 1994. Analysing qualitative data. *Routledge*. p.3.
- QULANDER, S.F., NAYYER, A.Q., ALI, S. AND SHAKIR, H.A., 2012. Lipid profile in smoking employees of University of Azad Jammu and Kashmir Muzaffarabad. *Punjab Univ. J. Zool.*, **27**(2): 79-82.
- SCHMIDT, E.M., PAULILLO, A.C., LAPERA, I.M., MARTINS, G.R.V., JUNIOR, L.N., TESTI, A.J.P. AND FAPESP-BRAZIL, B., 2010. Serum biochemical parameters of female bronze turkeys (*Meleagris gallopavo*) during egg-laying season. *Int. J. Poult. Sci.*, **9**: 177-179.
- SCHMIDT, E.M.S., PAULILLO, A.C., DITTRICH, R.L., SANTIN, E., DA SILVA P.C.L. AND BELTRAME, O., 2007. The effect of age on hematological and serum biochemical values on juvenile ring-necked pheasants (*Phasianus colchicus*). *Int. J. Poult. Sci.*, **6**: 459-461.
- SEISER, P.E., DUFFY, L.K., MCGUIRE, A.D., ROBY, D., GOLET, G.H. AND LITZOW, M.A., 2000. Comparison of pigeon guillemot: Blood parameters from oiled and on oiled areas of Alaska eight years after the Exxon Valdez oil spill. *Mar. Bull.*, **40**: 152-164.
- SIMARAKS, S., CHINRASRI, O. AND AENGWANICH, W., 2004. Hematological, electrolyte and serum biochemical values of the Thai indigenous chickens (*Gallus domesticus*) in northeastern, Thailand. *Songklanakarin J. Sci. Technol.*, **26**: 425-430.
- SMITH, M.F., WEST, H.N. AND JONES, R.D., 2000. The cardiovascular system. in Avian Physiology. Wittow GC. 5th Ed. *Academic Press, San Diego*. pp. 141-223.
- TRAS, B., INAL, F., BAS, A.L., ALTUNOK, V., ELMAS, M. AND YAZAR, E., 2000. Effects of continuous supplementation of ascorbic acid, aspirin, vitamin E and selenium on some haematological parameters and serum superoxide dismutase level in broiler chickens. *Br. Poult. Sci.*, **41**: 664-666.
- VECEREK, V., STRAKOVA, E., SUCHY, P. AND VOLSLACROVA, E., 2002. Influence of high environmental temperature on production and haematological and biochemical indexes in broiler chickens. *Czech J. Anim. Sci.*, **47**: 176-182.
- VOSLAROVA, E., BEDANOVA, I., VECEREK, V., PISTEKOVA, V., CHLOUPEK, P. AND SUCHY, P., 2006. Changes in haematological profile of common pheasant (*Phasianus colchicus*) induced by transit to pheasantry. *Dtsch Tierarztl. Wochenschr.*, **113**: 375-378.