

Original Research Paper

## Body weight and Morphometric traits characterization of Some Nigeria Homing Pigeons (*Columbia livia*).

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### Abstract

Growth traits characterization of Nigeria homing pigeons was done using one hundred and thirty eight (138) birds from three locations (LCT) of different agro-ecological zones in Nigeria [Kebbi (KEB):North West; Ilorin (ILR): North Central and Osogbo (OSG): South West]. Parameters measured were body weight (BW) in gram and morphometric body parameters in cm viz. Head length (HL), beak length (BL), neck length (NL), body length (BL), body girth (BG), wing length (WL), body height (BH), thigh length (TL), drumstick length (DL) and keel length (KL). The results showed that, significant ( $p<0.05$ ) differences existed between body weight and body parameters measured except BL. ILR pigeons had significantly ( $p<0.05$ ) higher BW (263.51g) compared to OSG (204.15), but similar ( $p>0.05$ ) to KEB (249.76g); the morphometric body parameters measured showed that HL, BG and WL values were significantly ( $p<0.05$ ) higher in ILR; OSG had significantly ( $p<0.05$ ) higher values for KL, while KEB pigeons had significantly ( $p<0.05$ ) higher values for BL, NL, BH, TL, DL, and SL. Positive and significant correlations ( $p<0.01$ , 0.05) exists between locations, NL, SL and BH; BW was negatively correlated with locations with a significant (0.01) value of -0.58. PCA shows the clustering of growth traits from 18.94 to 25.14% under PC1 and 2, canonical discriminant functions grouped KEB and OSG with 56.60%; ILR and KEB with 43.60% while hierarchical clustering shows that KEB homing pigeons are distinct from those of ILR and OSG. This results shows that locations have significant effects on growth traits in Nigeria homing pigeons.

**Keywords:** Growth Traits, Location, Pigeons, Univariate and Multivariate Analysis.

### Introduction

Pigeons (*Columbia livia*) are durable birds raised with little capital input and can thrive in harsh climates and endowed with some biological features. They are monogamous couple birds, with stable production where both sire and dam contribute to brood eggs and feed young squabs, they consumed less feed and easier to raise by resource poor farmers. They are of numerous advantages with unique qualities, in Nigeria pigeon are generally raised for consumption within the compound and only a very small number of them reach the trade market where they are either sold for meat or breeding stock (Sonaiya, 2000). Apart from being extensively used for scientific research notably in genetics, physiology and psychology (NRC, 1991) and it has a game meat flavour and highly relish by pigeon meat lover. Its squab is highly nutritious with greater dressing percentage; larger proportion of soluble proteins and a smaller proportion of connective tissue compare to most meats and highly recommended for people with digestive disorders (Anonymous, 1997). Some authors have characterize pigeon population (Bhowmik et al., 2014, Pavarez et al., 2016) in the past, while Fajemilehin et al. (2017) and Daiko et al. (2017) had researched into Nigerian domestic homing pigeon. Despite all the good attribute of this class of birds, Nigerians still focused on chicken production and improvement and pay little attention to lesser known poultry species of which pigeons are one.

Thus, awareness and great attention must be given to local and lesser known poultry species for commercial production of meat and egg in order to bridge the gap between animal protein intake and future food security in Nigeria and there is need to diversify into production of lesser known birds of which domestic pigeon is one to complement chickens and other known poultry production

The importance of maintaining genetic diversity in domestic livestock is advocated worldwide by Food and Agriculture organization (FAO, 2010). Thus, conservation of native breeds as Animal genetic resource (AnGr) is important to fill anticipated breeding demands in the future (Tadano et al., 2007). It has been suggested that before attempting any genetic improvement, animals must first be characterized and their quantitative traits must be understood (Sola-Ojo and Ayorinde, 2009), while FAO (2010) stated that the future utilization of genetic resource depends on breed characterization, Ayorinde and Oke (1994) reported that variation in body weight within a flock could be attributed to genetic and the environmental factor that impinge on individuals and Parvez et al. (2016) concluded that breed characterization is essential to formulate the conservation and improvement strategies for the breed, with all these assertions phenotypic characterization is very important to measure and describe genetic diversity in any indigenous stock for their effective utilization and breed development. This study aimed at comparing body weight and morphometric body parameters in pigeons of three major locations of different Agro –ecological Zones in Nigeria with the hope of providing basic information on metric traits that could be useful in characterization and breeding of this valuable bird for better and improved production with respects to their locations.

## Materials and methods

### *Experimental Birds*

One hundred and thirty eight (138) adult homing pigeons were purchased at random from three selected locations in the North Central, North West and South West, Nigeria, Pigeons are raised in large quantities in selected area and they are of three different agro-ecological zones, which can form the basis of pigeon cross breeding experiment in future. The exact origin of the pigeons were, Ilorin (Kwara State), Birnin Kebbi (Kebbi State) and Osogbo (Osun State) Nigeria; 37, 51 and 50 pigeons were purchased from each location, respectively. On arrival at the experimental farm (Fair and Firm International limited Farm, Tanke Oke-Odo, Ilorin, Kwara State, Nigeria, a private farm with all necessary facilities to keep and rear pigeons), they were wing tagged according to their locations and given anti stress, then allowed to acclimatized for two weeks during which feed and water were provided for them ad libitum and data were collected and recorded according to their place of origin.

### *Sample Locations and Coordinates of the Sampling Sites*

Kebbi, Kwara, Osun state are located in the North West, North Central, South West Geopolitical zone of Nigeria (Figure 1). The coordinates of the sampling sites shows that Kebbi, Kwara and Osun are located in 12.450 N, 4.200 E; 8.500 N, 4.550 E and 7.770 N, 4.570 E respectively as shown in Table 1.0 (Chineke et al., 2011). The homing pigeons were purchased from six central poultry markets (three in Kwara, two in Kebbi and One in Osun). The specific point of purchased and their coordinates were: (i) Sabon Kasua Birninkebbi (12.27130N, 4.12010E), (ii) Sofon Kasua Brininkebbi (12.27130N, 4.11010E) in Kebbi State; (iii) Oja Tuntun (8.48950 N, 4.53660 E), (iv) Oja Oloje (8.980010 N, 4.53290 E), (v) Oja Ipata (8.499810 N, 4.56180 E) in Ilorin South, Ilorin West and Ilorin East local government of Kwara State; and (vi) Oja Oluode Osogbo (7.77640 N, 4.55980 E) of Ifelodun local government area in Osun State (TSNWS, 2010 and KWSG, 2017).

**Table 1.** Sample Locations and Coordinates of the sampling sites.

Pigeon ID	Sampling locations	State	Number of Pigeons Sampled	Coordinates of sites
ILR	Ilorin	KWARA	37	8.50 <sup>0</sup> N; 4.55 <sup>0</sup> E
KEB	Birnin Kebbi	KEBBI	51	12.45 <sup>0</sup> N; 4.20 <sup>0</sup> E
OSG	Osogbo	OSUN	50	7.77 <sup>0</sup> N; 4.57 <sup>0</sup> E

### *Data Collection*

#### *Body weight and linear body parameters measured*

Twelve (12) quantitative parameters taken from the homing pigeons were; body weight (BW), head length (HL), beak length (BK), neck length (NL), body length (BL), body girth (BG), wing length (WL), body height (BH), thigh length (TL), drumstick length (DL) keel length (KL) and Shank Length (SL). Body

weight of individual birds was determined by placing each pigeon on the loading pan of the Mettler Toledo® top loading scale to the nearest gram, while the linear body measurements were performed as described by Sola-Ojo and Ayorinde (2009) using a measuring tape and recorded in cm.

### Statistical Analysis

Data obtained were subjected to Analysis of Variance using the model  $Y_{ij} = \mu + a_i + e_{ij}$ .

Where  $Y_{ij}$  = Overall Observations;  $\mu$  = Overall Mean;  $a_i$  = location/origin effect;  $e_{ij}$  = random residual error. Significant differences among means were compared ( $p < 0.05$ ) using the Duncan Multiple Range Test procedure (Duncan, 1955) and other univariate and multivariate analysis were performed using SPSS (2013) version 7.0.

## Results

### Body weight and Linear body parameters in Homing pigeons studied

The average values obtained for body weight and some morphometric body parameters measured in the homing pigeons of three different locations in Nigeria is as shown in Table 2.0. The results indicated significant ( $p < 0.05$ ) variations in body weight value with ILR pigeon been about 17.30 % bigger in body weight than OSG pigeon but similar in body weight when compared to KEB that have a higher body weight with a numerical difference of 13.75g. HL, NL, BG, WL, BH and SL had significantly ( $p < 0.05$ ) higher values in KEB pigeons despite the fact ILR pigeon had higher value for overall BW. ILR and KEB pigeon had significantly ( $p < 0.05$ ) higher values for BG (18.58 and 18.35 cm). Across the three Locations of study, no significant ( $p > 0.05$ ) differences was seen in BL and it ranged from (23.71 to 24.39cm), but OSG pigeons had significantly ( $p < 0.05$ ) higher values for KL (7.50 cm) and HL (4.50cm), although similar to the value of HL obtained for ILR pigeons which was 4.62. The results shows variations in body weight and other morphometric body parameters measured along with it.

**Table 2.** Mean and Standard Deviation of bodyweight (g) and linear body parameters (cm) in the Homing Pigeons according to their Origin.

Traits	ILR (n=37)	KEB (n=51)	OSG (n=50)
BW	263.51±36.91 <sup>a</sup>	249.76±31.85 <sup>a</sup>	204.15±45.47 <sup>b</sup>
HL	4.62±0.45 <sup>a</sup>	4.31±0.58 <sup>b</sup>	4.50±0.28 <sup>a</sup>
BK	2.00±0.22 <sup>c</sup>	2.13±0.28 <sup>a</sup>	2.09±0.26 <sup>bc</sup>
NL	3.81±0.59 <sup>c</sup>	4.38±0.38 <sup>b</sup>	4.68±0.46 <sup>a</sup>
BL	24.39±4.1	23.71±1.96	23.72±2.02
BG	18.58±1.17 <sup>a</sup>	18.35±3.97 <sup>a</sup>	16.83±1.82 <sup>b</sup>
WL	13.68±2.07 <sup>a</sup>	12.49±1.91 <sup>b</sup>	12.40±1.39 <sup>b</sup>
BH	13.96±1.44 <sup>b</sup>	14.41±0.87 <sup>a</sup>	14.00±0.96 <sup>b</sup>
TL	3.17±0.54 <sup>b</sup>	3.61±0.38 <sup>a</sup>	3.09±1.07 <sup>c</sup>
DL	5.95±0.92 <sup>b</sup>	6.56±0.57 <sup>a</sup>	5.76±0.74 <sup>b</sup>
KL	6.89±0.70 <sup>c</sup>	7.00±0.51 <sup>bc</sup>	7.50±1.86 <sup>a</sup>
SL	3.20±0.50 <sup>c</sup>	3.92±0.60 <sup>a</sup>	3.32±0.68 <sup>b</sup>

BW: Body weigh; HL: Head Length; BK: Beak Length; NL: Neck Length; BL: Body Length; BG: Body girth; WL: Wing Length; BH: Body Height; TL: Thigh Length; DL: Drumstick Length; KL: Keel Length; SL: Shank Length.

It was observed from Table 4.0, that positive and significant ( $p < 0.01$ ; 0.05) relationship existed between locations of the homing pigeons, NL and SL with a moderate value of 0.57 and 0.58, respectively and a higher significant ( $p < 0.01$ ) value of 0.74 for BH. From the correlation output, it was observed that BW was negatively correlated ( $p < 0.01$ ) with locations of the pigeon with a moderate value of -0.58, but positive and significantly ( $p < 0.01$ ) correlated with WL (0.46) and SL (0.52). Correlations values obtained between other morphometric traits measured were either significantly or non- significantly low.

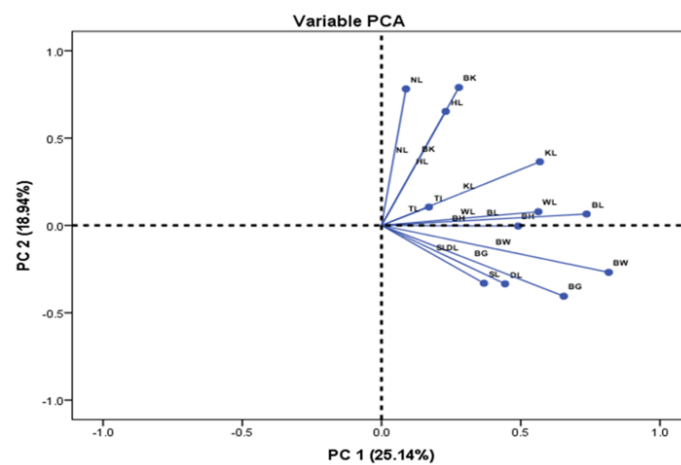
The variable Principal component analysis (PCA) results shows that BW, SL, DL and BG clustered and rotated together for classification under PC1 with 25. 14%, while TL, NL, WL, BL, and KL rotated together under PC2 with 18.94%. The canonical discriminat function (Figure 3) shows that KEB and OSG clustered together under Can 1 with 56.60%, while ILR and KEB clustered together under Can 2 with 43.40%, with interrelationship between the pigeons in Can 1 and 2 irrespective of their locations. The hierarchical cluster analysis (Figure 4) indicates that KEB pigeons are distinct with values between 2 and 25 and far from those of ILR nad OSG which are more closer together between 0 and 3

**Table 3.** Phenotypic Correlations between Sample Locations and Growth Traits Measured

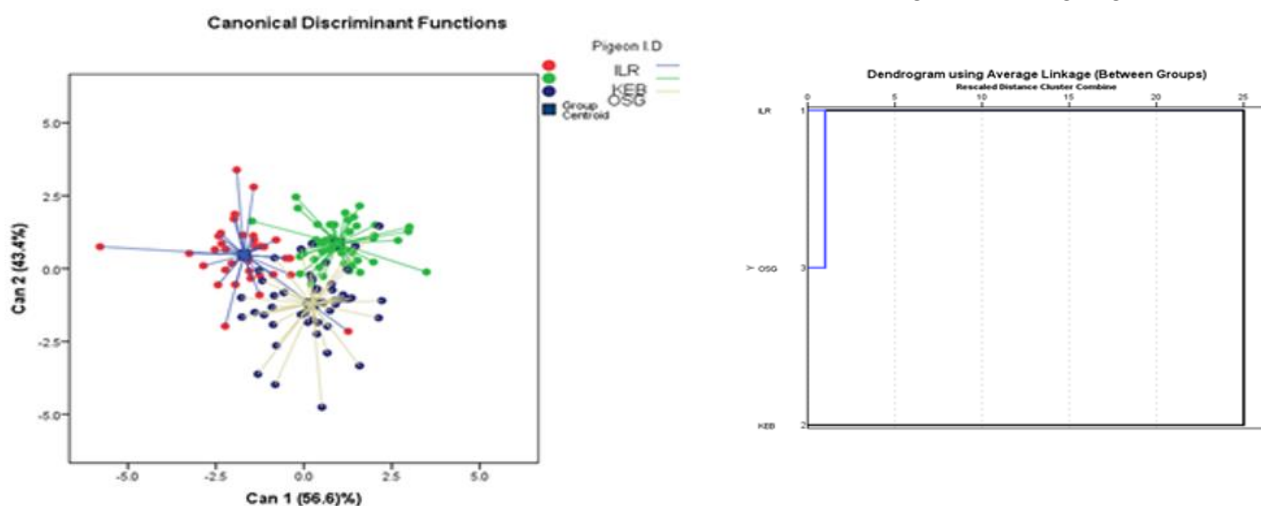
\*\*Correlations Significant at 0.01 \*Correlations Significant at 0.05

	LCT	BW	HL	BK	NL	BL	BG	WG	BH	TL	DL	KL	SL
LCT	1												
BW	-0.53**	1											
HL	-0.08	0.06	1										
BK	0.11	-0.09	0.09	1	*								
NL	0.57**	-0.30**	-0.15	0.27**	1								
BL	-0.09	0.26**	0.16	-0.23*	-0.07	1							
BG	-0.26**	0.39**	0.04	-0.14	-0.29**	0.16	1						
WL	-0.26**	0.46**	0.07	-0.09	-0.19	-0.06	-0.01	1					
BH	0.74**	0.16	0.00	0.02	0.13	0.22*	0.04	0.07	1				
TL	-0.01	0.06	0.09	-0.01	0.10	0.11	0.01	0.09	0.08	1			
DL	-0.13	0.43**	-0.12	-0.12	-0.14	0.14	0.21*	0.15	-0.08	0.04	1		
KL	0.20*	0.03	0.04	0.27**	0.24**	0.16	0.04	-0.05	0.37**	0.04	0.03	1	
SL	0.58*	0.52**	-0.05	-0.14	0.04	-0.01	0.04	0.01	-0.01	-0.27*	0.28**	0.07	1

LCT: Locations; BW: Body weigh; HL: Head Length; BK: Beak Length; NL: Neck Length; BL: Body Length; BG: Body girth; WL: Wing Length; BH: Body Height; TL: Thigh Length; DL: Drumstick Length; KL: Keel Length; SL: Shank Length.



**Figure 2.** Variable Principal Component Analysis of growth traits in Nigeria Homing Pigeons from three



**Figure 3.** Canonical Discriminant Function of of Nigeria Homing Pigeons based on their Location.

**Figure 4.** Hierarchical Cluster of effects of locations on Nigeria Homing Pigeons growth Traits.

## Discussion

Variations in quantitative traits observed in this study is in accordance with the early studies by some authors on Nigerian and outside Nigeria pigeons across various agro-ecological zone/geo-political zone (Bhowmik et al., 2014, Pavarez et al., 2016, Fajemilehin et al., 2017). Body weight obtained for pigeon in this study was higher than the range of body weight 200 -220g reported by Ebunoluwa et al. (2015) and lower than the average body weight 283.32g and 416.39g reported by (NRC, 1991; Fajemilehin et al. (2017) and Daiko et al. (2017) but was within the value of 265.13 and 268.00g reported by (Omojola et al. (2012) and Sonaiya, (2000) for homing pigeons found in guinea and rainforest zone of Nigeria. This study also revealed that pigeons from the North western part of Nigeria as represented by those from KEB have higher values for majority of linear body parameters except keel length; this shows that the pigeons from the North west geopolitical zones of Nigeria area are taller than those from other two regions. The differences in quantitative traits observed in this study could be due to different agro-ecological/geo-political area of study and socio economic nature of pigeon breeder in the study area as stated by Yakubu et al. (2011) that some of these morphological traits are sensitive to the nature of their environment and nutrition.

The Phenotypic correlations results obtained shows that locations of pigeons studied have significant effects on their neck length, shank length and body height and these three traits should be carefully selected when homing pigeons are been considered for improvement in any of these three selected areas. The results also showed that the body weight had negative correlations values between with locations and this could be indications that their body weight value does not depend on where they are found. However, significant and positive correlation values existed between body weight, neck length and shank length and an improvement in any of these two body parts will lead to an improvement in overall body weight of chickens., this findings corresponds with the report of Maciejowski and Zieba (1982) where some of the linear body parts were reported to be an indicator for body weight development in poultry and that of Sola-Ojo et al. 2013 where significant relationships were reported for correlation between body weight and some linear body parameters in chickens. From this study, Phenotypic correlation values showed that BW was negatively correlated with locations and its an indication that the body weight values of the homing pigeons does not depends on their location or origin. A distinct comparative analysis was observed between the three locations from the canonical discriminant functions 1 and 2, while the variable principal component analysis shows that all BW, SL, DL, and BG clustered together under PC1, while WL, BL, KL, TL, WL and BH clustered together under PC2 for the classification of homing pigeons with a value of 25.14 and 18.94%, respectively. The hierarchical cluster analysis grouped ILR and OSG pigeon together while those from KEB are clearly distinct from the other two locations, this might not be far from the fact that KEB pigeons are from the North western part of the country and very far from ILR and OSG with a closer distance as shown in Figure1. This study also correspond with the assertions of past authors that growth traits characterization is useful in obtaining better understanding of the composition and developmental pattern of poultry strains (Maciejowski and Zieba, 1982; Sonaiya, 2000; Sola-Ojo and Ayorinde, 2009 and Sola-Ojo et al., 2013) and characterization is a guide for breeding and development programmes in all poultry species.

## Conclusion

These findings revealed that significant variations existed in the quantitative traits of the homing pigeon studied with respects to their locations and this fact will compliment efforts by animal breeders in homing pigeons characterization based on their locations. It will also enhance homing pigeons conservation which is threatened by large scale transformation of the agricultural systems towards rearing of other poultry stocks. Variations in body weight and other morphometric body parameters measured shows that there is room for genetic improvement of pigeons across Nigeria. Therefore, Poultry breeder should focus on selection and development of pigeon which is regarded as one of the lesser known poultry for the production of animal protein and bridging of the existing gap in shortage of animal protein been experienced by masses in the country. Pigeons are easier to rear with minimal cost of production and will be affordable for resource poor framers to produce it will also contribute positively to the available animal protein for the teeming population, thus information obtained here will serve as a guide in selection and improvement of pigeons for better growth traits.

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### **Availability of data and materials.**

The authors declares that data collected and materials used are available

### **Authors' contributions**

Sola-Ojo, Abubakar and Adeniyi conceived and designed the experiment

Sola-Ojo, Abubakar and Ibiwoye performed the experiment and were involved in data collection

Sola-Ojo analyzed and interpret the data

Abubakar and Ibiwoye wrote the manuscript, while all the authors revised and approved the final manuscript.

### **Ethics approval and consent to participate**

This work was carried out under the ethical approval of the University of Ilorin, Ilorin, Kwara State Nigeria and all the authors agreed to participate in the research.

### **Consent for publication**

Not applicable.

### **Competing interests**

The authors declare that they have no competing interests.

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