Farmers' choice of breeding stock and trait preferences in tropically-adapted chickens in five agro-ecological zones in Nigeria

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Abstract
This study aimed at determining chicken genotypes of choice and traits preference in chickens by smallholder farmers in Nigeria. Data were obtained from a total of 2,063 farmers using structured questionnaires in five agro-ecological zones in Nigeria. Chi square ($\chi 2$) statistics was used to compare categorical variables. Ranking of the six genotypes and twelve traits of preference was carried out using the non-parametric Kruskal–Wallis H and Friedman tests. Categorical principal component analysis (CATPCA) was used to assign farmers into groups. With the exception of Shika Brown, preferences for chicken genotypes were significantly ($P \leq 0.01$) influenced by agro-ecological zone. Overall, FUNAAB Alpha, Sasso and Noiler chicken were ranked 1st, followed by Kuroiler (4th), Shika Brown (5th) and Fulani birds (6th), respectively. Across genotypes, preferences for traits varied significantly ($P \leq 0.005$ and $P \leq 0.01$). Traits of preference for selection of chicken breeding stock were body size, egg number, egg size and meat taste. The two PCs extracted, which explained 65.2% of the variability in the dataset, were able to assign the farmers into two groups based on preference for body size of cock and hen and the other ten traits combined. The present findings may guide the choice of appropriate chicken genotypes while the traits of economic importance may be incorporated into future genetic improvement and conservation programmes in Nigeria and in Sub-Saharan Africa.
Keywords: Chicken, traits, non-parametric, multivariate analysis, Nigeria

Introduction
Smallholder poultry sub-sector in Sub-Saharan Africa is beset with myriad of problems among which are poor nutrition, limited technical know-how, vagaries of climatic factors, slow-growth, low meat yield, small size/number of eggs, low-input and high mortality. In order to address the factors militating against high chicken production and productivity at the smallholder level, research efforts in the area of genetics and breeding amongst others have been made in the past three decades (Sonaiya, 2016). One of such is the development of chicken genotypes that are adapted to the prevailing tropical conditions (Adebambo *et al*., 2018). However, it has been reported that the proper identification of appropriate chicken breeds that will be suitable to a particular environment or agroecological zone in Nigeria is required for

the growth and development of the poultry industry. Such decision is expected to be based on farmers' choice especially at the smallholder level using the bottom-top approach. This, coupled with farmers' traits of preference, may be valuable inputs for appropriate design and implementation of agro-ecologically friendly and sustainable genetic improvement programmes. Under the African Chicken Genetic Gains (ACGG) project, Kuroiler and Sasso birds (foreign, but tropically-adapted genotypes) alongside the genotypes developed in Nigeria (Fulani, FUNAAB alpha, Noiler and Shika Brown) were tested in five agroecological zones of Nigeria. This paper reports a study aimed at evaluating choice of chicken genotypes and trait preferences by ACGG participating smallholder chicken farmers in Nigeria. This may assist in future research efforts on genotypes and traits of economic importance by private and public intervention programmes geared towards boosting smallholder chicken production.

Materials and Methods

The post on-farm data collection study was conducted in five agro-ecological zones under the ACGG project in Nigeria. The birds (Sasso, Kuroiler, Fulani, Shika Brown, Noiler and FUNAAB alpha) given to the farmers were managed under the traditional poultry scavenging system in all the five zones. Each zone was represented by a State (Kwara, Rivers, Imo, Nasarawa and Kebbi) and involved a total of 2,063 rural chicken keepers. In each zone, twelve villages, 2 per local government area (LGA) in each of the 3 senatorial districts were randomly selected. Structured questionnaires were used to elicit information on the choice of chicken genotypes and traits of preference in a post on-farm data collection survey. The traits Body Size–Cock (BSC); Body Size–Hen (BSH); Supplementary Feed Consumption–Cock (SFC); Supplementary Feed Consumption–Hen (SFH); Egg Number–Hen (ENH); Egg Size–Hen (ESH); Scavenging Ability–Cock (SAC); Scavenging Ability–Hen (SAH); Meat Taste–Cock (MTC); Meat Taste–Hen (MTH); Ease of Sales–Cock (ESC) and Ease of Sales–Hen (ESH) as perceived by the respondents were ranked on a scale of 1 (Like very much), 2 (Like), 3 (Not Important), 4 (Dislike), 5 (Dislike very much), 6 (Not Applicable). Percentage distribution of chicken genotype of choice by the farmers across zones and gender was obtained using Pearson's Chi square. Ranking of the five genotypes in order of preference by farmers and of the traits of economic importance was carried out using the non-parametric Kruskal–Wallis H and Friedman tests followed by Mann–Whitney U and Wilcoxon Signed-rank tests for Post hoc analyses. In order to explore hidden patterns of trait preferences for appropriate grouping of the respondents, categorical principal component analysis (CATPCA) procedure was used. SPSS (2015) statistical package was employed in the analysis.

Results and Discussion

The preference for a chicken genotype was significantly ($P \leq 0.01$) influenced by agroecological zone with the exception of Shika Brown (Table 1) with FUNAAB Alpha, Sasso and Noiler chicken ranked 1st, followed by Kuroiler (4th), Shika Brown (5th) and Fulani (6th), respectively (Table 2). The high preference for FUNAAB Alpha, Sasso and Noiler birds in the present study could be due to their desirable performance in the field. This could have been influenced mainly by their body size and egg number (Table 3). Although Kuroiler was ranked fourth, it was able to compete well with Sasso and Noiler chicken. This implies that in the case of non-availability of the latter, Kuroiler could be a good substitute. The low ranking of Shika Brown might be attributed to the fact that the breed was developed mainly for egg production unlike others that are dual-purpose. The least preference for Fulani chicken could be as a result of its low productivity compared to other genotypes. However, this genotype is renowned for its high adaptability to the prevailing hot-dry tropical environment of Nigeria (Yakubu and Ari,

2018) and good scavenging ability. Some of the merits indicated by farmers for the choice of a particular genotype in the current study are similar to the egg productivity and body size traits reported by Sisay *et al*. (2018). Gender differences (Table not shown) in the present study as regards the choice of Sasso chicken may be attributed to poultry keeping objectives and varied importance attached to the chicken genotype by both male and female farmers. Traits of preference for selection of breeding stock in the present study were body size, egg number, egg size and meat taste. The observations on body size and egg yield are in consonance with the findings of Mahoro *et al*. (2018) that they are important economic traits to select in the indigenous chicken. Meat quality in form of good taste is an important trait in the poultry industry. It has been recommended that breeding strategies should aim not only at the growth and performance of chicken, but also put into consideration the qualitative aspects of meat (Paiva *et al*., 2018).Two PCs were extracted which explained 65.3% of the variability in the dataset and revealed that irrespective of gender and agro-ecological zone, the farmers in Nigeria can be grouped into two: Those that emphasize BSC and BSH and those that attach more importance to SFC, SFH, ENH, EZH, SAC, SAH, MTC, MTH, ESC and ESH.

Conclusion

The present study revealed equal ranking of FUNAAB Alpha, Sasso and Noiler, followed by Kuroiler, Shika Brown and Fulani chicken across five agro-ecological zones in Nigeria. Traits of economic importance that appeared consistent in selecting breeding stock were body size, egg number, egg size and meat taste. The chicken farmers were distinctly assigned into two groups (body size and non-body size traits) using categorical principal component analysis. These findings when combined with quantitative on-farm data have implications for future breeding programs geared towards increased chicken production and productivity in the tropics using bottom-top approach.

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Table 1. Chicken genotype preference by farmers across zones in Nigeria

	Zone						
	Kwara	Rivers	Imo	Nasarawa	Kebbi		
Factor	No (%)	No (%)	No (%)	No (%)	No (%)	Chi-square	P-value
Genotype							
Shika Brown							
Liked	49 (59.0)	40 (52.6)	60 (72.3)	48 (57.1)	52 (61.9)		
Not Liked	34 (41.0)	36 (47.4)	23 (27.7)	36 (42.9)	32 (38.1)	7.342	0.119^{ns}
FUNAAB Alpha							
Liked	38 (79.2)	40 (90.9)	30 (62.5)	43 (89.6)	42 (87.5)		
Not Liked	10 (20.8)	4 (9.1)	18 (37.5)	5 (10.4)	6 (12.5)	17.671	0.01**
Fulani							
Liked	17 (47.2)	16 (48.5)	3 (8.3)	2 (5.6)	14 (38.9)		
Not Liked	19 (52.8)	17 (51.5)	33 (91.7)	34 (94.4)	22 (61.1)	30.433	0.01**
Kuroiler							
Liked	68 (81.0)	64 (83.1)	74 (88.1)	58 (69.0)	52 (64.2)		
Not Liked	16 (19.0)	13 (16.9)	10 (11.9)	26 (31.0)	29 (35.8)	18.743	0.01**

Sasso							
Liked	62 (73.8)	66 (88.0)	77 (91.7)	67 (79.8)	50 (60.2)		
Not Liked	22 (26.2)	9 (12.0)	7 (8.3)	17 (20.2)	33 (39.8)	30.246	0.01**
Noiler							
Liked	67 (79.8)	47(61.0)	73 (86.9)	74 (88.1)	67 (79.8)		
Not Liked	17 (20.2)	30(39.0)	11 (13.1)	10 (11.9)	17 (20.2)	22.675	0.01**

** Significant at $P \leq 0.01$
^{ns}Not significant

Table 2. Ranking of preferred chicken genotypes by farmers in Nigeria

Genotype	Liked	Not Liked	Mean Rank[v]	Kruskall-Wallis Test	Position
	No (%)	No (%)			
Shika Brown	297 (64.8)	161 (35.2)	1496.65^{c}		5th
FUNAAB Alpha	303 (87.6)	43 (12.4)	1194.98^{a}		1st
Fulani	72 (36.5)	125 (63.5)	1872.32^{d}		6th
Kuroiler	410 (81.3)	94 (18.7)	1277.59^{b}		4th
Sasso	502 (85.1)	88 (14. 9)	1228.00^{ab}		1st
Noiler	475 (84.8)	85 (15.2)	1231.50^{ab}	292. 970**	1st

**Significant at $P \leq 0.01$; Means in columns followed by different letters are different significantly ($P \leq 0.05$)
[v]The lower the mean rank, the more important the genotype

Table 3. Mean ranks of traits preference across six chicken genotypes and their significance level according to Kruskall-Wallis test[v]

	Genotype						
	Shika Brown	FUNAAB Alpha	Fulani	Kuroiler	Sasso	Noiler	
Traits	Mean Rank	Mean Rank	Mean Rank	Mean Rank	Mean Rank	Mean Rank	Kruskall-Wallis Test
BSC	1082.90^{b}	971.94^{a}	1351.16^{c}	1018.16^{ab}	1010.99^{ab}	1012.96^{ab}	40.292**
BSH	1088.59^{b}	974.47^{a}	1230.45^{c}	1023.56^{ab}	1010.54^{a}	1002.51^{a}	21.008**
SFC	1013.94^{b}	991.78^{b}	975.38^{ab}	1014.69^{b}	1096.48^{c}	911.83^{a}	28.286**
SFH	1005.98^{b}	971.39^{ab}	939.06^{ab}	1001.40^{b}	1102.78^{c}	910.31^{a}	32.361**
ENH	801.83^{a}	878.48^{b}	1059.23^{c}	982.83^{bc}	1042.54^{c}	925.90^{b}	49.808**
EZH	821.92^{a}	924.11^{b}	1197.42^{d}	936.70^{bc}	1007.94^{c}	951.92^{bc}	39.894**
SAC	965.69^{ab}	946.06^{a}	885.13^{a}	1033.12^{b}	1068.86^{c}	1021.86^{bc}	16.406**
SAH	982.42^{ab}	912.29^{a}	883.56^{a}	1013.05^{b}	1077.72^{c}	1016.14^{bc}	22.065**
MTC	911.95^{a}	1029.04^{b}	1059.87^{b}	1000.97^{b}	1018.89^{b}	1055.10^{b}	14.402*
MTH	877.24^{a}	970.45^{b}	1012.48^{bc}	1010.54^{bc}	999.60b^{c}	1056.98^{c}	21.744**
ESC	938.38^{a}	973.57^{a}	1164.73^{b}	1015.77^{ab}	1016.11^{ab}	957.03^{a}	14.225*
ESH	933.71^{a}	927.94^{a}	1094.91^{b}	982.25a	1028.14^{b}	926.91^{a}	16.222**

*, ** Asymptotic significance at $P \leq 0.005$ and $P \leq 0.001$, respectively
Means followed by different letters in rows are different. [v]The lower the mean rank, the more important the trait

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