Effect of Age and Sex on Serological Indices of Japanese Quail (*Coturnix coturnix japonica*) Reared in Derived Savanna Area of Nigeria

Ojedapo, L. O.
Department of Animal Nutrition and Biotechnology,
Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria.
E-mail: ojedapolam@yahoo.com

ABSTRACT

The study is to evaluate the effect of age and sex on serological indices of Japanese quail (Coturnix coturnix japonica) reared in derived savanna area of Nigeria. A total of 200 quails comprising 100 each of male and female were selected for this study. Fifteen each of the males and females quails were randomly selected at each week of 6, 7, 8, 9, 10 and 11 respectively. Data were obtained on Total Protein (TP) using Biuret method, Albumin (ALB) using dye binding techniques with bromocresol green, Globulin (GL) using differences between total protein and Albumin, Sodium ion (Na+) and Potassium ion (K+) using flame emission spectroscopy, Serum Alanine Amino Transferase (SALT) and Serum Aspartate Amino Transferase (SAST) using method described by Bergmeyer, for both sexes on the quails. The results obtained show among others that statistical differences were observed for all the parameters of serological indices in relation to age and sex. Therefore, it is concluded that age and sex have an influence on serological indices of quail.

Keywords: *Pharaoh Quail, derived savanna, serum chemistry, age and sex*

INTRODUCTION

Japanese quail (*Coturnix coturnix japonica*) is the smallest avian species farmed for meat and egg production (Panda and Singh, 1990). It has also assumed worldwide importance as a laboratory animal (Baugarther, 1993). Distinct characteristic include rapid growth enabling quail to be marketed for consumption at 5-6 weeks of age, early sexual maturity - resulting in short generation interval, high rate of lay and much lower feed and requirement than domestic fowl (Adeogun and Adeoye, 2004). Japanese quail in the wild feed on insects, grains, grass and various seeds. They thrive well and grow efficiently when domesticated and fed with high protein diets. These birds were first domesticated in Japan, when a Japanese emperor obtained relieved from tuberculosis after eating quail meat in the later part of the ninetieth century (Howes, 2000). *Coturnix coturnix japonica* has been found to have no known morbid disease but they suffer from respiratory disorder, these do not spread fast and mortality rate is very low. Hence, it is not difficult to maintain the health of the quails. Meanwhile, Japanese quails are affected

by common poultry diseases but are fairly disease resistance due to their ability to produce immunity with the help of their serological indices (Oladunjoye, Ojebiyi and Ojedapo, 2008). Investigations of normal serum indices of poultry are very much essential in diagnosing the various pathological and metabolic disorders. Serum can be used as diagnostic tools in order to assess the health status of individual or a flock. Determination of serum value of poultry are influenced by age, sex, breed, climate, geographical location, season, day length, time of the day, nutritional status, life habitat of species, present status of individual and other physiological factor (Lamorede, 1996; Ibrahim and Abdu, 1992).

Serum chemistry reference values provide useful information about the physical condition of individuals, making them useful tools in differentiating normal and healthy animals from abnormal or diseased states. This is also applicable to Japanese quails that are used for producing eggs and meat for human consumption and as laboratory animals (Scholtz and Flachowsky, 2009). Evaluation of serum enzyme activities of predictor of passive transfer status in animal suggest that passive transfer in neonatal lambs can be successfully predicted by measurement of serum gamma-glutamyl transferase (GGT) activity but not measurement of the other enzymes (Britti, 2005). However, the aim of the study is to investigate the influence of age and sex on the serological indices on Japanese quail reared in derived savanna zone of Nigeria

MATERIALS AND METHOD

This experiment was carried out from June to September 2012 at the Poultry unit of Teaching and Research Farm Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria. Ogbomoso is a derived savanna Zone of Nigeria that lie within the latitude $8^{o}15^{o}$ north and longitude $4^{o}15^{o}$ east. The area has an annual rainfall of 1247mm with latitude of 300-600meter above the sea level while the mean annual temperature is about 27^{o}C (Ojedapo *et al.,* 2012).

Two hundred Japanese quails (*Coturnix coturnix japonica*) were purchased at day old from Foresight Hatchery Nigeria Limited, Oluyole industrial estate Ibadan, Oyo state. Quail used in these experiments were kept under normal brooding condition in brooding floor pen until they were 3 weeks of age under continuous light and with gradual decrease in room temperature from 37^{o}C at brooding to 25^{o}C at six weeks of age. At three weeks of age, 180 birds were individually weighted and randomly divided into two sex experimented groups according to the aim of the experiment. The first group was male while the second group was female. All birds were kept under similar condition during the period of the experiment. The birds were fed a ration containing 28% crude protein and 2800kcalME/kg at age 0-4 weeks, 24%CP and 2800kcalME/kg at 4-8 weeks and 18%CP, 2700kcalME/kg at 9 weeks till the end of experiment. Parameter collected includes blood serum which was collected through the wing vein of the

bird into non ethylene di-amine tetra acetic acid (EDTA) bottle for coagulation to occur. The coagulated blood sample was spin in centrifuge for extraction of serum from the whole sample. These following variables were analysed in the university laboratory in Ibadan. Total protein was determined using the Biuret method as described by Doumas (1975). Albumin was determined using dye binding techniques with bromocresol green as described by Doumas and Biggs, (1972). Globulin was also determined by differences between total protein (TP) and Albumin (ALB). Serum alanine aminotransferase was determined by method described by Bergmeyer, Scheibe and Wahlefeld (1978). Serum Aspartate Aminotransferase was determined also by method described by Bergmeyer, Scheibe and Wahlefeld (1978). Sodium ion was measured directly by flame emission spectroscopy. Potassium ion was determined directly by flame emission spectroscopy. All parameters collected were subjected to analysis of variance using the general linear model (GLM) of SAS (2003). Model adopted is

$$Y_{ijk} = \mu + A_i + H_j + (AH)_{ij} + e_{ijk}$$

Where

Y_{ijk}	=	measurement of individual bird
μ	=	overall mean
A_i	=	fixed effect of age *ith* (6, 7, 8, 9, 10, 11)
H_j	=	fixed effect of sex *jth* (1, 2)
$(AH)_{ij}$	=	interaction between age *ith* and sex jth
e_{ijk}	=	random error

RESULTS AND DISCUSSION

Table 1 shows the least square means of serological value of both male and female quail at age 6, 7 and 8 weeks. Significant difference were observed in all parameters measured with increase in age. All parameters were significantly increased from the age of 6 to 8 weeks in both sexes. Total protein (TP) value were only significantly higher in male at age of 7 weeks. Though, there were differences in value obtained for albumin (ALB) with an increase in age in relation to both sexes yet they were not significant. Globulin values in females were higher at all age to that of male. Sodium and potassium ion values were higher at age of 6 and 8 weeks in female quail but lower to that of male at the age of 7 weeks. Serum alanine aminotransferase (SALT) and serum aspartate aminotransferase (SAST) values were higher in male than female throughout the age categories except at 8 weeks of age where it was lower to that of female.

The results show that significant differences were observed between the sex and age on the serological indices. At 6th, 7th and 8th weeks of age, female quails were favoured for GL (2.05gd/L, 3.05gd/L and 4.13gd/L), Na+ (39.40mmol/L and 69.87mmol/L), K+ (23.93mmol/L and 50.93mmol/L) while males took the lead for SALT (29.87μ/ml and 42.20μ/ml) and SAST (36.53μ/ml and 65.20μ/ml).

However, for 9th, 10th and 11th weeks of age, females quail revealed higher value for GL (1.98gd/L), whereas; males quail were favoured for Na+ (64.13mmol/L), K+ (42.93mmol/L), SALT (33.53µ/ml) and SAST (47.73µ/ml) than their females' counterpart. Generally, the variables increase as the birds attaining ages. Table 2 shows the least square means of serological value of both male and female quail at age 9, 10 and 11 weeks. Significant differences were observed in globulin, sodium and potassium ion, SALT and SAST, whereas, insignificant difference was observed in TP and ALB throughout the ages. TP and ALB show different value as age increases but none of which is significant. Globulin value was significant only at the age of 9 weeks but no significant records was obtained at 10 and 11weeks of age in both sexes. Higher significant values of sodium ion were observed in male at age of 10 and 11weeks compared to that of female which show high significant values only at the age of 9 weeks. Potassium ion is significant at the ages of 10 and 11weeks but was inconsistent between male and female. SALT shows highest significant values in male quails at the ages of 9 and 11weeks over its female counterpart but there were no significant observations at the age of 10 weeks.

Meanwhile, only SAST shows highest value of significant in male quails over female quails at all age categories. Serum biochemical analysis in regards to immune status of poultry can be used in predicting potential resistance of poultry to disease and developing new strains, that are genetically resistant to poultry diseases (Amao, Ojedapo, Oyewumi and Ameen, 2012, Pavlik, Poklndova, Zapletal and Jelinek, 2007 and Ameen et al., 2007). Clinical biochemistry is increasingly being used as an aid to diagnosis in avian species (Elizabeth, Antonio, Ivan and Gislaine, 2010). Also, it is well known that blood protein in birds depend on age and sex and they may vary due to season (Fudge, 2000).

The present study shows that there were significant differences in serum total protein among different ages of Japanese quail. This is in accordance with the work of Edens (2011) on gender, age and reproductive status effects on serum prolactin concentrations in different varieties and species of poultry. These findings also supported the work of Levy *et al.* (2006) on reference value for biochemical test in poultry and Hanan (2010) who worked on variation in egg performance and plasma constituents at different ages of female Japanese quail. Result of Natalija *et al.*, (2007) showed that concentration of total protein in serum of chickens shown significant growth with ageing. This present research is in accordance with the quoted data as there were increases in concentration of total protein from 6 to 8 weeks and from 10 to 11weeks. The describe changes were related to the most important physiological role of blood protein, e.g. as a source of amino acids for synthesis of tissue protein. Growth of the organism demand an intensive supply of amino acids, whose transport form are proteins in blood, also energetic and other biological active substances that are mostly transported by blood are attached to serum proteins (Natalija *et al.*, 2007).

From the sex wise value obtained in this study, it was observed that in both male and female quails, the total protein increased with age from 6 - 8 weeks and from 10 - 11weeks but decline in age of 9 weeks. It was observed that the total protein values in female quails were higher at the ages of 8, 9 and 11weeks than that of male quails. This is in agreement with the work of Elizabeth, Antonio, Ivan and Gislaine (2010) on serum biochemical parameters of female bronze turkey but disagree with the work of Bakhiet *et* al. (2006) and Bounous and Stedman (2000) that total protein in juvenile wild turkeys and Sudanese geese are the same. Mary, Priya and Gomath (2008) also stated that both age and sex had definite influence on protein value as it was observed in this present study.

Serum albumin and globulin value increased with an increased in age and the variations in the mean values of albumin and globulin obtained in this study were similar to the variations observed in the other species. The increase in protein values recorded in the current study was reflected both in albumin and globulin values separately. However, the difference in the value between males and females were more pronounced in globulin fraction than in albumin at the ages of 6 - 9 weeks (Mary, Priya and Gomath, 2008). Perhaps age and sex had more influence on globulin than on albumin as being reported by Kundu, Mohanty, Mishra and Misra, (1993) and Darshan, Pand and Dev Roy (1987) that age had greater influence on serum protein level in females than in males. It was inferred that age and sex had definite influence on protein value which was more pronounced in females between sexes and in globulin among the various fractions of protein in quail, thus similar to the findings of Mary, Priya and Gomath (2008).

Sodium and potassium ions increase with increase in age from 6 - 11 weeks in both sexes with high level of significance. The highest value of sodium ion was recorded in female quails at 8 weeks of age but 11weeks in male quails. Potassium values show highest value for that of female quails at 8 weeks of age. Thus increase in sodium and potassium ions were due to dietary sodium increase in variation of feed at different ages. This was also reported by Dalc and John (1985). The highest value obtained from female show that they grow faster than male as this was in agreement with the work of Dalc and John (1985) and Alcantara, Hanson and Smith (1980).

It was also inferred that the mean SALT and SAST were significantly elevated as age increase from 6 - 8 and fluctuated from age of 9 - 11weeks in both sexes. The SAST values were significantly higher in females. Several physiological changes may occur in the metabolism of female birds due to laying (Elizabeth, Antonio, Ivan and Gislaine, 2010). SAST and SALT are age dependent to varying degrees among different species and the cause of this age - dependent increase in activity has not been defined (Hochleithner, 1994). Published reference values vary according to breeding activity, sex, age and time of year (Lewandowski, Campbell and Harrison, 1986). Biochemical components changed significantly as the bird

aged (Amao, Ojedapo, Oyewumi and Ameen, 2012). Meanwhile, the SAST obtained in this study were in agreement with those reported for female Japanese quails by Scholtz and Flachowski (2009) but disagree with Obinna *et al.* (2011) who report that SALT has significant higher effect on sex with male than female helmeted guinea fowls.

CONCLUSION

The purpose of this study was to examine the effect of age and sex on serological indices of Japanese quail (Coturnix coturnix japonica) reared derived savanna area of Nigeria. Data were obtained on Total Protein (TP) using Biuret method, Albumin (ALB) using dye binding techniques with bromocresol green, Globulin (GL) using differences between total protein and Albumin, Sodium ion (Na+) and Potassium ion (K+) using flame emission spectroscopy, Serum Alanine Amino Transferase (SALT) and Serum Aspartate Amino Transferase (SAST) using method described by Bergmeyer, for both sexes on the quails. Statistical differences were found for all the parameters in relation with age and sex. Thus, base on this research, it suffices enough to conclude that age and sex has an influence on serological index of quail. The serological indices might serve as an indicator or ability of quail to withstand various poultry disease.

Table 1: Least square means of serological indices of male and female quail at different age of 6, 7 and 8 weeks

			Interval of Serum Collection		
Parameters	**Sex**	**N**	**6 weeks**	**7weeks**	**8 weeks**
Total protein (gd/L)	Male	15	3.15+0.30	4.03 +0.06a	4.35+0.04
	Female	15	3.02+0.08	3.88+ 0.04b	4.67+0.07
Albumin (gd/L)	Male	15	1.09+0.02	1.11+0.02	1.17+0.01
	Female	15	1.05 +0.01	1.18+0.03	1.17+0.01
Globulin (gd/L)	Male	15	1.76+0.08b	2.74+0.06b	3.21+0.04b
	Female	15	2.05+0.08a	3.05+ 0.04a	4.13+0.11a
Sodium ion (mmol/L)	Male	15	38.40+1.38b	58.33+1.42a	60.87+1.50b
	Female	15	39.80+0.90a	49.93+0.80b	69.87+1.72a
Potassium ion (mmol/L)	Male	15	22.73+1.46b	40.67+0.94a	44.87+0.64b
	Female	15	23.93+0.43a	37.00+0.80b	50.93+1.20a
SALT (μ/ml)	Male	15	29.87+1.10a	42.20+1.18a	46.80+0.60b
	Female	15	24.07+0.40b	34.67+1.08b	54.20+1.82a
SAST (μ/ml)	Male	15	36.53+1.17a	65.20+1.27a	67.07+1.06b
	Female	15	35.27+0.46b	57.00+1.06b	74.40+1.21a

ab Means along the same column with different superscript at the same age are significantly different ($P<0.05$)

SALT = Serum alanine aminotransferase

SAST = Serum aspartate aminotransferase

Source: Experimental Result, 2012

Table 2: Least square means of serological indices of male and female quail at different age of 9, 10 and 11 weeks

			Interval of Serum Collection		
Parameters	**Sex**	**N**	**9 weeks**	**10weeks**	**11 weeks**
Total protein (gd/L)	Male	15	2.59+0.09	3.75+0.08	3.81+0.14
	Female	15	2.97+0.08	3.74+0.06	3.86+0.06
Albumin (gd/L)	Male	15	0.95+0.04	1.20+0.04	1.12+0.02
	Female	15	0.94+0.02	1.09+0.02	1.21+0.02
Globulin (gd/L)	Male	15	1.83+0.08b	2.60+0.08	2.78+0.12
	Female	15	1.98+0.06a	2.60+0.06	2.73+0.08
Sodium ion (mmol/L)	Male	15	34.93+1.58b	53.93+2.10a	64.13+2.14a
	Female	15	35.13+0.99a	52.73+0.94b	59.07+1.03b
Potassium ion (mmol/L)	Male	15	21.60+1.26	37.33+1.35b	42.93+1.28a
	Female	15	21.00+0.62	38.53+0.62a	41.20+0.59b
SALT (μ/ml)	Male	15	24.47+1.44a	39.40+0.90	33.53+1.17a
	Female	15	21.40+0.68b	39.47+0.67	32.67+0.84b
SAST (μ/ml)	Male	15	34.27+1.17a	60.67+1.83a	47.73+1.97a
	Female	15	32.67+0.58b	59.27+1.19b	45.73+0.67b

ab Means along the same column with different superscript at the same age are significantly different ($P<0.05$)

SALT = Serum alanine aminotransferase

SAST = Serum aspartate aminotransferase

Source: Experimental Result, 2012

REFERENCES

Adeogun, I. O. and **Adeoye, A. A.** (2004). Heritabilities and Phenotypic Correlation of Growth Performance in Japanese Quail. *Livestock Research for Rural Development,* 16(12):15 - 21.

Alcantara, P. E., Hanson L. E. and **Smith J. D.** (1980). Sodium Requirements Balance and Tissue Composition of Growing Pigs. *Journal of Animal Science,* 50, 1092 - 1101.

Amao S. R., Ojedapo L. O., Oyewumi S. O. and **Ameen S. A.** (2012). Influence of Strain on Haematological and Blood Biochemical Indices in Broiler Chicken Reared in Derived Savanna Environment of Nigeria. *Journal of Agricultural Science and Technology* (In print).

Ameen S. A., Adedeji O. S., Akingbade A. A., Olayeni T. B., Ojedapo L. O. and **Aderinola O. A.** (2007). The effect of different feeding regimes on haematological parameters and immune status of commercial broilers in derived savanna zone of Nigeria. Proceedings of the 32nd Annual Conference of Nigerian Society for Animal Production at University of Calabar, Nigeria. Pp. 176 - 178.

Bakhiet A.O., Ali M. S., Al Sharif A. and **El Badwi S. M.** (2006). Some biochemical value in the young and adult Sudanese geese (Anser anser). *Journal of Animal Veterinary,* 5:24-26.

Baugarther, J. (1993). Japanese quail production, breeding and genetic. Proceeding of the 10th intl symp. On current problem of Avian Genetic, Nitra Slovakia Pp 101 - 103.

Bergmeyer H. U., Scheibe P. and **Wahlefeld A. W.** (1978). Optimization of methods for aspartate amino transferase and alanine amino transferase. Clinical chemistry 24:58-73.

Bounous, D. I. and **Stedman, N. L.** (2000). *Normal avian haematology: chicken and turkey.* In Fieldman, B. F., Zinkl J. G and Jain N. C. (Eds). *Schalm's Veterinary Haematology.* Lippincott, Williams and Wilikins Philadephia Pp: 1147 - 1154.

Britti, D. (2005). Evaluation of serum enzyme activities as predictors of passive transfer status in lambs. Department of Veterinary Clinical Science, School of Veterinary Medicine, University of Teramo, Viale Italy.

Darshan N., Pand J. N. and **Dev Roy, A. K.** (1987). Studies on the biochemical parameters of the blood of adult broiler parents. *Indian Journal of Poultry Science,* 22: 138 -140.

Doumas, B.T. (1975). Standards for total protein assay. Clinical chemistry 21:1159.

Doumas, B. T. and **Bigg, H. G.** (1972). *Determination of serum albumin.* In Coop G. R. (Ed) *Standard method of Clinical chemistry* (Vol. 7, 175). New York: Academic press.

Dalc C. H. and **John, A. F.** (1985). Efficiency of feed utilization; Plasma electrolytes and plasma Basic Amino Acid in young pigs. *Journal of Nutrition,* 115:1366 - 1371.

Eden, F. W. (2011). Gender, Age and Reproductive Status Effect on Serum Prolactin Concentrations in Different Varieties and Species of Poultry. *International Journal of Poultry Science,* 10(11), 832-838.

Elizabeth M. D., Antonio C. P., Ivan M. L. and **Gislaine R. V.** (2010). Serum Biochemical Parameters of Female Bronze Turkeys (Meleagris gallopavo) During Egg - Laying Season. *International Journal of Poultry Science,* 9(2), 177-179.

Fudge, A. M. (2000). L*aboratory Medicine - Avian and Exotic pets.* Philadelphia: W.B. Saunders Company.

Hanan A. H. (2010). Variation in egg performance and plasma constituents at different Ages of females Japanese quail. Egypt. *Egypt Poultry Science,* 30(2), 565 - 581.

Hochleithner, M. (1994). *Biochemistries.* In Ritchie B. W., G.. J. Harrison (Eds). *Avian Medicine: Principles and application* (223 - 245). Florida: Wingers Publishing, .

Howes J. R. (2000). Japanese Quail As Round in Japan. *Quail quarterly* 1:19 - 30.

Ibrahim M. A. and **Abdul P. A.** (1992). Ethno-agro Veterinary perspective of poultry Management, health and production among the Hausa/Fulani of rural Nigeria. In Proceedings of the Scientific Session of Nigerian Medical Association pp 172 - 181.

Kundu A. K., Mohanty B. P., Mishra S. C. and **Misra, M. S.** (1993). Age related changes in the haematology of Guinea fowls. *Indian Journal of Poultry Sciences,* 28: 200 - 207.

Lamorede, A. G. (1996). The role of veterinarian in a developing economy. *Nigerian Veterinary Journal,* 1: 106 - 111.

Levy, D., Julie, K., Cynda, C., Linda, L and **Werner, D.** (2006). Department of Small Animal Clinical Science, College of Vet Med. University of Florida. *Journal of the America Veterinary Medicine,* 223(7):1033 - 1037.

Lewandowski A. H., Campbell T. W. and **Harrison G. J.** (1986). *Clinical chemistry.* In Horrison, G.J and Harrison (Eds) *Clinical Avian Medicine.* Philadephia, W.B. Saunders, pp 71.

Mary, Priya and **Gomath V. S.** (2008). Haematological and Blood Biochemicals in Male and Female turkeys of Different Age Groups. *Tamilnadu Journal of Veterinary and Animal Sciences,* 4(2), 60 - 68.

Natalija F., Zvonko S., Suzana M., Blanka B. L and **Maja Z.** (2007). Changes in Concentration and fraction of blood serum proteins of chickens during fattening. *Veterinary Archive,* 77:319 - 326.

Obinna Okoro V. M., Emmanuel O. U., Ogbuewu I. P., Obiakaunu H. and **Emenyonu C.** (2011). Effect of sex and systems of production on the haematology and serum biochemical characters of helmeted guinea fowls (Numida meleagris pallas) in South Eastern Nigeria. *International Journal of Biosciences,* 1(3):51-53.

Oladunjoye I. O., Ojebiyi O. O. and **Ojedapo L. O.** (2008). *Essentials of non ruminant animal Production, a monograph.* Ogbomoso: Ola printers behind California hotel Idi-Oro.

Ojedapo L. O., Amao S. R., Ameen S. A., Adedeji T. A., Ige A. O. and **Ogundipe, R. I.** (2012). Prediction of body weight and other linear body measurement of two commercial layer strain chickens. *Asian Journal of Animal Sciences,* 6(1): 13-22.

Panda, B and **Singh, R** (1990). Development in processing Quail. *World Poultry Science Journal* 46, 219 - 234.

Pavlik A., Poklndova, M., Zapletal, D. and **Jelinek, P.** (2007). Effect of housing system on Biochemical indicator of blood plasma of laying hen. *Acta Veterinary Biomedical Science,* 76. Pp 339-347.

SAS (2003). *Statistical Analysis System.* Institute inc. carries N.C. USA.

Scholtz, N. I. and **Flachowsky, G.** (2009). Serum chemistry reference value in adult Japanese quail including sex - related differences. *Journal of Poultry Science,* 8(6):1186 - 1190.