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Original Research Article

Phenotypic Correlation and Prediction of Body Weight from Body Linear Measurement of Nigerian Indigenous Pigeon in Akwanga Local Government Area of Nasarawa State

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Abstract: The study was conducted using one hundred and fifty matured domestic pigeons to measure body linear parameters as well as external and internal egg quality characteristics in other to determine phenotypic relationships and predict body weight from body linear measurements. Data were collected on body weight, shank length, breast girth, body length, wing length, tail length and beak length at maturity. Two hundred eggs were collected and analyzed for both external and internal quality characteristics. The data obtained were analyzed using the correlation and regression procedure of SPSS Statistical software. The result obtained from this study body weight correlate positively with all other body linear parameters. However, the relationships between beak length and other body parameters except body weight were negative and mostly low. The strongest relationship in this study was between body weight and shank length. The coefficient of determination was highest for shank length (0.710), followed by wing length (0.680), breast girth (0.630) while tail length had the least coefficient of determination (0.360). It was suggested that the best equation for predicting body weight from linear body measurement could be: BW = 40.9+1.96BL-0.84WL+3.98BG+0.112SL. From the findings of this study, it was concluded that shank length is the most suitable body measurement that could be used for selection of domestic pigeon due to its strongest phenotypic correlation with body weight and other body parameters.
Keywords: phenotypic relationships, matured domestic pigeons, egg quality, breast girth, body weight.

INTRODUCTION

Domestic pigeon (Colomba livia domestica) are durable birds that can be raised with little effort. They are able to survive in hostile climates. But raising pigeons for food is not as wide spread as it should be in this modern time as such its potential has hardly been tapped. Farmed pigeons are particularly promising as urban micro-livestock because they require little space and thrive in cities (N.R.C., 1991). Young pigeons (squabs) grow at a fast rate and their meat from the matured birds are finely textured with an attractive flavor. Pigeon meat which is tender and easily digested commands premium market prices therefore demand is hardly met in many places (N.R.C., 1991 and Hawes, 1984).

Under extensive management where the birds are released each day to feed themselves almost no land is needed. But in intensive conditions, where the birds spend their lives in confinement, a mere half hectare can be enough space to raise 2,000 pairs of pigeon. Free- ranging pigeons forage over a wider area than most domestic fowl because they fly out to find their feed. They brood the young with little intervention. Although not continuous, the production of meat from these fast growing, rapidly reproducing birds is more sustained than with most livestock. Almost nowhere are there taboos against consuming pigeon meat. The only limitation in some areas is the absence of an effective market, which is usually easy to create (Levi, 1977; N.R.C., 1991). In view of the importance of this small stock, it is necessary to initiate improvement programs that can genetically improve the birds for efficient and

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effective productivity. In order to establish a breeding program, it is essential to estimate genetic parameters for improving economic traits. The magnitude of the genetic parameter, for example correlation, could indicate the amount of improvement that can be achieve by selection.

Phenotypic correlation existing among body traits provides useful information on the performance, productivity and carcass characteristics in animals. Most of the body linear measurements reflect primarily the length of the long bones of the animal and when taken sequentially over a period of time, they generally indicate the way in which the animal body is changing shape and have been useful as predictors of live weight and carcass composition (Oke *et al*., 2004). Additionally, relationship between body weight and linear body measurements are important not only in predicting body weight but also useful in genetic improvement strategies. Pigeon Production is still at its tender age and has a lot of potentials that need to be properly articulated and publicized to create interest in researchers and farmers. Although considerable work may have been done on pigeon production, management, health and genetics, most of the works were carried out in temperate and sub-temperate climates. In Nigeria apart from the work of Adenowo *et al*. (1988), Adediran (2009), Anebi (2010) and more recently Momoh *et al.* (2013), there is little evidence of genetic work done on pigeons in Nigeria. Moreover, genetic parameters are population characteristics and environment specific. They change over time and thus need to be recomputed from time to time. The objective of the study was to determined phenotypic relationships as well as to predict body weight from body linear measurements of Indigenous Pigeon reared in Akwanga and its environs.

MATERIALS AND METHODS

The experiment was carried out at Akwanga Local Government Area of Nasarawa State. The study area falls within the Southern Guinea Savannah zone of Nigeria. Akwanga lies between latitude 7º and 9º North and Longitude 7º and 10º East. It has a climate typical of the tropical zone because of its location. It has a temperature ranging from 20ºc in October to 36ºc in March while rainfall varies from 13.73 cm in some places to 14cm in others (Faculty of Agriculture Lafia Weather Station, 2018).

Experimental procedure

The total of one hundred and fifty indigenous pigeons were used for the experiment. This comprised of 75 males and 75 females. The birds were sourced from neighbour hood who keep the birds and body linear measurements were taken. For the egg quality characteristics, 200 eggs were purchased and used for egg qualities assessment using destructive techniques.

Data collection

Body Weight: Live body weights were measured at maturity.

Body Linear Measurement: The linear body measurements such as body length, shank length, wing lengths and breast girth were measured at maturity using measuring tape.

Egg Quality Traits: The **e**xternal egg qualities traits such as egg length, egg width, egg shape index, egg shell weight and egg shell thickness were measured at maturity. Egg length and egg width were measured using a vernier calipers. For shell thickness measurement, eggs were broken and the shells were washed with clean water and cuticle gently removed and air dried for 24 hours. Samples were taken and measured with the aid of micrometer screw gauge. The internal egg qualities recorded include albumen length, albumen height, albumen width, yolk height, yolk width, yolk index and haugh unit. These were carried out using the destructive techniques. By this method, the eggs were gently broken and the content carefully poured on a flat platform. Vernier caliper was used to measure albumen length, albumen width, yolk width and yolk height.

Experimental Design and Analytical Procedure

The design of the experiment was Complete Randomized Design. Data on linear body measurement and egg characteristics were analyzed using correlation and regression procedure of SPSS Statistical software version 21.

RESULT

The phenotypic correlations between body weight and linear body measurement of Nigerian indigenous pigeon is presented in table 1. Relationship between body weight and linear body parameters were mostly positive, generally significant and ranged from moderate to high. However, the relationships between beak length and body weight as well as other linear body measurements were negative and mostly low. Relationship between body weight and shank length (0.501**) demonstrated highest relationship. However, the highest relationship among other parameters were the relationships between Tail length and body length (0.625**), shank length and breast girth (0.535**) as well as shank length and body length (0.528**).

Table 2 presents the Pearson's correlation coefficient between internal and external egg traits. As in body weight and body linear measurement, the correlation coefficients were mostly positive, generally significant and ranged from moderate to high. The relationship between egg weight and other egg quality traits were generally positive and mostly high. Relationship between albumen length and egg length (0.996**) demonstrated highest significance among relationship between egg quality traits. However, negative relationship was observed between egg weight and egg shape index (-0.817**).

The regression equation and coefficient of determination (R^2) for prediction of body weight (Table 3) from linear body measurements in domestic pigeon indicated that the coefficient of determination was highest for shank length (0.710), followed by wing length (0.680) and breast girth (0.630) while tail length had the least coefficient of determination (0.360).

Table 1: Pearson's correlation coefficient of body parameters of domestic pigeon in Akwanga and its environs

	BW	BL	WL	BG	SL	TL
BL	0.366*					
WL	0.474**	0.173				
BG	0.234	0.586**	0.032			
SL	0.501**	0.528**	0.154	0.535**		
TL	0.438**	0.620**	-0.011	0.477**	0.698	
BKL	0.183	-0.315*	-0.152	-0.023	-0.314*	-0.572**

BW = body weight, BL = body length, WL = wing length, BG = breast girth, SL = shank length, TL = tail length and BKL = beak length.

Table 2: Pearson's correlation coefficient of Egg characteristic of indigenous pigeon in Akwanga

	EWT	EL	EWD	ESI	ESW	EST	AL	AH	AW	YH
EL	0.897**									
EWD	0.773**	0.963**								
ESI	-0817	-0.782**	-0.513*							
ESW	0.891**	0.624**	0.527*	0.5866**						
EST	0477*	0.686**	0.897**	-0.082	0.309					
AL	0.932**	0.996**	0.913**	-0.813**	0.686**	0.642**				
AH	0.451*	0.793**	0.873**	-0.390	0.066	0.815**	0.734**			
AW	0.633**	0.633**	0.619**	-0.448*	0.636**	0.488*	0.650**	0.370		
YH	0.899**	0.627**	0.570**	-0.516*	0.964**	0.394	0.680**	0.123	0.469*	
YW	0.726**	0.837**	0.956**	-0.347	0.547*	0.932**	0.816**	0.781**	0.474*	0.650**

EWT= Egg weight, EL = egg length, EW = egg width, ESI = egg shape index, ESW = egg shell weight, EST = egg shell thickness, AL = albumin length, AH = albumin height, AW = albumin width, YH = yolk height and YW = Yolk width.

Table 3: Regression Equation and Coefficient of Determination (R^2) for Prediction of Body Weight from Linear Body Measurements in Nigerian Domestic Pigeon

Regression Equation	SE Coef.	R^2
BW=12.11 + 1.365BL	1.686	0.570
BW=12.11 - 8.622BG	3.204	0.630
BW=12.11 + 2.264WL	0.954	0.680
BW=12.11 – 1.778SL	1.508	0.710
BW = 12.11+12.186TL	2.755	0.360
BW = 12.11+39.924BKL	10.715	0.364

BW= body weight, BL= body length, BG= breast girth, WL= wing length, , SL = shank length, TL = tail length, BKL = beak length, SE Coef= standard error of the coefficient, R^2= coefficient of determination

The regression equation is **BW = 12.11+1.365BL-8.622BG+2.264WL-1.778SL+12.186+39.924**

DISCUSSION

Phenotypic Correlations

Relationship between body weight and body linear parameters were mostly positive, generally significant and ranged from moderate to high. Body weight correlate positively with all other body linear parameters as similarly reported by Anebi (2010) in pigeon, Oyetade (2011) in quail and Momoh *et al.*, (2014) in Japanese quail. The strongest relationship in this study between body weight and shank length agree with the report of Momoh *et al.*, (2014) and Adeogun and Adeoye (2004) in Japanese quail. Adeogun and Adeoye (2004) reported that, phenotypic correlations of body weight and shank length are positive at all age from 1-6 weeks of age. Oyetade (2011) also reported all positively and mostly significant ($P < 0.05$) phenotypic relationship between body weight and all body linear measurement at various ages in Japanese quails. This all positive and mostly significant phenotypic relationships between linear body parameters and body weight indicate that an improvement in one trait could lead to a concomitant improvement in the other traits. However, the relationships between beak length and other body parameters except body weight were negative and mostly low.

The generally positive and mostly high relationship between egg weight and other egg quality traits strongly agree with the reported of Gambo *et al.,* (2014) in Japanese quail. The relationship between albumen length and egg length (0.996**) demonstrated highest significance correlation among relationship between egg quality traits in this study. This was in contrally to the findings of Gambo *et al.,* (2014) who obtained highest relationship between egg weight and egg width in Japanese quail. Least relationship observed between egg weight and egg shape index (-0.817**) is in contrally to the findings of Kul and Seker (2004) and Gambo *et al.,* (2013) in Japanese quail who reported least variability between egg width and egg shape index. This observed differences could be due to breed differences. Pairs of parameters with high significant phenotypic correlation could be used in selection, assuming a similar genetic correlation also exist. This could mean that parameters involved are controlled by genes that are linked since genetic and environmental causes of correlation combined to give the phenotypic correlation (Falconer, 1989).

Body Weight Prediction from Linear Body Measurements

Shank length with the highest R^2 value among the linear body parameters indicates that it is the best predictor of body weight than the other body measurements. This finding is in agreement with the report of Anebi (2010) who reported that shank length was the best predictor of body weight than other body measurements in pigeons. Bokhari (2002) reported that shank length served as a reliable index of body weight during most of the pigeons growing period. Oyetade (2011) reported that a combination of all body measurements enhanced the efficiency of body weight prediction in Japanese quail. It can then be suggested that the best equation for predicting body weight from linear body measurement could be:

BW = 40.9+1.96BL-0.84WL+3.98BG+0.112SL

CONCLUSION

The result obtained from this study showed that the domestic pigeon in Akwanga Nasarawa State Phenotypic associations between economic traits of pigeon showed that correlation between body weight and linear body measurements as well as those between egg characteristics are generally positive. Body weight correlate positively with all other body linear parameters. The strongest relationship in this study was between body weight and shank length. This means shank length could be best used in selection. Also, improvement in any of the body or egg characteristics with positive relationship could lead to concomitant increase in the respective associated characteristics. From the findings of this research work, it is recommended that: This study has demonstrated that shank length is the most suitable body measurement for selection of domestic pigeon due to its strongest phenotypic correlation with body weight and other body parameters. The traits of economic importance in this study can be incorporated into an index (selection index) for simultaneous improvement of these traits, thereby saving time.

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