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MORPHOLOGICAL AND EGG CHARACTERISTICS OF INDIGENOUS CHICKEN IN EDO STATE, NIGERIA

BY

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ABSTRACT

Morphological, reproductive and egg quality data were obtained to phenotypical characterize indigenous chicken reared extensively in Edo State, Nigeria. The study was carried out between August and October 2004. The data obtained were on body weight (BWT), body linear measurements, which include: shank length (SKL), thigh length (THL). Breast length (BTL), wing length (WGL) and comb length (CBL), reproductive traits such as no of egg per clutch (NEC), clutch period (CPD) and hatchability (HB), and egg quality traits as egg weight (EWT), egg length (ELT), egg width (EWT), egg shell thickness (EST), egg shell weight (ESW), egg yolk weight (EYW), egg albumen weight (EAW) and yolk colour score (YCS). Qualitative traits studied were plumage colour, comb shape, ear lobe colour and shank colour.

Morphologically, adult indigenous chicken had mean value of 1.01(kg), 7.00(cm), 8.82(cm), 12.61(cm) and 3.43(cm) for BWT, SKL, THL, BTL, WGL and CBL respectively. Mean value obtained for reproductive traits were 8.39, 12.31(days) and 76.70(%) for number of eggs per clutch, clutch period and hatchability respectively while mean value of 34.90(g), 5.50(cm), 3.66(cm), 0.31(mm) and 8.60 were obtained for EGW, ELL, EWT, EST and YCS respectively.

Three feather type (smooth, frizzle and naked neck), four plumage colour (Brown, Black, mixture and white), four comb shape (single, pea, walnut and comb less), three shank colour (white, yellow and black) and three ear lobe colour (red, white and black) were identified to exist in the indigenous chickens. Body weight and body linear measurements were positively and significantly correlated ($P<0.05$). Reproductive traits showed no relationship with other traits. Egg quality traits exhibited significant correlation coefficient ($P<0.05$) only among themselves. Indigenous chicken showed wide morphological differences that can be exploited for the development of new breeds and strains.

Key words: morphology, egg, characteristics, indigenous chicken

INTRODUCTION

Indigenous chickens are those chickens that belong to an area where they have evolved; they are also called native chicken or local chickens (FAO, 2001; Adene, 2004). The indigenous chicken exhibit large variation in body size, plumage colour, feathering pattern, eggshell colour, ear lobe colour and shank colour. Inspite of the fact that they are mostly unimproved and uncharacterized, their contribution in terms of meat and egg supply cannot be overlooked. Indigenous chickens represent valuable resource for livestock development because their extensive genetic diversity allows for the rearing of poultry under varied environmental conditions, providing a range of products and functions.

Poultry is efficient in transforming feed into human food, requires low capital investment in comparison with the larger animal, no religion or social taboos and its products do not require storage and preservation facilities. These qualities have made it attractive in the context of poverty alleviation and quality protein supply in

Sub Saharan Africa (Tedelle, *et al.*, 2003). Indigenous chickens have not been characterized properly in different ecological zone in Nigeria. Information about this genetic resource is meagre. Available information in the literatures have variously described indigenous chickens due to considerable variations in the composition of their plumage, shank, beak and ear lobe colour (Oluyemi and Roderts, 1979; Missohou *et al.*, 1998; Benabdeljelil and Arfaoui, 2001). Such qualitative traits have also been reported to influence production and were also used in phenotypic characterization (Shanawany and Benerjee, 1991; Missohou et al., 1998). Body weights of indigenous chickens have been reported to range between 1.33 and 1.76kg for male and 1.40 and 1.50kg for females with improved management system adopted affecting body weight (Sonaiya, 2002). Studies on their reproductive performance showed that an indigenous hen had average production of 40 eggs of 45 50g in two cycles a year with hatchability rate of 60 100% (Branckaert, 1997; Adebambo, 2003). But, under improved management egg production could be as high as 80 120 per year (Adene, 2004). These qualities can be improved on based on empirical evidence especially in Nigeria were poultry is seen as the quickest source of quality protein to humans. To aid in the selection of breeding stock, egg production and other qualities are considered. This study was therefore undertaken to provide information through a field study for the morphological characterization of the Nigeria indigenous chicken and their eggs.

MATERIALS AND METHODS

Description of location

Data were obtained from indigenous chicken population in four locations in Edo State, Nigeria, which lies between long 06° 04'E and 06° 43'E and lat. 05° 44'N and 07° 34'N of the equator. The climate is of the lowland tropical rainforest type with distinct wet and dry seasons. The mean annual temperature is 27°C with relative humidity over 75%. Mean annual rainfall exceeds 2000 mm (Udo and Mamman, 1993). Edo state is divided into three geo-political zones called senatorial districts that are subdivided into local government areas. The locations used for the study are Ekosodin and Uwan in Ovia North-East local government area and Iyanomo and Ugbekun in Ikpoba-Okha local government area, all in Edo south senatorial district. The locations are rural communities where Agriculture is the main occupation. Livestock including poultry are kept in free range and extensive system of production.

Study Animals

The chickens from which the data were obtained were the indigenous chicken population reared extensively in the different locations. The birds were left to roam freely during the day and scavenge for food from refuse dumps and green vegetations. Their feeds were occasionally supplemented with kitchen waste, agro-byproducts and residues.

Housing for the birds usually consist of kitchen sheds, basket (woven) and cages and in most cases adult chickens sleep or roost on trees at night. There is no planned breeding programme instead the males run with the females and mating is natural. Reproduction, selection, incubation and brooding are left strictly to the birds.

Data Collection

Data were obtained from 502 indigenous chickens consisting of 189 males and 313 females. This was carried out between

August and October 2004. The indigenous chickens were caught when they roost at night and information on body weight, body measurements, reproductive and qualitative traits were obtained from them. Body measurements studied were shank length (SKL), thigh length (THL), breast length (BTL), wing length (WGL) and comb length (CBL). The reproductive traits were number of eggs/clutch (NEC), clutch period (CPD) and hatchability (HB). Hatchability was estimated as number of eggs hatched divided by NEC multiply by 100. Qualitative traits were plumage colour (PLC), comb shape (CBS), ear lobe colour (ELC) and shank colour (SKC). Forty-eight indigenous chicken eggs (10, 15, 12 and 11 from Ekosodin, Iyanomo, Ugbekun and Uwan respectively) were also collected for egg quality traits determination. Egg quality traits determined were egg weight (EWT), egg length (ELT), egg width (EWH), eggshell thickness (EST), eggshell weight (ESW), egg yolk colour score (YCS), egg yolk weight (EYA) and percent egg albumen weight (EAP). Internal egg quality traits were obtained after separating the yolk from the white when the eggs were cold. To separate, the egg is cracked in half and the white drain into a dish by transferring the yolk between the two halves of the shell. Thereafter, the yolk was placed in a second dish.

The qualitative traits (PLC, CBS, ELC and SKC) were observed and recorded. Body weight was measured using a simple spring platform scale of 0.05kg accuracy. Body measurements were taken with a measuring tape (Butterfly brand). Egg weight, eggshell weight, albumen weight and yolk weight were measured with an electronic weighing balance (Mettler PM 4800 Delta Range) to an accuracy of 0.01g. Egg length and width were measured with a vennier caliper to the nearest 0.01cm. Eggshell thickness was measured in mm as the average thickness of five pieces of eggshell obtained from each pole and 3 pieces at the centre at the widest diameter of the egg using a micrometer screw guage to the accuracy of 0.01mm. Roche Yolk Colour Fan scored egg yolk colour subjectively. The yolk was viewed through the leaves held above it to determine colour match. Similar egg quality traits were obtained from 20 eggs of commercial poultry birds reared at the University of Benin Farm Project for comparison.

Statistical Analysis

Discrete measurements on the form and appearance of the birds were analyzed using the frequency procedure of SAS (1999). Least squares analysis of variance of the discrete measurements on weight, linear measurements and egg quality traits was done using the general linear model (GLM) procedure of the statistical analysis system (SAS, 1999). The main fixed effects fitted for the body measurements, reproductive traits and egg quality traits included the discrete effects of sex (male, female), plumage colour (brown, black, mixed), comb shape (single, pea, walnut, comb less) and shank colour (white, yellow, black), found significant ($P<0.05$) in preliminary analyses represented as

$$Y_{ijkl} = +S_i + PC_j + CS_k + SC_l + E_{ijkl}$$

Where Y_{ijkl} = observed value of phenotypic trait

μ = Overall mean

S_i = effect of the ith sex (i = 1,2)

PC_j = effect of the jth plumage colour (j=1,2,3,4)

CS_k = effect of the kth comb shape (k = 1,2,3,4)

SC_l = effect of the lth shank colour (l =1,2,3)

E_{ijkl} = random residual error normally distributed with zero mean, variance

RESULTS AND DISCUSSION

The frequency distribution pattern of the qualitative traits of indigenous chicken found in Edo State, Nigeria is presented in Table 1 while mean value for body weight and body measurements is in Table 2 respectively.

Table I. Frequency distribution of qualitative trait in indigenous chicken in Edo State, Nigeria.

Variables	No.	Percentage Freq.
Feather type		
Normal	355	73
Frizzled	92	18
Naked neck	45	9
Plumage Colour		
Brown	311.	62
Black	111	22
Mixture	65	13
White	15	3
Comb Shape		
Single	462	92
Pea	20	4
Walnut	10	2
Comb less	10	2
Shank Colour		
White	206	41
Yellow	151	30
Black	145	29
Ear Lobe Colour		
Red	301	60
White	196	39
Black	5	1

Table 2. Mean value of some body measurements and reproductive traits

Traits	Mean	SD	CV%
BWT(kg)	1.01	0.19	15.00
SL(cm)	7.00	1.12	12.61
TL(cm	11.70	2.28	17.37
BL(cm)	8.82	1.54	15.83
WL(cm)	12.61	1.70	11.36
CL(cm)	3.43	1.65	18.77
NEC(no)	839	1.91	28.97
CP(days)	12.31	2.83	21.95
H(%)	76.70	16.94	24.03

BWT = body weight, SL = Shank length, TL = thigh length, BL = breast length, WL = wing length, CL= comb length, NEC = number of eggs Per clutch, CP = clutch period, H = hatchability.

Qualitative Description.

Feather type

Feather type distribution revealed that more of the chickens were smooth feathered, followed by frizzle and lastly naked neck with percentage distribution of 72.7, 18.3 and 9.0% respectively. The low percentage occurrence of the frizzle and naked neck may have resulted from unconscious selective breeding of the Edo people who preferred smooth feathered chicken at the expense of frizzle and naked neck for aesthetic reasons. If such trend continues, a time will come when the frizzle and naked neck will be extinct and their good qualities lost completely. Such situation calls for conservation/preservation of these endanger feather type as they may have some advantageous qualities peculiar to them as was also advocated by Sonaiya (2002).

Plumage Colour

Four plumage colour patterns were observed among the native chicken. They were brown, black, white and mixture with

percentage frequency distribution of 62.0, 22.0, 13.0 and 3.0% respectively. The low relative frequency of the white plumage colour can be attributed to the fact that white birds (especially cocks) are important items in traditional religious rites of the Edo's and secondly since this colour is predominant with the male birds they are readily sold or slaughtered. However, Nwosu and Omeje (1985) observed that the variation in plumage colour of birds was due to lack of conscious selection or breeding programme towards choice of colour. The large variation in plumage colour the indigenous chicken population is indicative of unconscious selection effort (Odubote, 1994). Selection for breeding with the aim of developing breeds and/or strains along the different colours observed is feasible as had been done on the indigenous chickens of Iraq (Al-Rawi and Al-Athari, 2002) and Ethiopia (Shanawany and Benerjee, 1991).

Comb Shape

Three comb shapes (single, walnut and pea) were observed. Single comb shape predominates with a percentage frequency of 92% followed by pea (4%) and walnut (2%) while 2 percent of the birds were comb-less. The high frequency of the single comb shape showed that indigenous chickens are mainly recessive for comb shape. If the heterozygous genotype has any relative advantage, improvement of the indigenous stock will be slow since only 4 percent possessed the pea comb shape that is generally regarded as the dominant comb shape. The comb-less birds observed are not surprising as similar observation was made by Somes (1993) in the Dutch Breda.

Shank and Ear Lobe Colour

Shank colours observed were white (41%), yellow (30%) and black (29%). Three ear lobe colours were noted. They are red (60%) white (39%) and black (1%). The high frequency of white shank and red ear lobe colours observed in this study is in line with the report of Oluyemi and Roberts (1979) and Smyth (1990). They observed white shank, red and white earlobes were dominant in the domestic fowl. The red ear lobe colour was attributed to the unmasked vascularization of the cutaneous tissue.

Physical Description

Mean, standard deviation and coefficient of variation of body measurements of the chickens are presented in Table 2. Mean body weight was found to be 1.01kg with CV of 15%. It fits well with 1.00kg reported by Adene (2004) but lower than 2.1, 1.65, 1.90 and 1.90kg reported by Marle-koster and Casey (2001) for four lines (Koek Koek, Naked neck, Lebowa-Venda and Ovambo respectively) of native chicken in South Africa. The higher value of Marle-koster and Casey (2001) was expected because these particular native chickens were genetically improved and were reared under intensive system of production. Shank length, thigh length, breast length, wing length and comb length showed CV of less than 20 percent while the number of eggs per clutch, clutch period and hatchability had higher variability of over 20 percent. Sex significantly influenced the measurements with male birds being significantly bigger ($P<0.05$) in all the body measurements (Table 3). Similar observation was reported by Adebambo (2003). Plumage colour only had influence on breast length (BTL), wing length (WGL) and comb length (CBL) with white coloured birds having higher values. The high values obtained for white birds suggest that with improved management and

selection, the white birds could be a good colour for indigenous broiler type. This may explain however, why broiler chickens are mainly white. The use of colour specificity for strains and functional identification in exotic chicken as reported by Adebambo *et. al.*, (1999) can also be exploited in the local chicken. Even in Ethiopia, chicken genotyping based on feather colour have been in practice (Shanawany and Banerjee, 1991).

Table 3. Least Square means of some body measurements and reproductive traits of indigenous chicken as influence by sex feather type, plumage colour: comb shape, ear lobe colour

Variables	Sub-less	Traits								
		BWT	SKL	THL	BTL	WGL	CBL	NEC	CHP	HB
Sex	Male	1.15[a]	7.93[a]	13.54[a]	9.24[a]	13.81[a]	5.56[a]	-	-	-
	Female	0.96[b]	6.62[b]	10.95[b]	8.65[b]	12.11[b]	2.54[b]	8.39	12.31	76.70
Plumage colour	Brown	1.00	7.18	11.70	8.65[b]	12.80[b]	3.43	8.22	11.79	75.14
	Black	0.99	6.82	11.82	8.82[b]	12.02[b]	3.05[b]	8.95	13.24	77.05
	White	1.12	7.00	9.87	11.17[a]	14.67[a]	5.50[b]	9.50	14.33	86.00
	Mixture	1.07	6.50	11.88	9.08[b]	12.23[b]	3.59	7.36	11.93	80.91
Comb shape	Single	1.00	6.97[b]	11.70	8.81	12.56	3.42[b]	8.40	12.26	76.58
	Pea	1.16	6.88[b]	11.00	9.38	12.75	3.00[b]	8.17	13.33	79.37
	Walnut	1.23	8.75[a]	13.00	8.00	14.50	4.75[a]	-	-	-
	Comb less	1.16	6.89[b]	11.20	8.75	13.00	3.50[b]	-	-	-
Ear lobe colour	Red	1.07	7.13	11.80	8.93	12.66	3.60	8.54	12.86	78.77
	White	1.00	6.79	11.54	8.60	12.51	3.11	8.15	11.58	74.38
	Black	1.00	7.50	12.00	11.00	13.50	3.50	10.00	14.00	70.00
Shank colour	White	1.02	6.96	11.65	8.54	12.47	3.16[b]	7.95	11.74	75.39
	Yellow	1.03	7.42	12.13	9.16	13.38	4.29[a]	8.58	12.27	73.02
	Black	0.98	6.60	11.36	8.95	12.05	2.92[b]	8.88	13.10	80.50

Therefore breed classification and breed development based on plumage colour is a potential possibility for native chickens found in Edo State, Nigeria. Comb shape had influence ($P<0.05$) on shank length (SKL) and comb length (CBL). Birds with walnut comb shape generally had higher values that were significantly different from other comb shaped birds. Walnut being the heterozygote cross between rose and pea can be said to have exhibited heterotic advantage over the pea and single that is however expected. Though, the relationship between comb shape and reproduction has not well be established but some relationship exist between them (Somes, 1993) which therefore suggest that birds with walnut comb shape will tend to produce more than other comb shape. The only egg quality trait influenced by plumage colour was eggshell thickness (EST) with mixed coloured birds having the highest mean value of 0.28mm (Table 4). This value is however lower than 0.33mm

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A comparative mean value of eggs from indigenous and exotic chicken presented in Table 5 showed that egg quality values obtained for the exotic chicken were generally higher and significantly different ($P<0.05$) from value obtained for local chicken. Mean value obtained for the different variables were similar to values reported by Ibe (1992) and Peters *et al.* (2002).

Table 4. Least square means of egg quality traits as influenced by shank colour, ear lobe colour and plumage colour.

Variables	Sub class	Traits						
		EWT	ELT	EWT	EST	ESW	EYW	EAW
Plumage Colour	Brown	33.49	5.10	3.69	0.34[a]	4.37	12.98	17.97
	Black	33.39	4.95	3.71	0.34[a]	4.29	12.02	16.95
	Mixture	36.35	4.90	3.80	0.28[b]	5.15	14.15	17.05
Shank Colour	White	37.06	5.19	3.78	0.36	4.72	13.89	18.56
	Yellow	33.53	5.20	3.85	0.32	3.97	11.93	17.48
	Black	33.32	4.82	3.56	0,32	4.23	12.32	16.65
Ear Lobe Colour	Red	34.81	5.01	3.64	0.33	4.22	12.59	17.81
	White	35.30	9.08	3.76	0.34	4.58	13.00	17.53

EWT = egg weight, ELT = egg length, EWT = egg width, EST = egg shell thickness ESW = egg shell weight, EYW = egg yolk weight, EAW = egg albumen weight, YCS = yolk colour score.
Means on the same column within subclass with different super script are significantly different ($P<0.05$).

Table 5. Comparison of egg quality traits of indigenous and Exotic chickens

Traits	Indigenous	Exotic
Egg weight (g)	34.91 [b]	63.96 [a]
Egg length (cm)	3.05 [b]	5.88 [a]
Egg width (cm)	3.66 [b]	4.43 [a]
Egg shell thickness (mm)	0.31 [b]	0.37 [a]
% egg shell weight	12.00 [a]	11.07 [b]
% egg yolk weight	39.73 [a]	26.23 [b]
% egg albumen weight	46.85 [b]	62.36 [a]
Yolk colour score	8.60 [a]	3.40 [b]

Means on the same row with different super script differ significant (P<0.05).

Significant difference in eggshell thickness may be due to the fact that the exotic birds were fed with diets containing enough calcium and phosphorus compared to the indigenous chicken that had to scavenge for feed, which may lack calcium and phosphorus. These are very important minerals required for bone and thick eggshell formation.

The better egg yolk colour score of the indigenous chicken can be attributed to the green vegetation consumed as they scavenge converting the pigments in the green vegetation to brighter yolk colour.

The result of the relationship between body measurements and egg quality traits as presented in Table 6 showed that all linear body measurements correlated significantly (P<0.05) with body weight of birds. The highest correlation coefficient of 0.714 and the least value of 0.232 were obtained for the relationship between body weight and wing length and breast length respectively. Similar values were reported by Gueye *et al.*, (1998). Reproductive traits showed no significant relationship among themselves and neither with other traits. Though, egg quality traits had no significant relationship with body measurements and reproductive traits, they exhibited both positive and negative significant relationship (P<0.05) among themselves. Peters *et al.* (2002) obtained similar results. The traits (linear measurements, reproductive traits and egg quality traits) were mutually exclusive.

CONCLUSION

The indigenous chicken as a repository of unexploited germ plasm holds the feature of poultry industry which calls for exploitation and subsequent development through an articulated and well-planned improvement programme rather than gradual adulteration with indiscriminate mating with exotic strains as presently done by backyard farmers. The low frequency occurrence of some qualitative traits that could be used in selection calls for conservation programme in order to conserve and preserve these rare traits.

Table 6. Correlation coefficients between body weight, body measurements, reproductive traits and egg quality traits of indigenous chicken in Edo State, Nigeria.

	TRAIT																
	BWT	SKL	THL	BTL	WGL	CBL	NEC	CPD	H	EWT	ELT	EWD	EST	ESW	EYW	EAW	YCS
BWT		0.38**	0.23*	0.23*	0.42**	0.53**	-0.04	-0.13	0.22	0.03	-0.29	-0.19	-0.40	-0.03	0.19	0.12	-0.15
SKL			0.74*	0.32*	0.71*	0.60*	0.12	0.12	0.05	0.12	-0.12	-0.10	-0.30	0.22	0.18	0.02	-0.28
THL				0.34*	0.48**	0.50**	-0.21	-0.15	-0.09	-0.18	-0.43	-0.08	0.25	0.23	-0.18	0.26	0.14
BTL					0.30*	0.30*	0.07	0.15	0.04	-0.29	-0.27	0.10	0.36	-0.04	-0.22	0.37	-0.13
WGL						0.64*	0.05	0.02	0.17	0.06	-0.06	-0.01	-0.02	0.28	0.09	0.06	-0.13
CB							0.19	0.19	0.05	0.52*	-0.19	-0.18	-0.30	0.03	0.01	0.01	0.01
NEC								0.73*	0.06	-0.21	-0.11	-0.14	0.36	-0.32	-0.22	0.28	-0.61
CPD									-0.03	-0.14	0.16	0.21	0.15	-0.09	-0.02	0.19	-0.78*
H										-0.11	0.05	-0.09	-0.18	-0.27	-0.14	0.18	-0.28
EWT											0.68*	0.76*	-0.12	0.82*	0.92**	0.88**	-0.09
ELT												0.81*	-0.27	0.38	0.52	0.78*	0.54
EWD													-0.02	0.69*	0.62*	0.75*	-0.46
EST														013	-0.05	0.23	-0.14
ESW															0.76*	0.59*	0.03
EYW																0.63	-0.05
EAW																	-0.19
YCS																	

**P<0.01 *P<0.05

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