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Relationship between body weight and some egg production trait in the Japanese quail (*Coturnix coturnix japonica*)

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ABSTRACT: A total of 48, 6 week old Japanese quails were selected randomly from an existing flock at the University of Ilorin. These were reared in individual cages to determine the effect of body weight on some egg production traits. Weekly body weight was obtained for each bird for a period of nine weeks. Eggs laid by each bird was collected and weighed weekly. One egg was selected per bird per week for external and internal egg analysis.

Data obtained were subjected to a one way analysis of variance using SPSS (2009). Phenotypic correlations among body weight and some egg production trait as well as regression equation that can be used to establish models for estimating production trait from the body weight were determined.

Body weight was positively and significantly ($P<0.05$) correlated with egg length (0.774) but not significantly ($P>0.05$) correlated with egg number, egg weight, egg breadth, yolk height, yolk weight, shell weight and the Haugh unit. Negative correlations were observed between body weight and album height (-0.003) and eggs index (-0.728). Average matured body weight was found to be 124.5 ± 26.3. Coefficient of determination for the regression analysis were not significant ($P>0.05$) except for egg length (R^2=0.599) and egg index (R^2=0.531).

For satisfactory performance in the Japanese quail a uniform flock body weight of at least 150g at sexual maturity should be maintained.

Keywords: Body weight, Egg traits, Correlation, Japanese quail.

Introduction

In Nigeria, chicken appears to be the most common of all the avian species. However, alternative source of high quality meat and egg within a relative shorter time and cheaper cost has now been found in the Japanese quail. Japanese quail has marked advantages such as its fast growth, early sexual maturity, high rate of egg production, short generation interval and short incubation period. (Panda *et al*., 1990; Reddish *et al*. 2003). Under favourable environment, quail hen can lay up to 280 – 300 eggs in their 1st year (Metin, 2006). Thus quail has an excellent potential to serve as an excellent and cheap source of animal protein for Nigerians (NVRI, 1996).

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The importance of bodyweight in egg type chicken can not be over emphasized. Body weight has been shown to significantly determine the performance and the economic value of the hen (Agaviezor et al. 2008). Ayorinde and Oke, 1995 has described variation in body weight within a flock to be attributed to genetic variation and environmental factors which in turn affect the profitability of egg production. However, the greatest limitation has been attributed to genetic differences within the flock which in turn leads to variation in performance (Ayorinde *et al;* 1988). Poultry producers are thus interested in breeding birds of minimum possible size and weight that will possess the desire production traits especially high egg production with maximum size (Ayorinde *et al.* 1988 and Oke *et al.* 2004).

The relationship existing between bodyweight and egg production traits have been well documented in chicken (Ayorinde *et al*; 1988; Chineke 2001; and Agaviezor *et al*; 2008) and in the guinea fowl (Ayorinde and oke 1995; Oke *et al.* 2004). A positive correlation has been reported between bodyweight and other egg quality traits. Ricklefs (1983) has reported that large body size resulted in large egg length, width and mass. Under weight hen cannot withstand long and persistent laying while over weight and excessively fat hen stop laying (Summer and Lesson, 1983).

It is therefore necessary, to establish such relationship that exist in the Japanese quail especially in the tropics where the birds have been identified as an excellent and cheap source of animal protein. This will go a long way in assisting commercial breeders in the choice of selecting a uniform flock body weight that will maintain optimum egg production in the Japanese quail.

This study therefore describes the phenotypic correlations that exist between bodyweight and some egg production traits in the Japanese quails as well as the regression equations that can be used for predicting performance from matured body weight.

Materials and Methods

Experimental birds

Forty eight female. Japanese Quails of 6 weeks old randomly selected from an existing flock at the university of Ilorin, Animal production pavilion were used for the experiment. Birds were wing tagged to allow proper monitoring of individual bodyweight gain and egg production traits. Each bird was kept in an individual wooden cage measuring 25 x 25 x 30 cm. Birds were allowed access to *ad libitum* feed and water throughout the 9 weeks experimental period.

Data collection

The birds were weighed at the beginning of the experiment and weekly thereafter. Eggs were collected daily and marked according to birds tag number. All eggs laid by each hen were weighed and the length and breadth measured. Egg index was determined as the ratio of egg breadth to egg length.

Weekly, one egg from each, hen was selected, the shell carefully broken and the contents emptied into a Petri dish. The albumen and yolk were separated and weighed. From samples taken from the narrow, middle and broad portions of each egg, the average shell thickness was determined.

Data collected were subjected to a one way analysis of variance using the SPSS (2009) statistical programme. Estimates of phenotypic correlations between the various parameters and body weight were also determined. The regression model used was of the type:

$$Y= a +b_1 x_1 + e_1$$

where
Y= dependent variable
a= intercept on y axis
b= regression coefficient
X_1= independent variable
e_1= residual error

Results and Discussion

The mean and standard deviations of weekly body weight (g) and different egg traits are presented in Table 1. There was an initial increase in the body weight gain of the experimental birds (124.5-143.1g) but as egg production increased, body weight gain began to drop. The decline in body weight has been reported by Duplesis and Erasmus 1970; Ayorinde *et al*. 1988 and Oke *et al* 2004. This they attributed to an increase diversion of nutrient from body weight gains to egg formation after maintenance requirements have been met. Thus there was an increase use of physiological reserves to counter egg production demands.

The number of eggs laid per bird per week varied from 2.25 – 4.6 with a henday production of 22.3 to 89.3%. Weekly egg weight averaged 8.32g with a range of 7.8g – 9.1g. this falls below the range observed by Turkmut *et al* 1999 and Alkan *et al*. 2010 who determined average quail egg to be 10.70g and 11.86g respectively. These differences however could be expected because of the difference in genetic structure, age of the flock and other environmental factors that can affect performance in a laying flock. Egg index varied from 78.22-88.24% which is slightly higher than the values of 75.6% and 80.45% reported by Eresanyin *et al* 2002 but within the values of 78.97 and 78.63%. It was observed that egg index decrease as the bodyweight increased which is in accordance with the report of Alkan *et al* 2010 that as body weight increased, egg index decrease. Ayorinde *et al* 1988 also observed a similar situation. A constant value of 0.30mm was observed for shell thickness throughout the experimental period. Erasayin *et al* (2002) also reported egg shell thickness in quails to be 0.20-0.30 while Orhan *et al*; 2001 reported the values of 0.21-0.22mm which is lower than the result obtained in this study. Egg shell weight, shell thickness and egg index have been described as important characters from the point of mechanical handling of eggs.

Table 1: Means of weekly bodyweight (g) and egg production
Traits (±S.D)

	1	2	3	4	5	6	7	8	9
BW	124.5	126.3	139.5	132.8	143.1	141.4	135.7	137.2	136.8
±SD	26.3	26.8	32.5	49.34	51.45	51.4	54.76	54.9	60.0
EW(g)	7.8	8.4	8.6	8.4	8.4	8.0	7.9	8.3	9.1
±S.D.	1.8	0.99	1.1	1.2	1.4	1.0	0.98	1.5	1.1
EL (cm)	2.5	2.8	2.9	2.8	2.8	2.8	2.8	2.8	2.9
± S.D	0.54	0.2	0.2	0.2	0.2	0.2	0.15	0.2	0.18
YH (mm)	10.4	11.4	11.8	11.2	11.1	11.0	10.7	10.7	11.1
±S.D	2.3	0.9	0.8	0.9	0.7	0.7	0.8	0.84	0.7
AH (mm)	4.97	5.6	5.8	5.4	5.1	4.6	4.6	0.7	4.7
±S.D	1.3	0.7	0.75	0.8	0.7	0.55	0.5	0.5	0.6
YW (g)	2.3	2.6	2.6	2.6	2.6	2.4	2.4	2.5	2.8
± S.D	0.6	0.5	0.4	0.6	0.6	0.6	0.4	0.7	0.44
AW(g)	3.99	4.4	4.5	4.5	4.4	4.4	4.3	4.4	4.9
± S.D	8.8	4.6	0.6	0.8	0.7	0.6	0.7	0.7	0.7
ST(mm)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
±S.D	0.6	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
SW (g)	0.6	0.72	0.7	0.7	0.7	0.7	0.7	0.7	0.8
S.D	0.15	0.09	0.1	0.08	0.13	0.1	0.12	0.1	0.097
EN	2.25	2.32	3.3	0.4	4.4	4.5	3.0	4.2	4.6
±S.D	0.9	0.3	0.5	0.9	0.8	0.9	0.2	0.3	0.5
EI (%)	88.2	78.95	80.8	79.5	79.96	74.44	79.98	78.93	78.22
±S.D	0.33	0.35	0.37	0.32	0.31	0.29	0.3	0.37	0.34
HU	12.23	12.22	12.23	12.22	12.23	12.31	12.24	12.23	12.22
±S.D	0.57	0.6	0.55	0.6	0.51	0.6	0.7	0.67	0.71
HDP (%)	22.3%	32.4%	41.7%	50%	68.9%	65%	67%	89.3%	77.5%

BW = Body Weight, EW= Egg Weight, EL= Egg Length, EB =Egg Breadth, YH = Yoke Height, AH =Albumen Height, YW= Yolk Weight, AW = Albumen Weight, ST = Shell Thickness, SW= Shell Weight, EN = Egg Number, HDP =Hen Day Production, EI =Egg Index, HU= Haugh Unit.

Table 2: Correlation coefficient between body weight and egg production traits.

	BW	EW	EL	EB	YH	AH	YW	AW	ST	SW	EN	HDP	EI	HU
BW	-													
EW	.366	-												
EL	.774*	.709*	-											
EB	.186	.755	.540	-										
YH	.530	.608	.707*	.553	-									
AH	-.003	.274	.152	.247	.760*	-								
YW	.413	.975**	.738*	.630	.635	.313	-							
AW	.382	.925**	.793*	.691*	.519	.115	.953**	-						
ST	.a	.a	.a	.a	.a	.a	.a	.a	.a					
SW	.552	.894**	.814**	.565	.522	.011	.901**	.917**	-a	-				
EN	.608	.504	.583	.146	.181	.292	.523	.562	.a	.662	-			
HDP	.630	.350	.600	.139	.083	-.628	.367	.519	.a	.572	782*	-		
EI	-.728*	-.446	-.864**	-.133	-.371	-.175	-.533	-.622	.a	-.726*	-.584	-.734	-	
HU	.349	-.439	-.013	-.234	-.135	-.449	-.471	-.410	.a	-.124	.245	.226	-.120	-

BW = Body Weight, EW= Egg Weight, EL= Egg Length, EB =Egg Breadth, YH = Yoke Height, AH =Albumen Height, YW= Yolk Weight, AW = Albumen Weight, ST = Shell Thickness, SW= Shell Weight, EN = Egg Number, HDP =Hen Day Production, EI =Egg Index, HU= Haugh Unit

Table 2 shows the correlation coefficient among body weight and egg production traits. A positive correlation was observed between body weight and all egg production parameters except egg length having a significantly P < 0.05 positive correction with body weight (0.774). egg index was Significantly (P < 0.05) negatively correlation with body weight (-0728). Egg weight also had a positive relationship with all other egg parameters except with index which was however not significant (P < 0.05)

The positive relationship observed between body weights and egg quality traits is supported by the findings of Chineke 2001 and Oke *et al* 2004 who also reported a positive relationship between body weight and the egg quality traits in commercial layers and the guinea fowl respectively. Oke *et al* 2004 concluded that a positive association between body weight and egg number indicate that the point of lay does not terminate actual weight increase. The negative correlation with egg index further confirms that as body weight increases the egg index decreases. The positive relationship between egg weight and other parameters is also supported by Farooq *et al* (2001) and Kul and Seker (2004) who also reported a positive association between egg weight and other egg parameters.

Table 3 shows the coefficient of determination (R^2) of simple linear regression of different parameters on age at sexual maturity. The regression coefficient were very low and the coefficient of determination (R^2) were not significant except for egg length (R^2=0.599) and egg index (R^2 = 0.531) this support the findings of Oke *et al* 2004 who also reported the regression of different parameters on age to be characterized by low coefficient of determination.

Conclusion and Recommendation

From the result of this study, average nature body weight was found to be 1245 ±26.3 while a significant relationship exist between body weight and ET sexual maturity and egg length and egg index which are important characters from the point of mechanical handling of the eggs. For satisfactory performance in the Japanese quail, a uniform flock body weight of at least 150g at sexual maturity should therefore be maintained.

Table 3: Regression Equation for Estimating Production Traits (Y) From Body Weight (x)

TRAITS	Y = a + bx	COEFFICIENT OF DETERMINATION R^2
EW	Y = 4.680 + 0.027x	0.134 NS
EL	Y = 0.520 + 0.17x	0.599*
EB	Y = 2.016 + 0.02x	0.35 NS
YH	Y = 5.509 + 0.41x	0.281 NS
AH	Y = 5.085 + 000x	0.000 NS
YW	Y = 0.975 + 0.011x	0.171 NS
AW	Y = 2.024 + 0.17x	0.146 NS
SW	Y = -0.030 + 0.005x	0.503 NS
EN	Y= -9.563 + 0.97x	0.370 NS
HDP	Y = -248.298 + 2.223x	0.397 NS
EI	Y = 1.365 + (-0.04)x	0.531*
HU	Y = 11.989 + 0.02x	0.122NS

NS = Not Significant Difference
* = Significant Difference

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