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TITLE: GENETIC CONSERVATION THROUGH EFFECTIVE UTILIZATION OF THE IMPROVED INDIGENOUS CHICKEN BREEDS BY RURAL HOUSEHOLDS IN NIGERIA.

AUTHORS and AFFILIATIONS

AREA AND TOPIC.

GENETIC GAIN-----STRATEGIES FOR LOCAL BREEDS.

- **AVIAN**

PIONEERING IN-THEATRE.

SUMMARY.

Our collection and genetic characterization of various indigenous chicken genotypes in Nigeria started in 1984 at the National Animal Production Research Institute, Shika, Zaria, (Shika Brown) in 1994 at the Federal University of Agriculture, Abeokuta, Nigeria (FUNAAB) and in 2014 in Obafemi Awolowo University, Ile-Ife (FULANI). Collections were screened and characterized for genetic improvement and effective utilization by rural households in Nigeria

With the financial and technical support of the Bill and Melinda Gates Foundation and the International Livestock Research Institute, Ethiopia, respectively, improved chicken genotypes were developed and evaluated alongside some other tropically adapted chicken breeds.

A total of six improved tropically adapted chicken breeds (three Nigerian – Shika Brown, FUNAAB alpha and Fulani; three imported – Kuroiler, Sasso and Noiler) were tested for 52 weeks on-farm, across five agro-ecological zones of Nigeria and on-station in a public University farm and a private farm in Ogun and Oyo States, respectively. Results showed the Nigeria's improved Indigenous chicken breed, the FUNAAB-Alpha, to be of comparable performance with the three imported breeds. It has met with high acceptance and demand after exhibition of the six breeds during the 2017 Science and Technology Expo in Abuja, Nigeria.

Keywords: i*ndigenous chicken, characterization, conservation, genetic improvement, rural household empowerment.*

INTRODUCTION.

Livestock conservation practice is changing rapidly in light of policy developments, climate change and diversifying market demands. The last decade has seen a step change in technology and analytical approaches available to define, manage and conserve Farm Animal Genomic Resources (FAnGR). However, these rapid changes pose challenges for FAnGR conservation in terms of technological continuity, analytical capacity and integrative methodologies needed to fully exploit new, multidimensional data. Poultry breeding has its own several challenges related to methodology, analytical approaches, data management and conservation. Because of the societal value (e.g., socio-economic and cultural) placed on the indigenous poultry breeds by rural communities and society as a whole and their profound population, they cannot be easily wished away from the economy and the production of the rural poor and in essence the economy of any nation. The overall conclusion is that despite the fact that the livestock sector has been relatively well-organized in the application of genetic methodologies to-date, there is still a large gap in its utilization for the improvement of the indigenous chicken genetic resources. The non application of genetic tools to characterize the many non-commercial local breeds, have consistently been hampering the utilization of these resources and more importantly relegating them to the background of been genetically poor.

In the breeding programme, we have endeavored to use both genetic and genomic data as indicators of genetic diversity among our chicken breeds. This has therefore helped in distinguishing Nigeria's indigenous chicken breed for effective conservation, as well as in improved breed development.

The Indigenous Chicken genotypes.

In Nigeria, indigenous poultry breeds development started in our University in 1994 with initial characterization of genetic resources collected all over Nigeria.

In general, an average indigenous fowl in the tropics weighs 0.9 -1.8kg, possesses a well-fleshed, compact body with somewhat light covering of wiry feathers that are free from down. Naked neck is the feature of some of the breeds while upturned feathers are found in some (that is frizzled). Their feather colour is very varied ranging from black to darker or lighter shade of brown intermingled with red or gold. Black is very common while white is unusual. Male characteristics are very marked in the cocks. The females on the other hand, have small heads, they lay 3-6 clutches of 12 -18 eggs per annum. The eggs weigh 33-48g and broodiness is very pronounced. All these fowls are very active and are vigorous foragers that are well adapted to the nutritional and climatic environment of their zone.

Between 1994 and 1999, Students of the Department of Animal Breeding and Genetics, Federal University of Agriculture, Abeokuta were involved in the collection of local chicken varieties from all over the country. These comprised the Normal feathered, Frizzle feathered, Naked Neck and the Fulani types. Collected birds were quarantined and screened for the first 6 months for survival and disease resistance without any form of vaccination (Plate 1).

RESULTS.

The first part of the programme is to determine and define the performance characteristics of the Nigerian indigenous chicken. Genomic evaluation was used to determine inherent variation and diversity, using different biochemical and molecular methods, mtDNA, Microsatellite and Single Nucleotide Polymorphisms (SNPs). However, only the development, multiplication, on-station and on-farm testing trials are to be reported here as well as the generation and characterization of improved lines for effective utilization and the economic empowerment of rural households in Nigeria. The characterization for physical traits of body dimension, egg production and reproduction of the Nigeria's indigenous chickens were carried by Ikeobi et.al., (1996) and Adebambo et. al.,1999; Ozoje et.al., 1999, Peters et.al., 2002a&b) and several postgraduate students in the Department of Animal Breeding and Genetics of the University (Tables 1 to 5). This was followed by the collection of Fulani ecotypes in 2014.

Crossbreeding Effect.

Crossbreeding to improve the body dimension and egg production with the Indian locally bred dual purpose chicken was carried out from 2001 to 2004 (Adebambo 2002, 2008; Adebambo et.al., 2006a &b; 2008). The Indian breed, developed by the Hebbal University in Hessaragatta, Bangalore, India happened to be a dual purpose bird that was attaining 2kg at 20 weeks of age and was laying 180 eggs per annum. It is a multi-coloured bird, developed for the rural poor under village scavenging condition.

The introduction of this bird helped to improve the body weight in 4 generations of selected local chicken and made them to attain a body weight of 1.6 to 2.1 at 20 weeks of age in 3 generations of crossbreeding using Artificial Insemination Adebambo (2007).

Cocks of 62.5% indigenous lines were persistently been used as the Male line on selected females to generate birds with higher body weight at maturity. The females weight varied from 1.6-1.8kg and were laying coloured and bigger sized eggs of 49gm at first lay and 55g at peak and later lay. The local female lines were consistently been used to confer lower age at first egg of 117 to 137days. With consistent selection for bigger body weight and more eggs, emphasis was on individual birds that lay 4 to 6 eggs per bird per week and this has helped to improve the egg production to 200-250 per annum within the 3 generations of 2005 to 2009 (Adeleke et.al., 2006).

While the project has endeavored to separate the genes of Normal Feathering, Frizzle feathering and Naked neck, we have similarly placed more selection pressure on the colour variants with profound increase on weight and reproductive efficiency such as black-splashed green and black splashed gold and barred while the Naked necks and Frizzled feathered were retained as heterozygotes for further breeding purposes. Data collection has been on growth and reproductive performance of various genotypes collected across the country (i.e. egg number, egg weight, growth performance, feed conversion ratio and carcass characteristics at 20weeks of age for the males, and reproductive performance for the females (Adebambo 2002, 2008; Adebambo et.al. 2007) (Tables 2 and 3).

Blood samples from 50 birds per genotype were used to assess genetic diversity of the Nigerian local chickens (Adeleke et.al. 2011). Dendrogram developed, revealed that the strains were clearly separated from one another with 55 percent mean genetic similarity among the four strains, the naked neck strain being the most divergent (Figures 2).

DEVELOPMENT OF THE IMPROVED INDIGENOUS LINES.

With the support of the Bill and Melinda Gates' Foundation for germplasm conservation, genetic evaluation, multiplication, subsequent crossing, with genomic evaluation, 6 pullet lines, 1 dual purpose and 1 broiler meat line were selected between 2014 and 2016 for distribution and for testing, on-station and on-farm across rural households in Nigeria.

The Naked Neck and Frizzled feathered birds were used in the development of the indigenous broiler lines because of the quality of their carcasses. Using MS analyses to distinguish between the homozygous and heterozygous genotypes among the Naked neck chickens, Osinbowale (2017) found that heterozygous naked neck birds often produce higher egg numbers with improved hatchability. She however reported that the homozygous genotypes result in higher mortality, lower fertility and hatchability with higher number of dead-in-shell (Table 4).

Presently, flocks of GPS and PS lines are being generated from the Gene Pool for the commercialization of the improved indigenous lines with 37.5 to 62.5 % indigenous blood as broiler and dual purpose layer lines for the emancipation of rural households in Nigeria.

Genetic variability in Newcastle Antibody Titre for Genetic Resistance.

Because of the high susceptibility of local chicken to New Castle disease, this study was conducted to evaluate the variation in antibody production to Newcastle disease (ND) vaccinated breeder birds and their progenies. The chicks were evaluated for maternally derived antibody (MDA) against ND virus and also the MDA transfer rate for each genotype. **E**nzyme Linked Immuno-Sorbent Assay (ELISA) test was used for the detection and quantification of antibodies to ND in the parent stocks and the chicks using IDEXX Newcastle Disease ELISA test kit. Antibody transfer rate among the Improved Indigenous birds were found to be higher than in Anak Titan. It shows that selection is possible within the improved locals for genetic resistance to NewCastle disease (Adeleke et.al.,2015). This is being incorporated in designing a breeding program for better adaptive potential (Table 5).

Evaluating the performance of improved and tropically adapted chicken (iTABs).

With the support of the International Livestock Research Institute (ILRI), Ethiopia, improved Indigenous and other Tropically Adapted breeds were tested On-Station and On-Farm across 5 agro-ecological zones of Nigeria as well as On-Station in a private and a University farm in Nigeria between 2016 and 2017. The improved Indigenous dual-purpose FUNAAB-Alpha, the local Fulani and the tropically adapted ShikaBrown were tested alongside 3 other locally adapted

imported breeds, the Sasso, Kuroiler and Noiler, for evaluation and comparison on growth and reproductive performance of the chicken breeds under rural scavenging setting. Two thousand and five hundred rural households were involved in the On-Farm testing to determine farmer preferred breeds under the village setting for economic empowerment and improved health and nutrition of rural households in the Nigeria.

On-Station and On-Farm Testing Results across Nigeria's Agro-Ecological Zones.

The results of the On-Farm across the agro-ecological zones of Nigeria, and the On-Station testing at a University farm and on a Private farm in Ogun and Oyo States of Nigeria were as reported in Figures 4& 5. The results show a very rapid growth up to 20 weeks of age among the imported tropically adapted breeds of Sasso, Kuroiler, and Noiler with average weight of 552±52.33 to 637±22.63 at 6 weeks of age at the brooder farms and 2751±327 to 3333.78±662g at 20 weeks of age for the males On-Farm, while the FUNAAB-Alpha males similarly weighed 501±53.74 and 2591±594 at 6 and 20 weeks respectively. An FCR of 2.69±0.19, 4.13±1.62 and 4.71±1.94 and 5.16±2.14, 4.65±1.39 and 5.37±0.27 for the FUNAAB-Alpha, Sasso and Kuroiler breeds respectively at 6 and 20 weeks of age, as the males were expected to be sold off by the farmers at 20 weeks of age. The carcass yield ranged from 60.89±12.42 of the Fulani to 65.79±2.83 of the FUNAAB-Alpha.

Level of adaptation of birds to environmental conditions was measured by the rectal temperature and the Haemoglobin content of the blood. While the haemoglobin content was higher in the FUNAAB-alpha followed by the Fulani, the rectal temperatures were lowest in both the FUNAAB-alpha and the Fulani (Figure 3).

Reproductive.Performance of the iTABs.

All the 6 breeds came into lay between 17 and 19 weeks, the indigenous, FUNAAB-Alpha, tropically adapted ShikaBrown and Noiler came into lay at 17 weeks while the others ranged between 18 and 19 weeks. Average weight of first egg varied between 39 and 55g while weekly egg production ranged between 2 and 5 eggs per bird (Figure 5).The birds attained peak of production between 25 and 26 for the Fulani and FUNAAB-α while the others peaked at 33 weeks for the Shika Brown and 39 to 40 weeks by the others. The rate of lay persisted till 28 weeks for the Fulani, 40 weeks for FUNAAB-α, 38 weeks for the Shika-Brown and 41 weeks for the others. The hen-day production was highest at 74% for the Shika Brown while it varied between 43.5 and 67% for the others.

Table 1: Frequency of some genes in the local chicken of Nigeria.

Genetic group	N	% Incidence	Gene frequency	Carriers in the population
Normal	1594	78.44		
Frizzled	223	10.97	F = 0.06 F = 0.94	11.64%
Naked neck	175	8.61	Na = 0.05 Na = 0.95	9.75%
Dwarf birds	11	0.54	Dw = 0.07 Dw = 0.93	13.51%

Source: Ikeobi, *et. al.* 1996.

Table 2: Mean egg values (%) of chickens as affected by breed type.

Type	No. of eggs	Mean egg wt (g)	Mean egg length (cm)	Mean egg width (cm)
Indigenous	602	39.99 ± .18	4.97 ± 0.01	3.91 ± .01
Exotic layer	108	54.28 ± .34	6.32 ± 0.02	5.39 ± .01

Table 3: Hatchability of eggs as affected by major genes. (Source: Peters 2000).

Major genes	No. of eggs	Hatched		*Infertile*		Dead in shell	
	Set	No.	%	No.	%	No.	%
Naked neck	165	65	39.4	31	18.8	69	41.9
Frizzled	128	69	53.9	39	30.5	20	15.6
Normal feathered	309	178	57.6	97	31.4	34	11.6
Exotic	106	58	54.7	34	32.1	14	13.2

Table 4. Reproductive Potential of the Improved Indigenous FUNAAB-Alpha breeds.

	Naked	Normal	Frizzle	Broiler
% Fertility	76.67	84.76	90.53	80.12
% hatchability	83.50	89.69	91.36	85.55
% dead in shell	9.46	8.90	7.53	8.23
%Weak in shell	0.53	1.32	0.42	0.35

Source: Osinbowale 2017.

Table 5. Antibody transfer rate among improved chicken genotypes FUNAAB-ALPHA.

BREED	ADULTS	CHICKS	MDA transfer rate %
Frizzle-feathered	413.333 ± 68.853	398.6 ± 43.871	96.4
Normal-feathered	426.333 ± 121.949	400.0 ± 53.952	93.8
Naked neck	481.667 ± 145.454	427.0 ± 89.353	88.7,
Anak Titan	1148.333 ± 532.843	398.8 ± 57.593	34.7

Source: Adeleke et.al.,2015.

PEDIGREE BIRDS ON STATION

Plate 1. Nigeria's Indigenous chicken in pen.

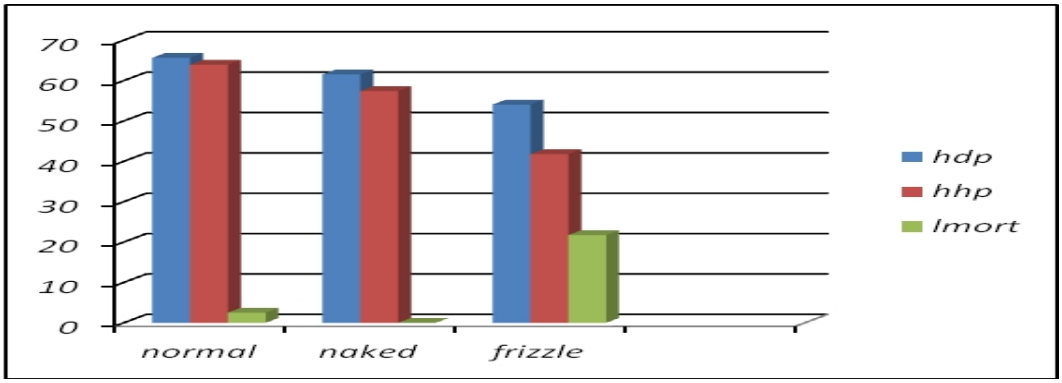

Fig. 1. Egg production performance of improved locals (Adebambo et.al.2013)

Hdp-% Henday Production; hhp- % hen housed production; mort- %Mortality

Fig. 2 Dendrogram developed by UPGMA cluster analysis of blood protein bands showing the coefficient of genetic similarities among the chicken populations.

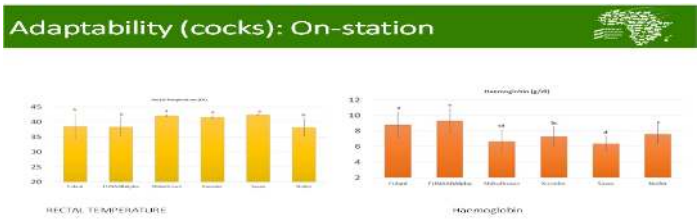

Fig.3 Adaptability of the iTABs on-atation.

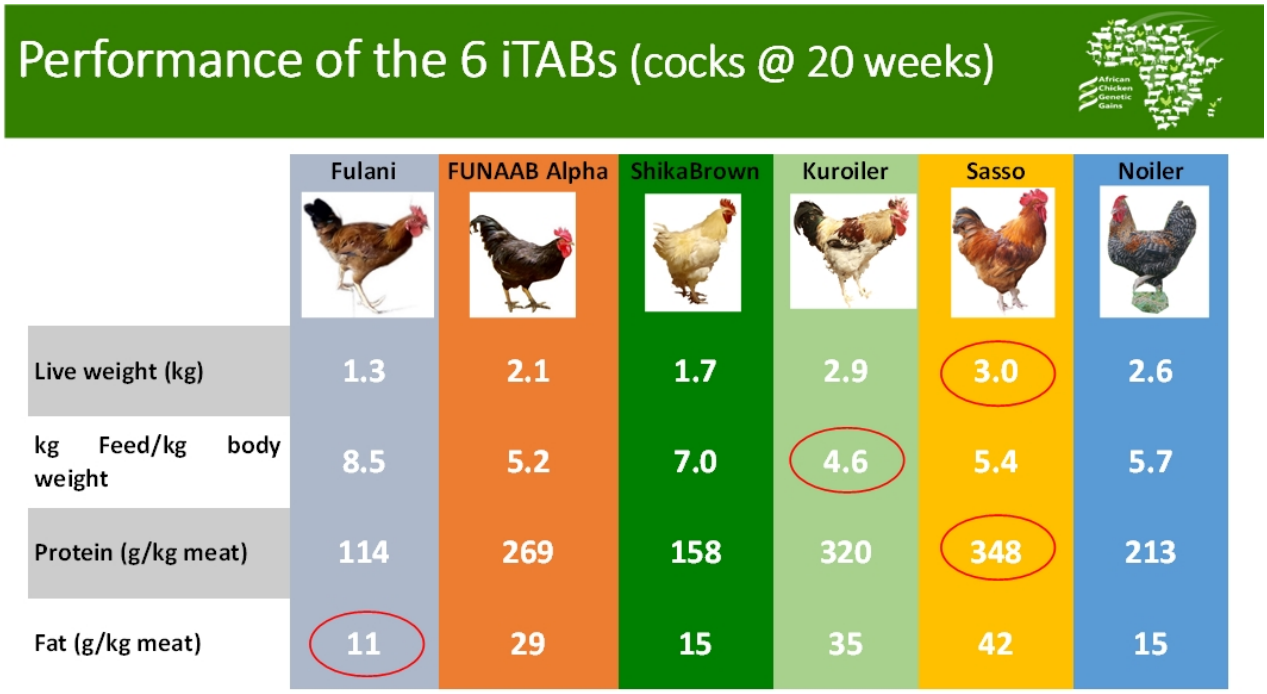

Fig 4 Growth Performance of the Indigenous and Tropicaly adapted genotypes(iTABs) on-farm

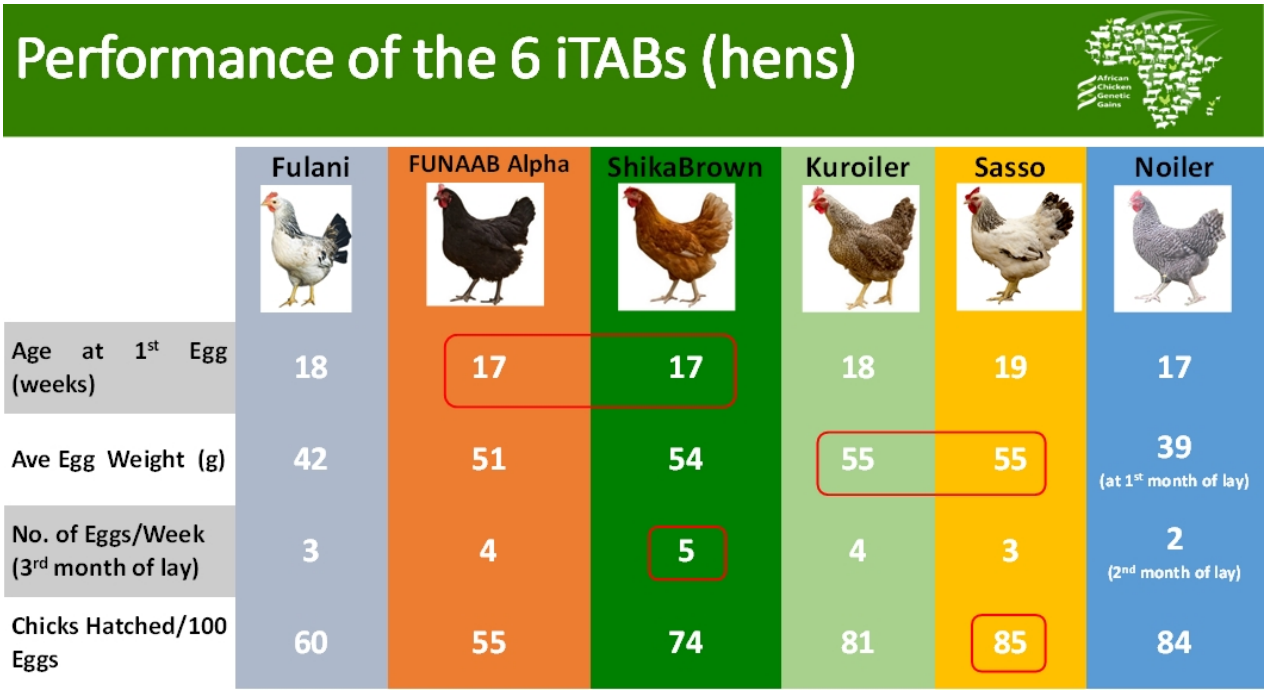

Fig 5. Reproductive performance of birds on On-Farm Testing.

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