Zoometrical indices and cephalometry studies of Adult Helmeted Guinea fowls (Numida meleagris galleata Pallas)

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Abstract

Zoometrical and cephalometric indices of four varieties of adult guinea fowls (Numida meleagris galeata Pallas) were investigated to ascertain varietal differences and/or similarities among them. One thousand, two hundred and seventy two (1,272) adult Guinea fowls comprising 425 pearl, 313 lavender, 271 black and 263 white varieties randomly selected from smallholders in Sokoto, Bodinga, Goronyo, Balle, Shagari and Illela villages were used for this study. Data on five zoometrical indices (body, shank, skull, helmet and wattle) and cephalomtric indices were taken on each of the varieties. The results showed low and similar ($p>0.05$) values in all the indices investigated. This indicates that the four varieties are not distinct varieties but only differ in plumage colour and that the head shape of the four varieties is dolichocephalic.

Key Words: *dolichocephalic, head shape, varietal differences, varieties, zoometrical indices*

INTRODUCTION

Guinea fowls are wild animals which live in arid rural areas in many African countries and have been occurring in very considerable numbers in recent years with improving organic agriculture (Yildirim, 2012). The production of guinea fowl as an alternative poultry is gaining ground throughout the world, especially in developing nations with increasing demand for its meat because of the advantage of its game-type flavour (Mareko et al., 2006 and Ogar, 2011). Therefore well grounded understanding of the animal biology is essential because when little is known about a resource's identity as a genetic group, its production, reproduction and adaptation potential, it is more difficult to embark on improvement programmes. There are five commonly known varieties of guinea fowl in Nigeria based on plumage colour namely: pearl, grey breasted, lavender, white and black (Ikani and Dafwang, 2004). Ayorinde (2004) reported that only four distinct varieties of guinea fowls were revealed as the white-breasted guinea fowl did not breed true but segregated to other colours when mated inter se. The veracity of this claims need to be verified using multi-faceted approaches among these are zoometrical indices and cephalometric index.

Zoometrical indices are relationships among body measurements that are used to describe the proportions and general size of the parts of animals which are currently receiving increased attention in birds (Strelec et al., 2005; Zenatello and Kiss, 2005 and Robertson et al., 2008). The indices provide general information on the ethnological and functional attributes of the birds. Ethnological indices contribute general information about varietal characteristics in terms of compactness, height, length and weight whereas functional attributes contribute information about the type, aptitude, purpose and production performance of the birds. Although the indices can be conveniently used as a tool to establish variation or similarity in anatomical proportions among animals of the same species, it may not reflect the physiogenomic variation of the individuals using them. This is because data obtained under the circumstance are not normally distributed but are truncated since they lie between 0 and 1 (Mulaudzi, 2006). Most zoometrical characters and physiological functions depend on body size and to remove this dependence, data could be analyzed as ratios to increase the precision of data generated on traits of interest (Packard and Boardman, 1988). Despite the reservations regarding the use of ratios to scale data, ratios still continue to enjoy wide use (Tshovhote et al., 2010).

Cephalometry is the scientific measurement of skull in living individuals while its synonym in dead individuals is craniometry (Muhammad et al., 2016). Cephalic index is a better means to model racial ancestry (Killgrove, 2005 and Saqib et al., 2012) particularly in air accident where it requires Forensic experts to determine the identity of persons involved (Rao, 2010). It is useful for anthropometry, forensic and orthodontic practice (El-Feghi et al., 2004). It could also be used to estimate the age of foetus for legal and obstetrical reasons and to categorize animals (Corey and Jantz, 2002). The terminology used to describe the craniofacial complex stemmed from classical anthropometry which employs measurements taken in living individuals and human skulls as well as indices that represent facial proportions (Edler et al., 2006). The use of a standardized terminology in phenotypic characterization in

different fields of knowledge is essential to facilitate communication between researchers and allow reliable comparisons between different studies from different areas (Allanson et al., 2009) thereby contributing to a higher level of scientific evidence (Franco et al., 2013).

In using, strictly skull based categorization method, anthropologists recognized three skull groups: dolicocephalic, mesocephalic and brachycephalic (Umar et al., 2006). However, William et al. (1995) categorized them as dolicocephalic, mesocephalic, brachycephalic or hyperbrachycephalic while Corey and Jantz (2002) reported that cephalic index could indicate an animal species to be dolichocephalic (long headed), mesaticephalic or mesocephalic or mesocranial (medium headed) or brachycephalic (short headed) if the ratio of the width and length are respectively less than 75%, between 75% and 83% and greater than 83%. These categorizations can be influenced by race, ethnicity, genetic interpretation, tradition, nutrition, environment and climate (Franco et al., 2013). Human genotypic variation in cranial shape is far greater within than between populations (Relenford, 1994) and local environmental conditions put hyperdolichocephaly and hyperbrachycephaly head shapes at slight selective disadvantages (Ralph, 2002). Succinctly, Corey and Jantz (2002) concluded that there was a "relatively high genetic component" of head shape. The objective of this study is to describe the similarity or diversity found in zoometrical indices and cephalic phenotypes of the four colour variants of helmeted guinea fowl.

Data Analysis

Each individual body part was expressed as ratio of body weight and data analyzed using a simple analysis of variance (ANOVA) procedure (SPSS, 1989). The zoometrical indices: body, shank, helmet and wattle were taken on each of the animals.

Body index = $\frac{\text{Body circumference}/2}{\text{Body weight}}$

Helmet index = $\frac{\text{Helmet width}}{\text{Helmet length}}$

Wattle index = $\frac{\text{Wattle width}}{\text{Wattle length}}$

Shank index = $\frac{\text{Shank width}}{\text{Shank length}}$

Body size = $\frac{\text{Body weight}}{\text{Wing length}}$

The cephalic index was calculated using the modified method of William et al. (1995)

Cephalic index = $\frac{\text{Skull breath}}{\text{Skull length}}$

Results and Discussion

Body Ratios and corporal indices

Table 1 showed the ratios of zoometrical measurements in the four varieties of helmeted guinea fowls. The result revealed that the ratios in all the parameters investigated did not differ ($p>0.05$) among the varieties. The shank length ratio as an index of density which indicates the degree of fleshing in relation to body size shows that all the varieties possess equal genetic potentials for production purposes. This is in agreement with the findings of Melesse and Negesse, (2011) though in local chickens of Ethiopia.

The zero value reported for body length in this study indicates that the birds are closer to being rectangular in shape which is indicative of good conformation for meat production (Cerqueira et al., 2011). The low values obtained for keel length in the four varieties demonstrated poor massiveness and stockiness of the birds. Massiveness and stockiness which, are used to assess musculature development, are traits for solidity of the body and clearly defined traits for meat-type birds. In the present study, meatiness trait was poorly but equally described in all the varieties using keel length ratio.

Table 2 showed the zoometrical indices and cephalic index of the four varieties of Guinea fowl. The indices were analyzed with the aim of studying the ratio between the two principal dimensions of the structures and to learn about how the structure is. The result showed similarities ($p>0.05$) among the varieties. The cephalic index, which showed low values in all the varieties, is of ethnological importance, particularly because its variation is not influenced by environmental factors and by the animal's management. In the individuals studied, the shape of the head was classified as dolichocephalic.

In conclusion, the four varieties are not distinct varieties but only differ in plumage.

Table 1: Ratios of zoometrical measurements in four varieties of helmeted Guinea fowl

Parameters	Pearl	Lavender	Black	White
Head thickness	0.32±0.01	0.36±0.01	80.40±0.01	0.37±0.01
Helmet length	0.23±0.01	0.23±0.01	0.23±0.02	0.27±0.04
Helmet width	0.15±0.01	0.12±0.01	0.14±0.01	0.13±0.01
Wattle length	0.05±0.01	0.06±0.01	0.06±0.01	0.06±0.01
Wattle width	0.18±0.01	0.18±0.01	0.15±0.01	0.17±0.01
Body length	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Keel length	0.28±0.01	0.30±0.01	0.27±0.01	0.26±0.02
Body circumference	0.05±0.00	0.05±0.00	0.05±0.00	0.05±0.00
Shank length	0.41±0.01	0.41±0.01	0.34±0.01	0.38±0.01
Shank thickness	0.73±0.02	0.73±0.03	0.78±0.02	0.83±0.04
Shank circumference	0.03±0.0	0.04±0.00	0.04±0.00	0.04±0.00
Drumstick length	0.02±0.00	0.03±0.00	0.02±0.00	0.02±0.00
Wing length	0.06±0.00	0.06±0.00	0.07±0.00	0.06±0.00
Thigh length	0.26±0.00	0.26±0.00	0.24±0.01	0.26±0.01
Body size (%)	6	6	7	7

Means along the same row with no superscripts are similar (P>0.05)

Table 2: Body indices and cranial index of four varieties of Guinea fowl

Parameters	**Pearl**	**Lavender**	**Black**	**White**
Cephalic index	0.18±0.01	0.16±0.01	0.29±0.01	0 .37±0.01
Body index	0.02.±0.00	0.03±0.00	0.01±0.0.00	0.00±0.00
Helmet index	0.69±0.03	0.89±0.03	0.76±0.03	0.82±0.05
Wattle index	0.57±0.002	0.60±0.04	0.72±0.02	0.64±0.02
Shank index	0.15±0.01	0.14±0.01	0.14±0.01	0.13±0.01

Means along the same row with no superscript are similar (P>0.05)

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