Original Research Article

Morphological Traits Study of Three Indigenous Poultry in Nigeria

ABSTRACT

Aim: This study investigated relatedness among three indigenous chicken types using morphological features and morphological trait interdependence within three indigenous poultry species in Nigeria

Study design: A complete Random sample design was employed in this study to investigate morphological relatedness.

Place and Duration of the study: Birds of reproductive age were sampled from 12 states across Nigeria between February 2013 and November 2015.

Methodology: Morphological traits were measured according to the FAO description. Nearest neighbor analyses (hierarchical cluster) were done using SPSS 23.0 version.

Results: The nearest neighbor analyses showed that higher degree of relatedness exists between the wild type chicken and the frizzle feather indigenous chicken type in Nigeria. Traits interdependence was observed between and among the different morphological traits within the different poultry species.

Conclusion: The characters measured could be of useful genetic importance that may play significant role as markers for selection or breeding programmes for improved productivity under free range or scavenging feed resource-based production systems.

Key words: Morphology; Poultry; Indigenous; Traits-interdependence

1. INTRODUCTION

Poultry plays great role in food security (animal protein) in most part of the world. The indigenous domesticated birds are said to cover over 60% of the world's total poultry population in most Africa nations [1]. In Nigeria, they are mostly found and reared by the rural populations in the rural home sets harnessing the birds for meat and income sources [1, 2]. These local indigenous poultry species have been identified to possess traits of great economic interest and values: they are hardy, show great ability

in resisting certain avian diseases or pathogens and require less attention on feed quality demand [2- 4]. These local poultry types are a great source of genetic reservoir for particularly genes that confer ability to adapt to the tropical and subtropical regions [1, 5].

Variations have been reported to exist among poultry populations and types. The variations come in many different forms, genetic and morphological makeup consisting of high important differences. Furthermore, traits interdependence in poultry species has been reported [3, 6- 8]. Adekoya *et al.* [2] stated that traits interaction exists within indigenous chicken types and observable relatedness between and among the chicken types. Significant sexual dimorphism in the body measurements between both sexes of muscovy duck in the ecotypes studied and low to high correlation between traits has also been reported by Ogah [7].

The understanding of the diverse morphological differences and the relationship which may exist provide valuable information on the poultry genetic reservoir: variations within and among different populations and types. Sustainable management, characterization, conservation and use of indigenous poultry is a necessity for increased and large scale poultry production, poverty alleviation, proper breeding programs and schemes, national development and global food security [9]. Variations within populations can be established or estimated using analytical packages such as the multifactorial analyses to analyze the morphological traits present within the population. Cluster analysis can show relatedness and or dissimilarity within and among items of a data set [10].

The present study aimed at examining the degree of relatedness among three indigenous chicken types: wild type, naked neck and frizzle feather, and the interdependence between and among morphological traits in the indigenous chicken, duck and guinea fowl populations.

2. MATERIALS AND METHODOLOGY

2.1 Study location

The sampled locations include the following states in Nigeria: Lagos, Ogun, Oyo, Osun and Kwara (South-West), Akwa-Ibom, Edo (South-South), Imo, Anambra and Enugu (South-East), Taraba, (North-East) and Benue (North central) states (Fig 1).

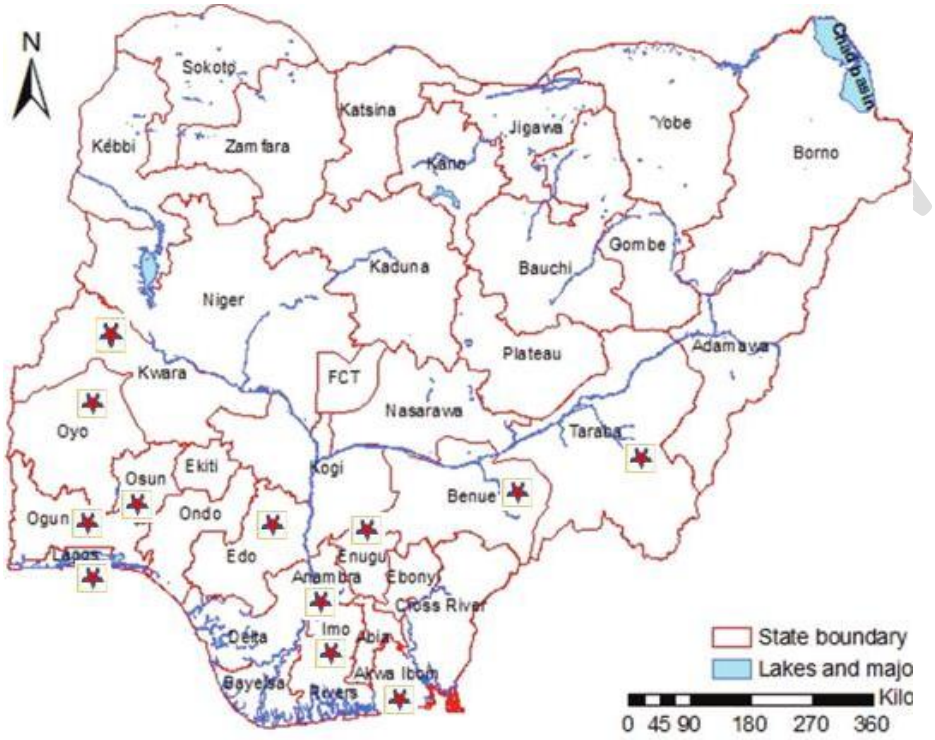

Figure 1: Sampled locations (states) in Nigeria ( )

2.2 Study population

A total of 429 indigenous birds of reproducing age: 247 chickens (96 wild type, 79 naked neck and 72 frizzle feather), 81 ducks and 101 guinea fowl were used for the study (Fig 2).

Wild type

Frizzled feather

Naked neck

Duck

Guinea fowl

Figure 2: The different indigenous birds studied.

2.3 Morphological traits measured

Ten qualitative and ten quantitative traits in each bird type were considered based on FAO description.

2.4 Statistical analyses

Nearest neighbor analyses (hierarchical cluster) were done using SPSS 23.0 version.

3. RESULTS

The result demonstrated that some degree of relatedness and non-relatedness exist among the three indigenous chicken types investigated based on the morphological data. Closer relatedness was observed to exist between the wild type chicken and the frizzle feather chicken type with the naked neck chicken type at a distance. Furthermore, traits interdependence were observed to exist between and among some traits investigated in all the indigenous poultry species:

3.1 Relatedness among three indigenous chicken types

Strong relatedness/similarities exist between the wild type chicken and frizzled feather indigenous chicken populations, however, the naked neck indigenous chicken type was distantly related (Fig 3).

3.2 Morphological traits interdependence

3.2.1 Chickens

Within the indigenous chicken population the back length, wing length and tail length formed a cluster. Shank length, beak length and comb length showed more relationship while the height was distinctly separated from the other traits (Fig 4). The qualitative traits skin colour, shank colour and beak colour formed a cluster but showed less relationship with eye and tail colours (Fig 5).

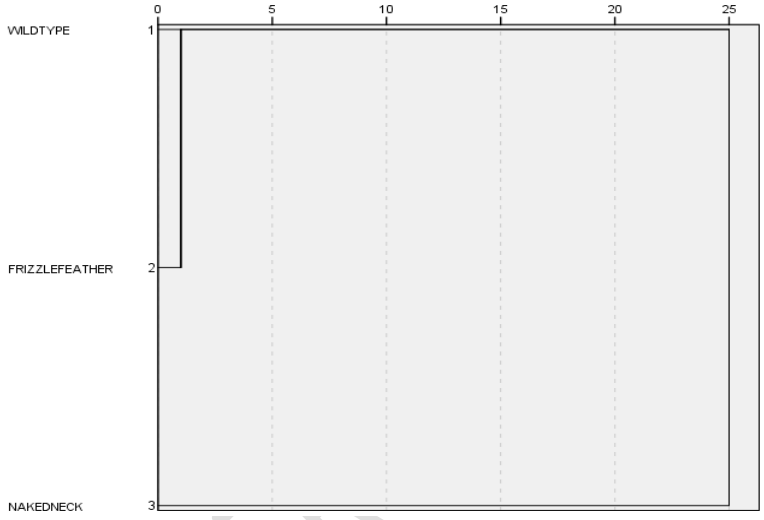

Figure 3: Closest neighbour relatedness among 3 indigenous chicken types.

The wild type and frizzled feather indigenous chicken populations showed more similarity but the naked neck type distantly related (Fig 3).

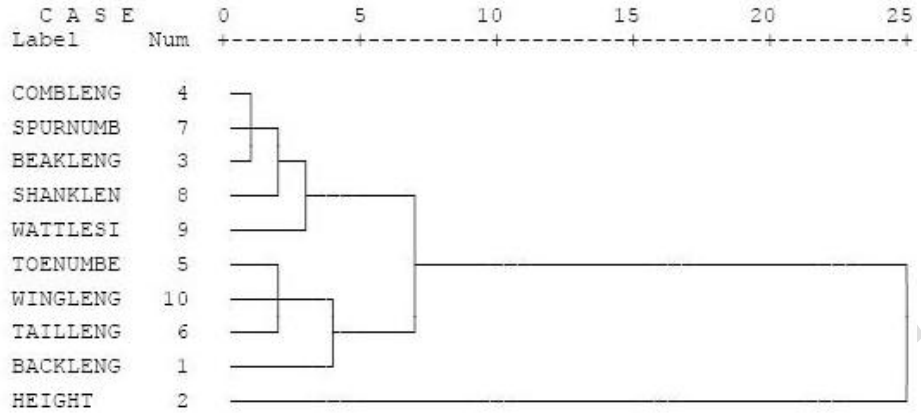

Figure 4: Interdependence among quantitative traits within the chicken population.

Within the chicken population comb length and the beak length formed a cluster (0.96 coefficient level) while the wing length, back length and tail length cluster (0.93 coefficient level) (Fig 4).

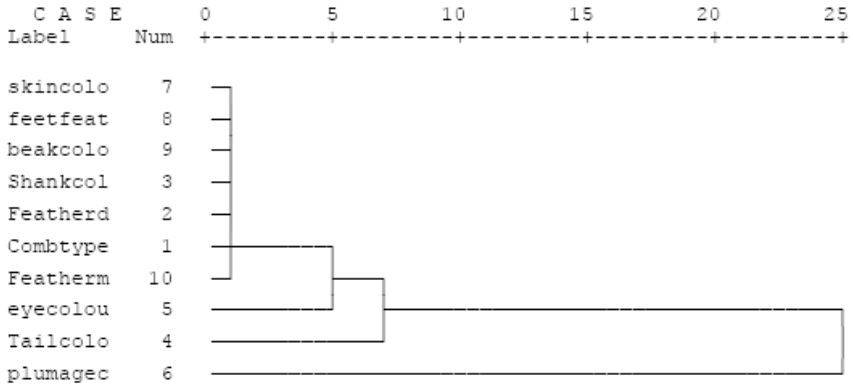

Figure 5: Degrees of interdependence among qualitative traits within the chicken population.

At 0.96 coefficient level skin colour, beak colour, shank colour, comb type and feather morphology showed strong interaction while the plumage colour was distinctly separated (Fig 5).

3.2.2 Guinea fowls

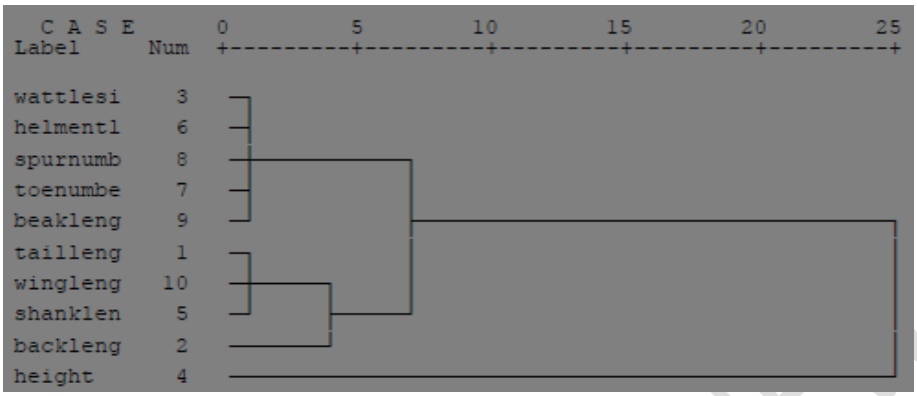

Figure 6: Dendrogram of quantitative traits interdependence within guinea fowl.

Trait interdendepence at 0.96 coefficient level among wattle length, helment length and beak length showed strong morphological trait interaction. Tail lenghth, wing length and shank length also showed some traits interdependence by clustering together to form a sub cluster while

the wing length, tail length and shank length formed a cluster (Fig 6). Among the qualitative traits measured the skin, shank, eyes and helmet colours formed a sub cluster (Fig 7).

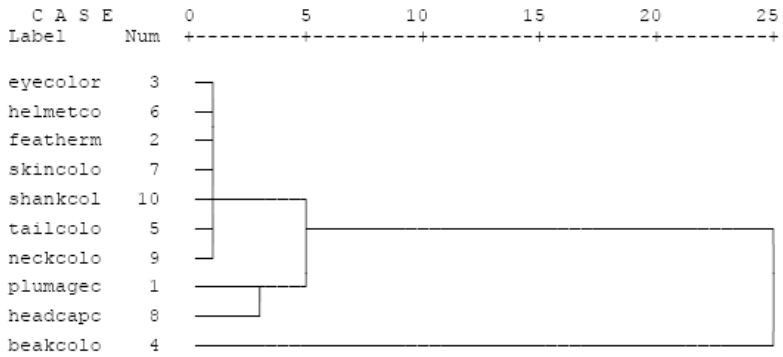

Figure 7: Degree of relatedness based on qualitative traits measurments within the guinea fowl.

3.2.3 Ducks

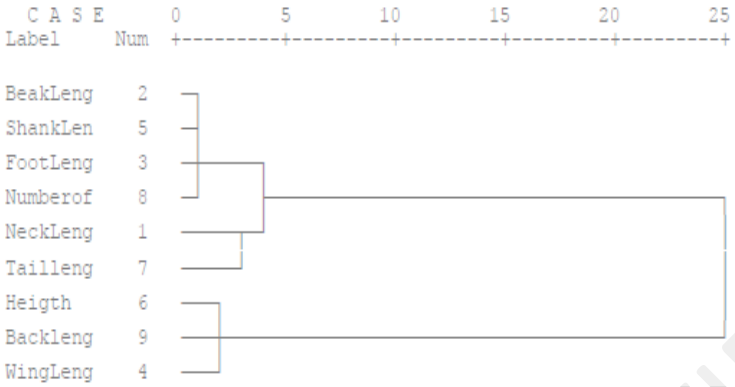

Figure 8: Dendrogram of qualitative traits interdependence within the ducks.

Among the ducks beak length, shank length and foot length made a sub cluster (0.96 coefficient level) while the height, back length and wing length made sub cluster (0.92 coefficient level) (Fig 8).

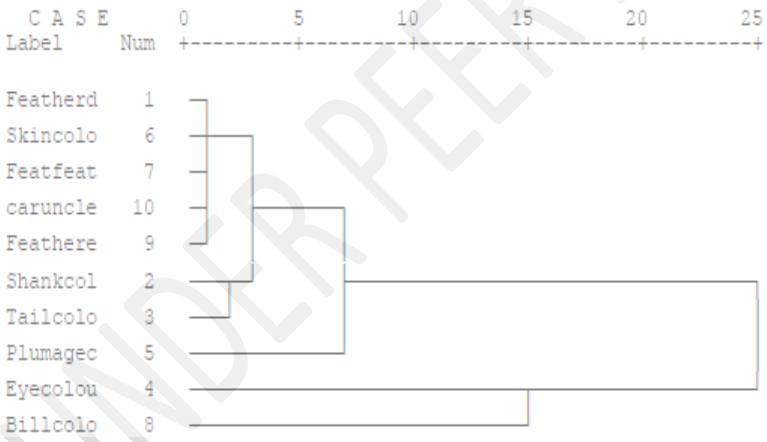

Figure 9: Degree of relatedness based on qualitative traits measurements within the ducks.

The skin colour, feather distribution, caruncle, shank colour and tail colour (0.92 coefficient level) clustered together. However, the eye and bill colours were distinctly separated from the other morphological features (Fig 9).

4. **DISCUSSION**

Genetic characteristics are expressed as phenotypes with influence from the environment. These expressions are often altered by variations in both the genetic compositions and the environment; some traits classified complex traits while some are controlled by single gene [11]. In the present study the wild and frizzle feather indigenous chicken types showed more relatedness among the three indigenous chicken types. This suggested closer ancestral line between the indigenous wild and frizzle feather chicken types than with the naked neck. This observation is consistent with the finding of Adekoya et al. [2]. It also agrees with Mogesse [3] who reported some degree of relatedness existing among some local chicken types in Ethiopia.

Furthermore, Nigussie et al. [12] reported heterogeneity in most morphological, phenotypical traits, and phenotypic diversity within indigenous chicken populations. The dendrograms in this report showed the existence of diversity in the morphological features of Nigeria indigenous chicken populations. This report, therefore, highlights the rich and diverse genetic reservoir present within the indigenous poultry population. What is the implication or research information for this? The population May, therefore, possess useful genetic traits that could be employed during selection or breeding programmes for improved productivity under free range or scavenging feed resource-based production systems.

Naked neck and feather morphology and to some extent wattle size within the chicken population showed high heritability with high genetic advance. Height in both the chickens and guinea fowls was distinctly separated from all other traits. In ducks, height showed strong relation with back and wing lengths. Back, tail and wing lengths also showed strong interdependence in both chickens and guinea fowls. This may suggest that the height may not have hereditary correlation with the other morphological traits in chickens and guinea fowls. The shank length also showed some degree of interdependence with back, tail and wing lengths in both the chickens and guinea fowls. Furthermore, beak length and wattle size were often seen to been with similar cluster in both chickens and guinea fowls. In all three poultry types skin and shank colours showed strong interdependence often in the same cluster. These findings may be indications that morphological traits influence or interact with one another's expression. Morphological traits interdependence has been reported by Ajayi et al. [13] in indigenous poultry. They added that the relationship observed among the morphological features is of significance in management, characterization and conservation of the genetic resources in this bird type. Yakubu and Ugbo, [4]

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revealed that diversity and trait independence exist in the duck's morphological trait as revealed in their study on duck populations from the guinea savannah and rainforest zones of Nigeria. They added that although morphological variation is present the studied populations might have descended from a common ancestral line or population.

These characters, based on the relationship displayed, showed the possibility of having direct effect on one another, and direct selection may be more effective towards the improvement of yield in the poultry. Furthermore, observed morphological and phenotypical variations that have economic values have been reported among the indigenous chicken populations in different parts of the globe especially Africa [3, 10, 14-16]. It is pertinent therefore in-depth molecular studies be done to evaluate the level of genetic differentiation and relationship present within these morphological features among the differentindigenous poultry species with the aim of aiding global food security and the conservation of the genetic resources before they are eroded.

5. **CONCLUSION**

Rich morphological traits diversity exists within the Nigeria indigenous chicken population. These traits are of economic importance and values and could be employed as selection markers during breeding programmes.

REFEENCES

1. FAO. Statistical database of Food and Agriculture Organisation of the United Nations, Rome., Italy. 2000.
2. Adekoya KO, Abazuh UD, Bankole KA, Oboh BO. A comparative morphological characterization of three local and three exotic chicken types in Nigeria. Unilag J Med Sci Technol. 2013; 1 (1): 87-96.
3. Mogesse HH. Phenotypic and genetic characterization of indigenous chicken population in Northwest Ethiopia. PhD, University of the Free State, South Africa. 2007.
4. Yakubu, Ugbo SB. An Assessment of Biodiversity in Morphological Traits of Muscovy Ducks in Nigeria using Discriminant Analysis. Int Conf Biol Environ Chem. 2010; 1(2011): 389-391

5. Horst P. Native fowls as reservoir for genomes and major genes with direct and indirect effects on adaptability and their potential for tropical oriented breeding plans. Anim Breed Abstract. 1989; **53**: 13-23.
6. Ladokun AO, Yakubu A, Otite JR, Omeje JN, Sokunbi OA, Onyeji E. Haematological and Serum Biochemical Indices of Naked Neck and Normally Feathered Nigerian Indigenous Chickens in a Sub Humid Tropical Environment. Int J Poult Sci. 2008; **7**(1): 55-58
7. Ogah M. Analysis of Morphological Traits of Geographically Separated Population of Indigenous Muscovy Duck (*CairinaMoschata*). Int J Poult Sci. 2009; 8(2): 179-182.
8. Ige AO, Salako AE. Transferrin Genetic Types in Fulani and Yoruba Ecotype of Nigeria Indigenous Chickens. Iranian J Appl Anim Sci. 2014**;** 4(1): 191-196.
9. INFPD/FAO/IFAD. 2011. Opportunities of poultry breeding programmes for family production in developing countries: The bird for the poor. Proceedings of an e-conference held 24 January-18 February 2011
10. Adedibu II, Ayorinde KL and Musa AA. Multifactorial Analyses of Morphological Traits of Extensively Reared Helmeted Guinea Fowls *Numidia Meleagris* in Kaduna and Kastina States of Nigeria. Brit J Appl Sci Technol. 2014; 4(25): 3644-3652.
11. Klug WS, Cummings MR, Spencer CA, Palladino MA. Concept of Genetics. 9th edition. Pearson Education, Incoporation, publishing as Pearson Benjamin Cummings, 1301 Sansome St., San Francisco, CA 94111. 2009
12. Nigussie H, Kebede K, Ameha N. Phenotypic and Morphological Characterization of Indigenous Chicken Populations in Southern Zone of Tigray, Ethiopia. J Biol Agric Healthc. 2015; **5**(21): 132-141
13. Ajayi OO, Adeleke MA, Sanmi TM, Yakubu A, Peters SO, Imumori IG, Ozoje MO, Ikeobi NC, Adebambo OA. Application of principal component and discriminant analyses to morpho-structral indices of indigenous and exotic chickens raised under intensive management system. Trop Anim Health and Prod. 2012; 44(4): 675-684
14. Ajayi FO. 2010. Nigerian Indigenous Chicken: A valuable genetic resource for meat and egg production. Asian J Poult Sci. 4 (4): 164-172

15. Olawunmi O, Salako AF, and Afuwape AA. Morphometric Differentiation and Assessment of Function of the Fulani and Yoruba Ecotype Indigenous Chickens of Nigeris. Int J Morphol. 2008; 26(4): 975-980
16. Khobondo J.O., Muasya T.K., Miyumo S., Okeno T.O., Wasike C.B., Mwakubambanya R., Kingori A.M. and Kahi A.K. (2015): Genetic and nutrition development of indigenous chicken in Africa. Livestock Research for Rural Development. 27(122). Retrieved February 6, 2017. Available: http://www.lrrd.org/lrrd27/7/khob27122.html