



ASSOCIATION AMONG BODYWEIGHT, LINEAR BODY AND CARCASS TRAITS OF JAPANESE QUAILS

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Abstract

This study was carried out to determine the phenotypic associations between body weight, linear and carcass traits of three strains of Japanese quail. A total of one hundred and eighty (180) day chicks of Japanese quails comprising of sixty Panda white (PW), Cinnamon Brown (CB), and Sigmond (SG) were used for the study. Data on body weight and linear body traits for each strain were collected fortnightly. Carcass traits were also measured on each strain. All phenotypic correlations were determined using Pearson's product moment correlation of SAS (2004) package. The results obtained revealed very high significant ($p < 0.01$) and positive phenotypic correlations between bodyweight and the linear body traits, which ranged from 0.676 – 0.799 (PW), 0.624– 0.976 (CB) and 0.518-0.947 (SG). There was no evidence of sexual dimorphism in the phenotypic associations for any strain due to strong, positive, and significant ($p < 0.01$) coefficients expressed by both male and female sexes. Strong, positive and significant ($p < 0.01$) phenotypic correlations also existed between live weight and carcass traits for the three strains. The values ranged from 0.752- 0.951 (PW), 0.839- 0.921 (CB) and 0.834-0.974 (SG). High, positive and significant ($p < 0.01$, $p < 0.05$) associations between live weight and carcass traits were also observed for male and female strains of Japanese quail studied. The phenotypic correlations observed showed that improvement in any of the strain results to corresponding improvement in body weight and or live weight and vice versa. It can be concluded that the linear and carcass traits are good determinants of body weight and live weight and could be used to estimate their values.

KEYWORDS: Association, Body weight, Carcass, Strain, Traits.

Introduction

The Japanese quail is one of the smallest avian species reared for egg and meat and it is becoming increasingly essential in the Nigerian poultry industry (Obi, *et al.*, 2019). Back in history, the reference to quail can be traced back in the old testament of the Bible as manna from Heaven (Numbers 11: 31). The newly hatched weighed 6 -8 grams and grow rapidly and fully feathered at about 4 weeks of age, males have cloacal glands a bulbous structure located at the upper edge of the vent which secretes a white foamy material, this unique material can be used to assess the reproductive fitness of the males (Obi, *et al.*, 2019). Japanese quail has the potential to serve as an excellent and cheap source of animal protein (Raji *et al.*, 2008).

Quantitative traits of economic importance are controlled by polygene which contributes a relatively small effects on traits, also pleiotropic and linkage gene effects seem to operate on the traits, therefore, when a trait is selected for improvement other traits may also change genetically (Obike *et al.*, 2019). Poultry breeders are interested in the relationships that exist between body weight and linear body parameters because it gives indication of feed efficiency and production performance (Okoro, *et al.*, 2010). The knowledge of the relationship existing between live weight, carcass traits and other performance traits in birds is crucial as it enables breeders to predict body weight and performance from linear body parts and vice versa (Assan, 2015). The author also asserted that the relationship between linear body measurements and performance traits could be useful in

designing appropriate management, selection and breeding programmes for utilization of poultry genetic resources.

Phenotypic correlations indicate the relationships between phenotypic values of animals, which gives information relating the degree to which individual traits could affect each other in selection process. Therefore, in selection schemes, phenotypic correlations are important estimates. Ojedapo *et al.* (2008) found positive significant phenotypic correlation between body weight and linear measurement three strains of broiler chickens. Olawumi (2013) showed significant positive phenotypic correlation between live weight and various carcass traits. The objective of this study was to determine the phenotypic associations between live weight, linear body and carcass traits of crossbred Japanese quails raised in humid tropical environment.

Materials and Methods

Experimental site

The study was conducted at the Poultry Unit, University Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria located at latitude 05°29'N, Longitude 07°33'E and altitude of 122m and sea level. Umudike lies within the humid rainforest zone of West Africa, characterized by long duration of rainfall and short period of dry season with maximum and minimum temperature of 32°C and 22°C respectively. Relative humidity ranges from 50- 95 %.

Experimental birds and management

Forty five (45) breeding Japanese quails comprising of 36 females and 9 males aged 68 days were used for mating. Each strain had 12 females mated to 3 males. Two hundred day (200) old chicks of Japanese quails comprising of 36 females and 9 males aged 68 days. Each strain had 12 females mated to 3 males, the hatching was done in a cabinet type incubator located at the Poultry Unit, University Teaching and Research farm, Michael Okpara University of Agriculture, Umudike. The chicks comprised of three (3) strains namely: Panda white (PW), Cinnamon brown (CB) and Sigmond (SG). The chicks were brooded using a coal pot to supply heat for the first 3 weeks of life. Care was taken to prevent chick from drowning in water troughs by filling the petri- dishes with pebbles. The birds were raised on a deep litter system under uniform management and environmental conditions. They were brooded for 3 weeks after which each strain was replicated for four times with 15 birds per replicate. The birds were fed with

formulated diet containing 20% crude protein and 2900 kcal Metabolisable energy/ kg and water was given *ad libitum*.

Data collection

Data on each strain were collected bi- weekly. Linear body traits were measured using a measuring tape in centimeter. The following body measurements were taken:

Body weight was done with the aid of weighing scale in grams. Body length was taken from the bill to the tail near the uropigial oil gland. Wing length was taken as the distance from the shoulder joint to the extreme of the terminal phalanges. Shank length was taken as the distance from the hock joint to the last ring before the tarsa – metatarsus joint. The Thigh length was taken from the beginning of the fibula to the hock joint, breast width was taken from the point of depression to the sharp edge. Keel length was taken from the V- joint to the end of the sternum.

At the end of the experiment, three birds per replicate were randomly selected for carcass yield measurement. They were deprived of feed over night to avoid gut fill, weighed and killed by slitting the jugular vein. Complete bleeding was ensured and feathers removed. The carcass was weighed after removing the head, shank and viscera to determine dressing percentage of carcass weight. The carcass was cut up into breast, wing, drumstick, back, shank, and thigh and their weight taken.

Estimates of phenotypic correlations among body weight and linear body traits as well as among live weight and carcass characteristics of each strain were obtained from the data generated using Pearson's Product Moment correlation of SAS (2004) package. The model is as shown below

$$r_p = \frac{\text{Cov}(P_x, P_y)}{\sqrt{V_x} \sqrt{V_y}}$$

Where,

r_p = phenotypic correlation

$\text{Cov}(P_x, P_y)$ = phenotypic covariance of traits x and y

V_x = phenotypic variance of traits x

V_y = phenotypic variance of traits y

RESULTS AND DISCUSSION

The phenotypic correlation coefficients between body weight and linear body traits in Panda white, Cinnamon brown and Sigmond strains of Japanese quails are presented in Table 1.

Table 1: The phenotypic correlations between body weight and linear body traits of Japanese quail strains.

Strain	Traits	SL	TL	BL	WL	BRW	KL
Panda white	BW	0.758**	0.676**	0.735**	0.799**	0.784**	0.797**
Cinnamon brown	BW	0.673**	0.624**	0.649**	0.976**	0.657**	0.870**
Sigmond	BW	0.518**	0.720	0.632**	0.835**	0.910**	0.947**

**Correlation is significant at the 0.01 level; BW= body weight, SL= shank length, TL= thigh length, BL= body length, WL= wing length, BRW= breast width, KL= keel length.

The results revealed that body weight had positively strong correlations ($P < 0.01$) with shank length, thigh length, body length, wing length, breast width and keel length in Panda white, Cinnamon brown and Sigmond. The coefficients ranged between 0.676- 0.799 (Panda white), 0.624 – 0.976 (Cinnamon brown) and 0.518 – 0.947 (Sigmond). The results observed in this study is in consonant with the findings of Yahaya *et al.*, (2012) who reported high and positive correlation coefficients of 0.86 – 0.97 between body weight and morphometric traits in Hubbard and Arbo – Acre broiler strains. It is also in line with the findings of Oyetade (2011) who reported all positively and mostly significant ($P < 0.05$)

phenotypic relationship between body weight and all linear body measurement at various ages. The findings from this work implies that as body weight or any one linear body trait increased, a corresponding increase was expressed in the other. The strong and positive correlations observed between body weight and morphometric traits of each crossbred Japanese quail strains also indicate that high correlated responses should be expected with selection.

The phenotypic correlation coefficient between body weight and linear body traits of male and female sexes of Panda white, Cinnamon brown and Sigmond strains of Japanese quail are shown in Table 2.

Table 2: Phenotypic correlation coefficients between body weight and linear body traits of male and female sexes of Japanese quails.

Strain	Sex	Traits	SL	TL	BL	WL	BRL	KL
Panda white	M	BW	0.732**	0.625**	0.715**	0.778**	0.652**	0.738**
	F	BW	0.791**	0.812**	0.652**	0.725**	0.698**	0.824**
Cinnamon brown	M	BW	0.677**	0.618**	0.587**	0.965**	0.649**	0.825**
	F	BW	0.605**	0.616**	0.586**	0.970**	0.660**	0.838**
Sigmond	M	BW	0.510**	0.719**	0.628**	0.807**	0.888**	0.927**
	F	BW	0.502**	0.720**	0.645**	0.921**	0.756**	0.825**

** $P < 0.01$, M = Male, F = Female, SL = shank length, TL = thigh length, BL = body length, WL = wing length, BRL = breast length, KL = keel length.

The phenotypic correlation between body weight and linear body traits of male and female of Panda white, Cinnamon brown and Sigmond strains of Japanese quail were highly significant ($P < 0.01$) and positive. The coefficient of correlation for males and females of each strain studied were very high and indicate strong relationship between body weight and morphometric traits. There was no evidence of sexual dimorphism noted in the association for any strain due to the strong, positive and significant ($P < 0.001$) coefficients expressed by both sexes. This is contrary to the report of Fayeye and Owioye (2016) who reported significant ($P < 0.05$) correlation estimates between body weight and conformation traits in Females and mostly non – significant ($P > 0.05$) in males of adult Isa Brown and Fulani ecotype chickens, but in agreement with the findings of Obike *et al.*, (2019) who noted very high significant ($P < 0.01$) and positive correlation estimates between body weight and linear body traits in both males and females of Hubbard, Marshall and Ross broiler strains.

In males, the correlation coefficients ranged from 0.625 – 0.778 (Panda white), 0.587 – 0.965 (Cinnamon brown) and 0.510 – 0.927 (Sigmond), while in females the range were from 0.652 – 0.824 (Panda white), 0.586 – 0.970 (Cinnamon brown) and 0.502 – 0.921 (Sigmond). This result agreed with Egena *et al.*, (2014) findings that phenotypic correlations of body weight and body measurements of indigenous Nigerian chickens were all positive and highly significant ($P < 0.01$). It is also in line with Obike *et al.*, (2019) who reported all positive and highly significant ($P < 0.01$) association between body weight and linear body traits of males and females sexes in Hubbard, Marshall and Ross broiler strains. The very strong and positive associations suggests high expectation of selection response which means that any selection program employed to improve any one of the conformation traits either in males or females of each of the Japanese quail strains will result to improvement in bodyweight and vice versa.

The phenotypic correlation coefficients between live weight and carcass traits of Panda white, Cinnamon brown and Sigmond strains of Japanese quail are presented in Table 3.

Table 3: Phenotypic correlation coefficients between live weight and carcass traits of Japanese quails.

Strain	Traits	DFW	DRW	BRW	Wing	DRS	Shank	Thigh	Neck	Back
Panda white	LW	0.915**	0.882**	0.752**	0.874**	0.768**	0.957**	0.852**	0.838**	0.858**

Cinnamon brown	LW	0.866**	0.921**	0.839**	0.847**	0.898**	0.844**	0.854**	0.878**	0.898**
Sigmond	LW	0.941**	0.965**	0.834**	0.886**	0.946**	0.974**	0.938**	0.921**	0.920**

**P<0.01, LW =Live weight, DFW = defeathered weight, DRW = dressed weight, BRW = breast weight , DRS = drum stick

Positive and highly significant correlations ($P<0.01$) were observed between live weight and the carcass traits studied (defeathered weight, dressed weight, breast weight, wing, drum stick, shank, thigh, neck and back) for the three strains. Olawumi (2013) showed that live weight had statistically significant ($P<0.01$) positive phenotypic correlations (0.889 – 0.987) with dressed weight, eviscerated weight, carcass weight, breast muscle weight, back weight, thigh weight and drum stick weight in Arbor Acre broilers. The result obtained in this present study is also in agreement with Obike *et al.*, (2019) who reported positive and highly significant phenotypic correlations ($P<0.01$) between live weight and carcass characteristics that ranged between) 0.839 – 0.986 (Hubbard), 0.834 – 0.955 (Marshall) and 0.938 – 0.996 (Ross). The current study revealed very high correlation estimates that ranged between 0.752 – 0.951 (Panda white),

0.839 – 0.921 (Cinnamon brown) and 0.834 – 0.974 (Sigmond) between body weight and carcass traits. This result indicates that the carcass traits are good determinants of live weight in each of the Japanese quail strains. Therefore, knowing the value of any one of the traits could be useful in estimating the live weight of the Japanese quail strains in a situation where the body weight could not be weighed before slaughter. The very high and positive phenotypic correlations between live and the carcass traits could be attributed to pleiotropic gene effect and linkage effect operating on the traits Obike *et al.*, (2019).

The phenotypic correlation coefficients between live weight and carcass characteristics of males and females of Panda white, Cinnamon brown and Sigmond strains of Japanese quail are shown in Table 4.

Table 4: Phenotypic correlation coefficients between live weight and carcass traits of male and female sexes of Japanese quails strains.

Strain	Sex	Traits	DFW	DRW	BRW	Wing	DRW	Shank	Thigh	Neck	Back
Panda white	M	LW	0.986**	0.842**	0.725**	0.610**	0.914**	0.853**	0.772**	0.810**	0.668**
	F	LW	0.972**	0.832**	0.512**	0.738**	0.812**	0.844**	0.520*	0.835**	0.740**
Cinnamon brown	M	LW	0.850**	0.924**	0.958**	0.942**	0.711**	0.964**	0.899**	0.996**	0.542**
	F	LW	0.972**	0.988**	0.987**	0.998**	0.687**	0.988**	0.840**	0.996**	0.682**
Sigmond	M	LW	0.992**	0.960**	0.890**	0.575**	0.812**	0.986**	0.928**	0.982**	0.911**
	F	LW	0.997**	0.972**	0.892**	0.510	0.820**	0.997**	0.983**	0.999**	0.977**

*P<0.05, **P<0.01, LW =Live weight, DFW = defeathered weight, DRW = dressed weight, BRW = breast weight , DRS = drum stick

Positive, high and significant ($P<0.05$, $P<0.01$) correlations between live weight and carcass traits of males and females of the three strains of Japanese quail were obtained. These strong and positive associations recorded for Panda white male (0.610 – 0.986), Panda white female (0.512– 0.972), Cinnamon brown male (0.542 – 0.996), Cinnamon brown female (0.682 – 0.996), Sigmond male (0.575 – 0.992) and Sigmond female (0.510 – 0.999) indicate that any attempt to perform phenotypic selection on any of the traits of the sexes would consequently result in improvement of live weight of the males and females of each strain Obike *et al.*, (2019). Tatjana *et al.*, (2014) reported strong, positive and highly significant ($P<0.01$) phenotypic correlation between body weight before slaughter and dressing percentage in both male and female Hubbard and Cobb 500 strains of broiler. Obike *et al.*, (2019) also reported positive, high and significant

($P<0.05$, $P<0.01$) correlations between live weight and carcass characteristics of males and females of Hubbard, Marshall and Ross broiler strains. The carcass traits are good determinants of live weight in male and female Panda white, Cinnamon brown and Sigmond strains of Japanese quail studied.

Conclusion

It can be concluded that body weight has strong significant and positive phenotypic correlation with linear body traits in the three strains of Japanese quail studied. Also, strong significant phenotypic correlations between live weight and all the carcass characteristics were observed among the three strains. The same trend was followed by the sexes. It can then, be submitted that linear and carcass traits are good determinants of body weight and live weight and could be used to predict their values.

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