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Phenotypic Characteristics of Indigenous Chickens in Selected Regions of Nigeria

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ABSTRACT

The Nigerian indigenous chicken called the native or village chicken are widely distributed in the rural areas of Nigeria, where they are kept by the natives principally as a source of protein and income. These native chickens play major roles not only in rural economies but also contribute substantially to the gross national income. This study aimed to determine the productivity of identified phenotypic characteristics and to aid the selection and genetic improvement of indigenous chickens in local areas of Nigeria (Ikole, Ekiti East and Oye local government). A total of 180 captive adult (normal feathering female and male) frizzled local chickens were scored and measured for phenotypic characteristics. There were no significant differences across the local governments (locations) comparing the native chickens for body weight, shank length, comb length, chest length, and comb height. The beak length and the body length were significant. The body weight ranged from 1.06 to 1.08 kg. Oye and Ekiti East local government had the highest similar value of 1.08 kg while Ikole local government had the least value (1.07 kg). The magnitude of the value of the parameters between shank length and comb height, between shank length and comb height, between shank length and body length, between comb height and comb length and between comb height and body length were positive and significant. There were positive and significant relationships between comb height and body weight and between clutch size and body weight (r = 0.34292, 0.36718) in frizzled local chickens. There was a significant positive relationship between shank length and beak length, between shank length and body weight, between comb height and beak length and between beak length and body weight. The correlations between shank colour and clutch size, between comb length and clutch size, and between beak lengths were negative. The performance of the local chickens can be greatly enhanced with improvement in basic management with the response to genetic improvement for increased body weight and egg production.

Keywords: Body weight, Indigenous chicken, Phenotypic characteristics

INTRODUCTION

The local or indigenous chickens (Frizzled Feathered / Gallus gallus) are a general term given to animals or birds kept in the wide-ranging or scavenging in the free-range. They are multipurpose unimproved birds with no identified description (Mengesha, 2012). Farmers in Africa gave these chickens names like; bush chickens or African hen (Gueye, 2009). Local chickens are mostly in each household and every culture owned them. Besbes et al. (2012) reported that family chickens are produced by families to get food, income and employment. Local chickens contribute significantly to the livelihood of the rural farmers by providing them with high-quality animal protein in the form of eggs and meat for family consumption (Molla, 2010), ease poverty and provide their owners with income and nutritional benefits (Reta, 2009). Most farmers keep local chickens including the poor, women, and children. They require little care and adapt well to rural conditions than exotic chickens (Gueye, 2010).

The Nigerian local chickens called the native or village chickens are widely distributed in the rural areas of the country where they are kept by the natives principally as a source of protein and income (Gueye, 2009). These native chickens play major roles not only in rural economies but also contribute substantially to the gross national income (Momoh et al., 2010) and (Wong, 2014). They appear to be generally heterogeneous with no specific colour pattern and no descriptive both in phenotype and genotype. The native chickens constitute

about 80 % of the 120 million poultry birds (Zuber, 2010). They are known for their adaptation superiority in terms of their resistance to endemic diseases and other high environmental conditions. One way of overcoming challenges posed by past strategies in improving sustainable productivity is through genetic selection and the development of sustainable indigenous parent stock (Zaman et al., 2005).

Among the major genes of interest that can be considered for this purpose is the naked neck. The naked neck chicken gene is incompletely dominant with Na/na birds showing an isolated tuft of feathers on the ventral side of the neck above the crop, while Na/Na birds either lack this tuft or it is reduced to just a few pin feathers or small feathers. The reduction in feather coverage in naked neck birds permits convectional heat loss from the animal surface, thereby leading to improved thermo-regulation under the prevailing conditions. In many developing countries, the local gene pool still provides the basis sector (Scanes et al., 2004). The genetic resource base of the indigenous chickens could form the basis for genetic improvement and diversification to produce breeds adapted to local conditions. In Nigeria, previous characterization attempts on indigenous chickens with major genes have been concentrated on on-station performance at the expense of on-farm testing (Chatterjee, 2009). In Nigeria, indigenous chickens were characterized along genetic lines of feathers and plumage colour (such as normal or frizzed feathered), body structure (Such as naked neck, dwarf types and colour variants (such as black, white, brown, mottled etc). The indigenous breed represents a huge reservoir of the chicken genome (Ajayi, 2010). Their continued use in low input small scale village production serves as cheap in-situ conservation techniques that need to be encouraged and supported. Several studies reported that local chickens contribute significantly to food security and poverty alleviation (Gueye, 2000). However, such studies also reported a low cost of producing these chickens because they feed by eating crumbs, ants and soil picking for survival (Okeno et al., 2012). Other studies show that local chickens need little space for rearing (Gueye, 2009). Furthermore, most social groups including landless families keep local chickens (Deshingkar et al., 2008). The frizzling and the naked genes in particular had been described as adaptability genes acting as sex makers and disease-resistant factors (Islam and Nishibori, 2009). In Ekiti state, however, there is little or no documentation on local chicken phenotypic characterization, production performances and breeds that produce more eggs and meat hence the study.

MATERIALS AND METHODS

Ethical approval

All experimental procedures were in line with commercial practices and approved by the Institutional Animal care and the use committees of the faculty of Agriculture, University Oye-Ekiti and were compliant with all local animal welfare legislation.

General description of the study location

This survey was carried out at three local government areas of Ekiti State, including Ikole local government, Oye local government, and Ekiti East local government. Ekiti State is located in South Western part of Nigeria with coordinates 70 N and 50150E. It was established in 1996 with its headquarters at Ado Ekiti. Ikole local government is one of the local government areas in the Ekiti state of Nigeria with its headquarters in Ikole town, it comprises towns and villages. It is located between latitudes 7047'0 N and longitudes 5031'0 E with 321 km^2. Oye local government area has its headquarters in Oye Ekiti. It has an area of 507 km^2. It was carved out of Ekiti north local government in 1989. It lies between latitudes 7053'21 N and longitudes 5020'41E. Ekiti East local government area has its headquarters in Omuo Ekiti. It has an area of 1072 km^2. It is situated at 7076' N and longitudes 50720 E.

Origin of the animals

The indigenous chickens examined in the study areas were those brought by producers or middlemen and resell them in the markets. The markets were chosen because of the availability of high populations of local chickens at the place. One hundred and eighty (180) indigenous chickens, comprising of 90 males and 90 females were randomly sampled from the study area. Animals were reared under an extensive and semi-intensive system fed with majorly kitchen waste with little feed supplementation from the owners and was partly sheltered in the night.

Data collection

Data were obtained for body parameters, such as plumage colour, eye colour, comb type, shank length, shank colour, body weight, body length, chest length, beak length, comb length, comb height, sex and egg parameter (clutch size). The data were collected using a dial spring weighing scale, tape rule, camera, ruler and GPS. Dial spring weighing balance was used to measure the live body weight of the chickens while a simple tape rule and ruler were used to take body linear measurements. Data on qualitative traits (plumage colour, eye colour, shank

colour) were taken by observation. The body weight was measured in kilograms on a top-loading weighing scale (dial spring weighing scale), body length was taken as the distance from the tip of the beak over the neck, through the body trunk to the tail, body length, shank length, comb height, beak length, comb length and chest length were also measured in centimetres using flexible measuring tape and ruler.

Statistical analysis

Data collected were subjected to simple descriptive analysis and subsequently analyzed using the Analysis of variance technique of SAS (2009). Differences in means were separated using Tukey's honestly significant test. A significant difference was declared at $p < 0.05$.

RESULTS AND DISCUSSION

Plumage colour

Seven plumage colour types (brown, white, and white/black/brown, and black, white\black, brown/black and white /brown) were observed in the indigenous chicken population in the study area. The variation of plumage colour is shown in Table 1. The predominant plumage colour across the three local government areas was white/black/brown (20%, 26.7%, and 28.3%, for Oye, Ikole, and Ekiti East local governments, respectively). Other colour variation included black (16.7%, 13.3%, and 15%), brown (8.3%, 10%, and 11.7%), brown/black (18%, 10%, and 10%), white (15%, 18.3%, and 15%), white/black (16.7%, 10%, and 8.3%), and white/brown (5%, 11.7%, and 11.7%) for Oye, Ikole, and Ekiti East local governments, respectively. The least dominant plumage colour across the three local governments was white/brown. In the current study, very diverse plumage colouration was observed among the local chickens of Oye, Ikole and Ekiti East local government area of Ekiti state. Deneke et al. (2014) attributed this to the lack of breeding programmes directed towards the choice of plumage colour.

Eye colour and comb type

Table 2 presents the variation of the head region characteristics (eye colour, and comb type). Four eye colours were observed orange, yellow, red and brown. The orange eye colour was the most common eye colour across the three local government areas of Oye, Ikole, and Ekiti East local governments (46.67%, 60%, and 55%, respectively). Other eye colours included red (16.7%, 15%, and 15%), yellow (45%, 20%, and 25%) and the brown colour which was least dominant in the three areas (0%, 5%, and 5%) for Oye, Ikole, and Ekiti East local governments, respectively.

Eye colour depends largely on the pigmentation (carotenoid pigments and blood supply) of a number of structures within the eye. Mancha (2004) and Guni and Katule (2013) reported orange eye colour as most common among the indigenous chickens of Nigeria and Tanzania, respectively. Similar findings were also reported by Ssewanyana et al. (2008) for Ugandan local chickens.

The single and the rose comb type were observed across the study area. The commonest comb-type was single. This observation agrees with the findings of Ikeobi et al. (2001) who reported that among the rose, walnut and pea, single is the most common comb-type in Nigeria. These differences are probably the usual differences observed between and within free-ranging local chickens in different geographical locations (Msoffe et al., 2002). Similarly, the fact that single combed chickens were predominant followed by those possessing rose and pea combs tallies with the reports of Ikeobi et al. (2001) and Mancha (2004) on indigenous chickens of Nigeria. The high variation in plumage and shank colour and comb type reported in this study is consistent with the findings of McAinsh et al. (2004) who stated that variation in phenotype is exactly what characterizes local chickens. They further stated that this is probably an expression of high variability at the genotype level.

Feather type

The normal feather type is more dominant across the three local government areas were 80%, 78.33%, and 86.44% for Oye, Ikole, Ekiti east local governments, respectively. This indicates that most farmers in the study areas (Oye, Ikole, Ekiti east local governments) keep the normal feathered type of chicken. However, the frizzled feather chicken is less dominant across the study areas. Equal numbers of male and female chicken were studied from the indigenous chicken population.

Four shank colours were observed in the three study areas (cream, yellow, brown and black). Across Oye, Ikole, and Ekiti East local governments, the yellow colour shank is most dominant (54.24%, 65%, and 61.67%, respectively) whereas the brown colour is less dominant in the three study areas. Dana et al. (2010) in Ethiopia and Daikwo et al. (2011) in Dekina, Nigeria, observed predominantly yellow shanks among indigenous chickens. The shank colour is significant across the three local governments.

Table 1. Plumage colour characteristics of indigenous chickens in the study areas

Locations / Plumage colour	Oye		Ikole		Ekiti East	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Brown	5	8.33	6	10	7	11.67
White	9	15	11	18.33	9	15
White/blk/br	12	20	16	26.67	18	30
Black	10	16.67	8	13.33	8	13.33
White/black	10	16.67	6	10	5	8.33
Brown/black	11	18.33	6	10	6	10
White/brown	3	5	7	11.67	7	11.67
P value: 0.498						

blk: Black, br: Brown

Table 2. Morphological characteristics of the head region of indigenous chickens in the study area

Locations / Eye colour	Oye		Ikole		Ekiti East	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Yellow	22	36.67	12	20	15	25
Orange	28	46.67	36	60	33	55
Red	10	16.67	9	15	9	15
Brown	0	0	3	5	3	5
Comb type						
Single	54	90	47	78.33	46	76.67
Rose	6	10	13	21.67	14	23.33

Table 3. Morphological characteristics of the sex and feather type of indigenous chickens in the study area

Locations / Sex	Oye		Ikole		Ekiti East	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Male	30	50	30	50	30	50
Female	30	50	30	50	30	50
Feather type						
Normal	48	80	47	78.33	51	86.44
Frizzled	12	20	13	21.67	14	13.56
P value for sex: 1.00, P value for feather type: 0.163						

Table 4. Morphological characteristics of the leg region of indigenous chickens in the study areas

Locations / Shank colour	Oye		Ikole		Ekiti East	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Cream	14	27.73	0	0	3	5
Yellow	32	54.24	39	65	37	61.67
Brown	1	1.69	0	0	0	0
Black	12	20	21	35	20	33
P value < 0.001						

Clutch size

Table 5 indicates that most female animals (hen) lay 8eggs per clutch which implies that they are less productive which can be as a result of poor feeding and management. Deneke et al. (2014), however, reported that 15 eggs in a clutch size of chickens were sampled in South-Eastern Ethiopia. Mean phenotypic variants of quantitative body measurements. There were no significant differences ($p > 0.05$) across the local governments for body weight, shank length, comb length, chest length and comb height. The beak length and the body length were significant ($p < 0.01$). The body weight ranged from 1.06-1.08 kg. Oye and Ekiti East local government had the highest ($p > 0.05$) similar value 1.08 kg while Ikole local government had the least value (1.06 kg). The bodyweight obtained in this study showed that the local chickens in the study area are of the light ecotype class, which was significantly lower than the value of

1.22kg obtained by Deneke et al. (2014). The study further revealed that the local chickens of Oye, Ikole, Ekiti East local government areas of Ekiti state have not undergone appreciable gene mixing with the exotic breeds, otherwise their body weight could have been high. Aganga et al. (2000) attributed low live weight in indigenous chicken to poor management. The shank length varied from 13.69 - 13.71 cm. Ikole local government had the highest value 13.86 cm ($p > 0.05$) followed by Oye local government with 13.71cm whereas Ekiti East has the least value (13.69 cm). The comb length ranged from 4.56-5.15 cm. Ikole local government had the highest similar value ($p > 0.05$) 5.15 cm, followed by Ekiti east local government with 5.12 cm while Oye local government has the lowest value of 4.56 cm. The beak length ranged from 2.36 - 2.67 cm. Ekiti east had the highest value ($p < 0.01$) 2.67 cm, Ikole had the value of 2.66 cm whereas Oye local government had the least value of 2.36. The body length varied from 38.55-43.50 cm. Ikole local government had the highest value ($p < 0.01$) 43.50 cm; Ekiti east had the value of 43.23 cm while Oye local government had the least value of 38.35 cm. The chest length varied from 13.63 - 14.14 cm. Ikole local government had the highest value ($p > 0.05$) 14.14 cm whereas Oye local government had the lowest value of 13.63 cm and Ekiti east had the value of 14.03 cm. The comb height ranged from 2.14-2.51 cm. Ekiti east had the highest value ($p > 0.05$) 2.51 cm followed by Ikole local government which had 2.49 cm while Oye local government had the least value of 2.14 cm.

Table 5. Clutch size of indigenous chicken in the study areas

Locations / Clutch Size	Oye		Ikole		Ekiti East	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
5	0	0	3	5	0	0
6	2	3.33	2	3.33	6	10
7	5	8.33	3	5	6	10
8	13	21.67	11	18.33	10	16.67
9	5	8.33	7	11.67	4	6.67
10	4	6.67	4	6.67	5	8.33
12	1	1.67	1	1.67	0	0

Table 6. Mean phenotypic variants of quantitative body measurements of indigenous chicken in the study areas

Locations / Parameters (cm)	Oye	Ikole	Ekiti East	Pr(Value)
Body Weight (kg)	1.08 ± 0.03	1.06 ± 0.02	1.08 ± 0.03	0.922
Shank length	13.71 ± 0.17	13.86 ± 0.19	13.69 ± 0.19	0.773
Comb length	4.56 ± 0.30	5.15 ± 0.27	5.12 ± 0.26	0.241
Beak length	2.36 ± 0.06^{b}	2.66 ± 0.04^{a}	2.67 ± 0.04^{a}	< 0.05
Body length	38.35 ± 0.49^{b}	43.50 ± 0.65^{a}	43.23 ± 0.64^{a}	< 0.05
Chest length	13.63 ± 0.22	14.14 ± 0.24	14.03 ± 0.25	0.279
Comb height	2.14 ± 0.17	2.49 ± 0.17	2.51 ± 0.16	0.212

Means bearing different superscripts in a row differ significantly ($p < 0.05$)

Table 7. Correlations between body and egg parameters of indigenous chicken in the study areas

Parameters	Shank length	Comb height	Comb length	Beak length	Body length	Clutch size	Body weight
Shank length	1^{ns}						
Comb height	0.56011^{**}						
Comb length	0.34473^{**}	0.61522^{**}					
Beak length	0.22615^{*}	0.18936^{*}	0.31107^{**}				
body length	0.40305^{**}	0.54062^{**}	0.44062^{**}	0.08524^{ns}			
Clutch size	-0.42005^{**}	-0.43807^{**}	-0.46764^{**}	-0.22827^{*}	-0.33335^{**}		
Bodyweight	0.22251^{*}	0.27727**	0.34292^{**}	0.17206^{*}	0.27016^{**}	0.36718^{**}	1^{ns}

**: Correlation is significant at 0.001 probability level, *: correlation is significant at 0.05 probability level; ns: Not significant

Correlations between body parameters

Correlation coefficients between body and egg parameters are shown in Table 7. The magnitude of the value of the parameters between shank length and comb height (r = 0.560011), between shank length and comb height (r = 0.034473), between shank length and body length (r = 0.40305), between comb height and comb length (r = 0.61522) and between comb height and body length (r = 0.54062) were positive and significant ($p < 0.05$) There was also a positive and significant relationship between comb height and body weight and between clutch size and body weight (r = 0.34292, 0.36718). Between shank length and beak length, between shank length and body weight, between comb height and beak length and between beak length and body weight there was positive and significant ($p < 0.05$) correlation coefficients (r = 0.22615, r = 0.22251, r = 0.17206) respectively. The parameter between shank length and clutch size, between comb height and clutch size and between comb length and clutch size had a negative and significant ($p < 0.05$) with correlation coefficients (r = -0.42005, r = -0.43807, r = -0.33335) respectively. However, the correlation between beak length and clutch size was negative (r = -0.33335) and still significant ($p < 0.05$). Similarly, the positive correlation between body length and shank length is also an indication that they could be used complimentarily in selection. The results of this study are similar to reports by Mancha (2004). However, the negative correlations between clutch size and shank length, and between clutch size and shank length are indications that shank length may not be suitable for improving both egg weight and clutch size.

CONCLUSION

The study showed wide variations among the traits considered among the indigenous chickens in the study area. The study reveals phenotypic variability which is affected by both genetic and environmental factors with Ikole and Ekiti East local government having better phenotypic variants of quantitative body measurements than Oye Ekiti. Considering the hardy nature and productive performance of these chickens they have vast potential for subsequent breeding works. The performance of the local chickens can be enhanced greatly with improvement in basic management systems given. The local chickens are also responsive to genetic improvement for increased body weight and egg production. Performance of the local chickens can be enhanced greatly with improvement in basic management systems given which will enhance the responsiveness to genetic improvement for increased body weight and egg production.

DECLARATIONS

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Adeola Oyebanji collected the samples, carried out the fieldwork, and wrote the first draft. Anthony Ekeocha, Ademiju Adeolu Aganga, Festus Adeyemi Adejoro, Oluwadele Joshua Femi and Olayinka Mariam Tawose supervised the overall research and revised the draft and final script approved by the authors.

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Ethical considerations

Ethical issues including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been checked by the authors.

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