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Research Article

Correlation and regression of traits associated with age and sex of Japanese quail *(Coturnix coturnix, japonica)*

Faruq[1], A.A., Sohel[1], M.S.H., Poddar, S., Rakib[2], T.M., Momin[3], M.M., Khan[3], M.K.I.

[1] Department of Anatomy and Histology, [2] Department of Pathology and Parasitology,

[3] Department of Genetics and Animal Breeding, Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram-4225

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** Corresponding Author :*

Cell: +8801737 116141

Email: faruqabdullahal103@gmail.com

ABSTRACT

This study was conducted to estimate the correlation and regression coefficient of traits of Japanese quail *(Coturnix coturnix, japonica)* under litter management in respect to age and sex. A total of 250 day old chicks of quail were reared up to seven weeks feeding with locally available commercial feed. Weekly live weight and weight of different body parts just after slaughter were kept on periodic basis. Correlation and regression parameters of those traits were estimated. The average body weight of male and female quail in three different weeks (3rd, 5th and 7th) were 50.7, 103, 136.08 and 56.01, 108.8, 146.32 respectively, which indicated that the female quail were heavier than the male. Weight of different organs and body weight of quail increased gradually with the increased of age. A slight difference was observed in the shank length and beak length in both sexes as a result of increasing age. Weight of abdominal fat was higher in male, while the weight of gastrointestinal tract and liver was higher in female in respect to age. The correlations of body weight with abdominal fat, gastrointestinal tract and liver weight in both sexes of quail at three different weeks were high and positive. The regression model parameters that is intercept and slope and R^2 value for male and female were positive. Male quail showed lower values than the females in terms of body weight and liver weight. Male quail also showed higher values than female quail for weight of abdominal fat. However, the higher R^2 values indicated the close agreement between male and female in terms of different trait. The outcome of this study will help the farmers and policy makers in making decision for future profitable quail farming in Bangladesh.

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1. INTRODUCTION

Japanese quail is the smallest farmed avian species for commercial egg and meat production with the advantage of faster growth, early sexual maturity, high rate of egg production, short generation interval, short incubation period, easy maintenance, excellent and cheap source of animal protein, satisfactory FCR rate, high meat quality (Ahmad *et al.,* 2013; Hussain *et al.,* 2013). Both quail meat and eggs are characterized by high nutritive value that is low in fat and cholesterol (Garwood and Diehl., 1987) which is particularly important for the patient of cardiovascular diseases and

in Bangladesh quail farming will be a promising sector as a source of protein in the form of egg and meat production. The effect of age and sex was more prominent on body weight gaining, shank development and length gaining in Japanese quail (Khaldari *et al.,* 2013). The effect of age and sex was also prominent on weight of abdominal fat, Intestine and liver (Kumari *et al.,* 2009). Live weight of poultry depends on different body parts and internal organs. However, there are very few studies are cited in literature (Czaja and Gornowicz., 2004; Khalid *et al.,* 2012) about this; but it is very important to identify the impact of these factors on body size and weight. Therefore, the present study was aims to know the effects of such organs to body shape, size and weight of quail and to estimate the correlations, regression parameters and R^2 values of different traits between body weight and other organs in Japanese quail.

2. MATERIALS AND METHODS

The study was conducted at local quail farm known as Kazi Poultry and Cottage, Pirojali (Sarkar Para), Gazipur Sadar, Gazipur from 12th February 2014 to 5th April 2014. A total of 250 day old chicks (DOC) of Japanese quail were bought to the farm. The quail rearing unit was not environmentally controlled. During the 7th week of observation the total no. of birds were 213. Brooding, lighting, floor space, feeding, watering, balance ration and medication for the DOC up to 7th week of age for quail were maintained as traditional quail rearing system. The farm was visited every day and observed the birds. Data was collected by observation and estimation in a regular interval. The following data were collected from the farm (amount of feed intake, body weight and weight gain, shank length, beak length, and weight of liver, gastrointestinal (G.I), tract and abdominal fat after slaughter). The amount of feed intake (g/bird/day) was measured by number of quails per feeder and amount of feed supply per day in the feeder and weighing of the remaining feed that is left over. Body weight (g/bird) was measured directly by digital weighing balance once in a week by random selection of 25 male and 25 female quails and recorded. The shank length (cm) was taken as the distance between the foot pad and the hock joint, Shank length, beak length was measured by a simple ruler once in a week along with the body weight measurement. At the age of 3rd, 5th and 7th weeks 5 male and 5 female quails were catch randomly for slaughter. The Liver, G.I tract and abdominal fat was collected separately from each bird weighted and recorded. The weight of those organs was taken using a digital weighing balance (g/organ).

Mean with standard error of different traits were estimated by PROC GLM and PROC MIXED of SAS (SAS, 2008) using the following randomized block design according to (Steel *et al.*, 1997).

$$Y_{ijk} = \mu + T_i + S_j + e_{ijk}$$

Where,

Y_{ijk} = the observed value of a given individual;

μ = the overall mean for trait;

T_i= effect of weeks;

S_j= effect of sex; and

e_{ijk} = the random error associated with the measurement of each individual distributed as N $(0, \sigma^2)$.

Mean differences were obtained by least significant differences (LSD) test at 5% level of significance (Steel *et al.,* 1997).

Fitting of linear regression

In the linear equation (Y = a+bx, where Y is the value of the traits, X is the age in weeks, a and b are the parameters that define the shape of the curve) the different traits (body weight, abdominal fat weight, G.I. tract weight and liver weight) was set as dependent variable and time (age at weeks) was set as independent variable. The regression model was analyzed by Microsoft Excel 2007 to estimate the model parameters along with the fit statistics (R^2).

3. RESULTS AND DISCUSSIONS

The least square means and standard error for different trait of both sexes of quail was presented in Table 1. Result revealed that, average body weight female quail at three different weeks (3rd, 5th and 7th) was 56.01, 108.8, 146.32 (g) which was significantly heavier than male quail (Table 1) and the outcome is similar with the previous findings (Saatci *et al.,* 2006; Shokoohmand *et al.,* 2007).

Table 1: Least square mean with standard error of different traits of Japanese quail

Traits	Traits	Weeks		
		3rd	4th	5th
Body weight (g)±SE	Male	50.70 a±0.53	103.00 a ±0.84	136.08 a ±0.88
	Female	56.01b±0.56	108.80 b ±0.73	146.32 b ±0.90
Shank length (cm) ±SE	Male	2.90 a ±0.04	3.00 a ±0.03	3.04 a ±0.03
	Female	3.15 b ±0.02	3.17 b ±0.03	3.19 b ±0.03
Beak length (cm) ±SE	Male	1.94 a ±0.02	1.96 a ±0.02	1.97 a ±0.02
	Female	2.03 b ±0.01	2.05 b ±0.01	2.07 b ±0.02
Weight of Abdominal fat (g) ±SE	Male	5.18 a±0.11	6.80 a ±0.04	8.14 a ±0.08
	Female	1.5 b ±0.03	1.6 b ±0.03	1.8 b ±0.07
Weight of G.I. tract (g) ±SE	Male	8.96 a ±0.12	11.66 a ±0.38	12.72 a ±0.43
	Female	16.12 b ±0.11	17.7 b ±0.29	18.36 b ±0.31
Weight of liver (gm) ±SE	Male	1.88 b ±0.04	2.02 b ±0.02	2.14 b ±0.05
	Female	4.44a±0.12	5.12 a ±0.09	5.40 a ±0.15

Legends: a and b superscript denote significant difference between sex.

Slightly differences was observed in the shank length and beak length of sexes and this differences might be due to genotype, sex and age and this findings were agreed with a findings (Adeogun and Adeoye., 2004).

The weight of liver and gastrointestinal tract was higher in female quail in comparison to the male quail (Table 1), it might be due to higher metabolism and growth rate in female than male, which seems to be similar with some previous results (Kul *et al.,* 2006; Ayasan *et al.,* 2000; Banerjee., 2010). The weight of abdominal fat was higher in male quail in comparison to female (Table 1); it might be as a reason of variation of hormonal secretion in different sex and minimum metabolic energy loss by male quail, similar type of findings was found in the previous study (Genchev *et al.,* 2005; Banerjee., 2010).

Table 2: Correlation of different traits with body wt. in both sexes of quail at three different weeks

Body weight (g)	Male			Female		
	Wt. of abdominal fat (g)	Wt. of G.I. tract (g)	Wt. of liver (g)	Wt. of abdominal fat (g)	Wt. of G.I. tract (g)	Wt. of liver (g)
Week 3	-0.9	-0.09	-0.43	0.37**	-0.72	-0.85
Week 5	0.45**	0.95**	0.21**	-0.16	0.82**	0.38**
Week 7	0.23**	0.54**	0.18**	-0.78	0.12**	-0.29

Legends: **Correlation is significant at 0.01% level

Correlation of body weight with abdominal fat weight, G.I tract weight and liver weight in both sexes of quail in the three different weeks is shown in Table 2. From Table 2, it was indicated that, the correlation between body weight and weight of abdominal fat for male and female quail in three different weeks, was positive for male at 5th and 7th week and negative in 3rd week. Highest correlation was found at week 5 for male quail and it was 0.45. In case of female the results was opposite to the male that is in female at 5th and 7th week the correlation was negative and in 3rd week it was positive, which was found 0.37. These estimates were

in agreement with the previous report (Leenstra and Pit., 1988; Gaya *et al.*, 2006; Khalid *et al.,* 2012).

In case of the correlation between body weight and weight of G.I. tract for male and female quail in three different weeks, in both sexes at 5th and 7th week the correlation was positive and in 3rd week it was negative, highest correlation was found at week 5 (0.95 and 0.82, respectively for male and female). These estimates were in agreement with (Becker *et al.,* 1984) in chicken. In case of, the correlation between body wt. and wt. of liver for male and female quail in three different weeks, male at 5th and 7th week the correlation was positive and in 3rd week it was negative, highest correlation was found at week 5 (as 0.21) where as in female correlation at 3th and 7th week the correlation was negative and in 3rd week it was positive, Value of correlation at 5th week for female was positive and value was 0.38. These estimates were in agreement with outcome of (Cahaner and Nitsan., 1985) in chicken.

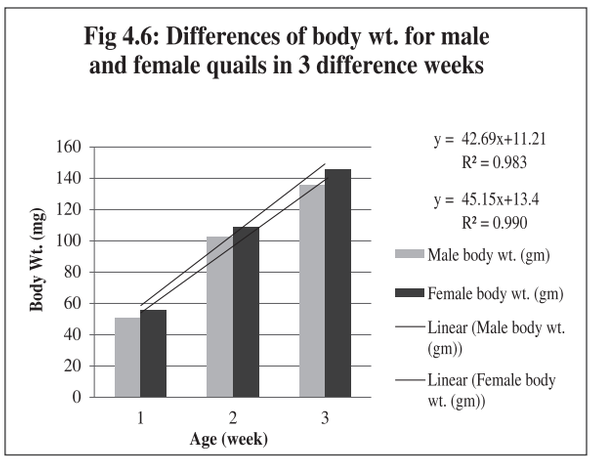
Considering these three traits, highest correlation was observed in male, second highest correlation was in female 0.82. Both of the highest correlation was at 5th week and for the correlation between body weight and wt. of G.I. tract. Therefore, study represents that in 5th week of age quail was more correlated for correlation between body weight and wt. of G.I. tract and male were more correlated than female. It might be due to the cause of more body weight of male quail required more feed compare to female.

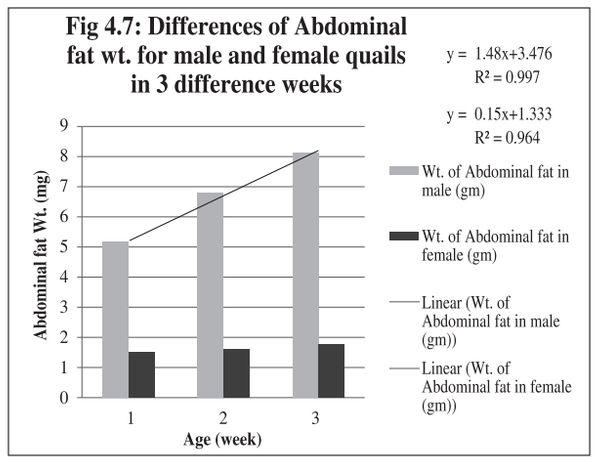
Table 3: Regression parameter and R^2 of different traits in both sexes of quail at three different weeks

Sex	Male			Female		
	Intercept(a)	Slope(b)	R^2	Intercept(a)	Slope(b)	R^2
Body wt.	11.21	42.69	0.98	13.40	45.15	0.99
Abdominal fat wt.	3.75	1.48	0.99	1.33	0.15	0.97
G.I. tract wt	7.35	1.88	0.94	15.15	1.12	0.95
Liver wt.	1.753	0.13	0.99	4.03	0.48	0.95

Table 3 indicated that, model parameters were positive in both sexes where female shows higher values in all the traits except abdominal fat weight. Highest values of intercept (a), slope (b) and fit statistics (R^2, Coefficient of determination) indicates more fitted.

The higher R^2 values indicated close agreement between dependent and independent variable. If a model achieves R-squared above 90%, it indicates close agreement (Karmakar and Ray., 2011) hence R^2 values of the present study showed close agreement that means the traits value will increased with the increase of age. In case of non-linear models considered R^2 values above 0.89 as superior (Khan and Ahmed., 2010).





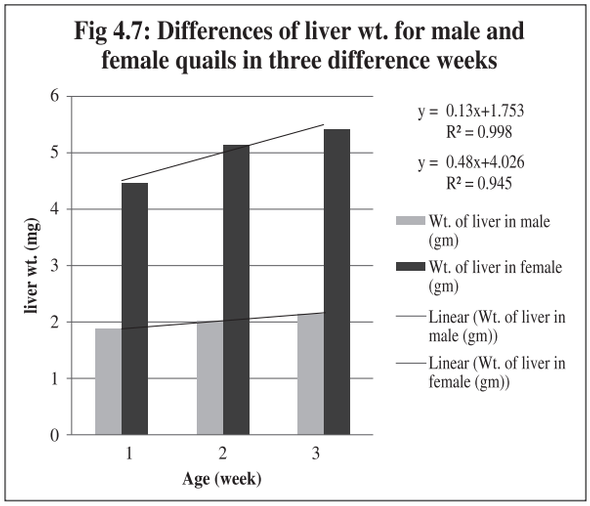


Fig 4.7: Differences of liver wt. for male and female quails in three difference weeks

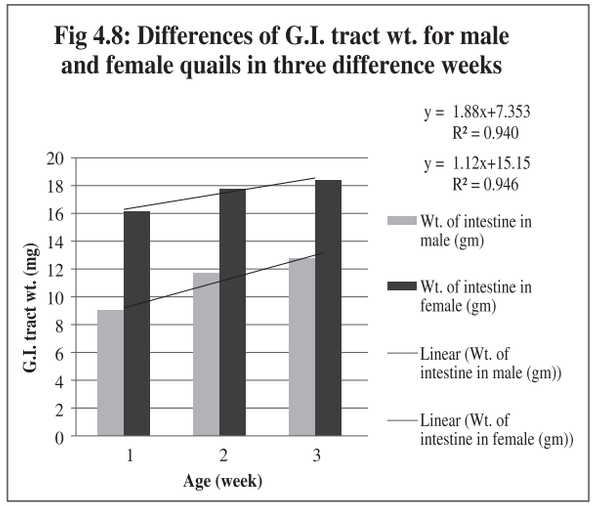


Fig 4.8: Differences of G.I. tract wt. for male and female quails in three difference weeks

4. CONCLUSION

The above study reveals that, female quail birds were heavier than the male. Significant differences were observed in the shank length and beak length in both sexes with the increases of age. Weight of abdominal fat was higher in the male birds, while the weight of gastrointestinal tract and liver was higher in female in relation to age. All the organs weight increased with age and body weight also increased with age, this was the indication for that if the weight of different organ increase then total live weight also increases. The correlations of body weight with abdominal fat weight, G.I tract and liver weight in both sexes of quail at three different weeks were high and positive. The regression model parameters for quail male and female was found positive and the higher R^2 values indicated the close agreement between male and female quails for different trait.

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