REPRODUCTIVE EFFECTS OF PARENT STOCK OF NIGERIAN INDIGENOUS CHICKENS CROSSBRED WITH ARBOR ACRE BROILERS AND GROWTH PERFORMANCE OF THEIR F_1 PROGENIES

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ABSTRACT
Nigerian Indigenous Chickens (NICs) exhibit valuable genetic traits, including heat tolerance, hardiness, and scavenging capacity for survival in tropical environments. A study involving 30 matured chickens (1 cock, 10 hens) of Frizzled Feather (FF) and Fulani Ecotype (FE), along with 24-week-old Arbor Acre broilers (AA), aimed to assess their breeding and growth performances. Semen collected from cocks was used for insemination, generating 73 progenies. Fertility was highest in AA×FF (91.30%) and lowest in AA×FE (83.34%), while hatchability peaked in AA×FF (85.71%) and declined in AA×FE (80%). Breed and sex significantly influenced growth parameters. At 4 weeks, AA×FF exhibited the highest Feed Conversion Ratio (FCR) at 4.82a, while AA×FE showed higher Feed Intake (FI) at 154.70 and Weight Gain (WG) at 32.47. At 8 weeks, AA×FF had increased FI (205.70) and FCR (1.84) but lower Body Weight Gain (BWG) at 111.73, whereas AA×FE demonstrated higher BWG at 162.58. In conclusion, superior fertility and hatchability were observed in AA×FF and AA×FE. AFE progenies demonstrated better growth performance characteristics, suggesting that Arbor Acre and Fulani Ecotype crosses can be selected for improved growth in indigenous chickens. The study highlighted the potential for strategic breeding to enhance indigenous chicken traits, supporting sustainable poultry farming in tropical regions.
Keywords: Nigerian Indigenous chicken, Fertility and Hatchability, Growth performance.

INTRODUCTION

Indigenous poultry constitute a major asset to poor farmers who cannot afford to maintain exotic chicken on intensive management system. However, not much is known on these flocks about their management and general breeding performances despite the inherent advantages it confers on rural farmers (Ajayi, 2010). There is need therefore to assess the performances of Nigerian local chickens and to improve their productivity which is characterized by small body weight, small egg size and few number of eggs (Nwagu and Nwosu, 1994; Adebambo *et al.,* 1999). Olawoyin (2006) concluded that genetic improvement of Nigerian indigenous chicken could help to alleviate the problems of animal protein shortage especially in the rural areas. In Nigeria, reproductive performance evaluation among crossed, local and exotic chickens were conducted from different researchers in Nigeria (Adeleke *et al*., 2012; Adedeji *et al.,* 2015 and Alabi *et al.,* 2017,) and the overall output of the crossed breed was superior than either of the native or exotic parents under the different production systems, thus producing a hybrid vigour. The offspring of the crossbreds were also well resistant to harsh tropical condition and produced a comparable amount of egg and meat (Molede, 2014 and Amao, 2018, Addis).

Crossbreeding has been a major tool for the development of present-day commercial breeds of chickens (Adeleke *et al.,* 2012; Alewi *et al.,* 2012), and could likewise be used to improve the indigenous chickens. This study aimed at improving the growth performance of Nigerian indigenous chicken and also to assess the reproductive traits of parent stock.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the Poultry Unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso Oyo State, Nigeria. Ogbomoso is situated in the derived savanna zone of Nigeria on longitude 4°10' East of greenwich meridian and latitude 8°10' North of the equator. The altitude is between 300 and 600m above sea level. The mean annual rainfall and temperature are 1,247mm and 27°C respectively (Google Earth Map, 2022).

Experimental Birds and Management

The experimental chickens that were used for this study are the local chicken and exotic broiler breeds. The local strains are the Frizzle feather and Fulani ecotype at maturity. The local birds were selected from the available chicken population while some were purchased at local markets and villages. Arbor acre hens were acquired from a reputable farm at 7-8 months of age. A total of 30 birds were sourced and used as parent for the experiment. The experimental birds were strictly under the intensive management.

Experimental Feed and Feeding

The sires and dams were fed ad-libitum with commercial breeder feed containing 17.5% Crude Protein and 2700 kcal/kg Metabolizable Energy. Medications and vaccinations was done as required.

Housing and Management of Chicks

Seventy three chicks resulting straight crossings were properly identified by wing tagged with an industrial galvanized aluminum tags at the wing web at day-old. The chicks were fed with a commercial chick feed that supplied 22% Crude Protein and 3000kcal/kg Metabolizable Energy up to four weeks of age. Thereafter, they were fed with commercial grower and finisher ration that supplied 18% Crude Protein and 3100kcal/kg Metabolizable Energy from 4 to 12 weeks of age, clean and cool water was supplied ad-libitum while medication and vaccination was done as at when due.

Experimental Mating

Straight crossings were done with Arbor acre cocks and Nigerian local hens to get the F_1 crossbred progenies. Artificial Insemination (AI) was adopted in mating the hens. The massage technique were used to collect semen from the Arbor acre cock. The mating procedure is as follows:

Straight crossing

Arbor acre (male) x Frizzled feather (female): AA_m x FF_f

Arbor acre (male) x Fulani ecotype (female): AA_m x FE_f

Egg Fertility and Hatchability

Four weeks into laying, a hen lay between 3 to 4 eggs every week, and eggs were collected for 5 weeks in batches, 178 eggs were randomly selected from purebred crossing, while 80 crossed eggs were collected from straight crossing from different parent hens and were taken to the hatchery in batches. At the hatchery, the following parameters were monitored: number of fertile eggs, number of eggs hatch and dead in shell: number of fertile eggs, hatch eggs and dead in shell.

Growth Performance

Body weights, feed intake, and feed to gain ratio was monitored from birds crossbred progenies from day-old to 12 weeks of age.

Data Analysis

Data obtained were subjected to analysis of variance in a Completely Randomized Design using the procedure of General Linear Model of SAS (2009) and significant means were separated with the same procedure of SAS (2009) at $p<0.05$.

Model for Growth Parameters

$Y_{ijk}= \mu + \alpha_i + \beta_j + e_{ijk}$

Where,

Y_{ijk} = Individual observation with each genotype

μ = Overall Mean

α_i = Mean effect of i^{th} genotype (1,2) on BWG, FI and FCR

β_j = Mean effect of j^{th} sex (Male, Female) on BWG, FI and FCR

e_{ijk} = Experimental random error common to measurement in each bird and assume to be normally and independently distributed with a mean of zero and variance δ^2.

RESULTS AND DISCUSSION

Tables 1 and 2 revealed the absolute values and percentage of egg set, fertility and hatchability estimated in different chicken crosses. AFF crosses had higher value (23) of egg set. Out of the number of eggs set in the two crossbreds, AFF had higher percentage (91.30%) fertility than AFE (83.34%). Infertility was observed to be higher in AFE with 16.67% while lower fertility was obtained in AFF (8.70%). Out of the fertile eggs in each cross, higher hatchability was observed in the AFF eggs with 85.71% hatchable eggs, while 80% hatchable eggs for AFE. This shows that AFF eggs

performed better in terms of hatchability than the AFE eggs. Dead-in-shell was lower in AFF eggs (14.29%) while it was higher in AFE eggs (26.67%). Table 3 shows the means ± SE of growth performance of Arbor acre broiler strain crossbred with Fulani ecotype and Frizzle feather chicken at 4, 8 and 12 weeks respectively. At 4 weeks old, AFF shows a higher FCR (4.82a) while AFE had higher FI (154.70) and WG (32.47). At 8 weeks old, AFF command a higher FI (205.70) and FCR (1.84) but low body WG (111.73) while higher WG (162.58) was revealed in AFE.

Table 1 Absolute values of Egg Set, Fertility and Hatchability as Affected by Arbor acre Frizzle feather and Arbor acre Fulani ecotype Hens

BREED	No of Egg set	Fertile Egg	Infertile Egg	Hatched Egg	Dead-In-Shell
AFF	23	21	2	18	3
AFE	18	15	3	12	4
N	41	36	5	30	7

AFE = Arbor Acre × Fulani ecotype crossbred, AFF = Arbor Acre × Frizzle feather

Table 2: Percentage of Egg Set, Fertility and Hatchability as Affected by Arbor acre Frizzle feather and Arbor acre Fulani ecotype Hens

BREED	No of Egg set	% Fertile	% infertile	% Hatched	% Dead-In-Shell
AFF	23	91.30	8.70	85.71	14.29
AFE	18	83.34	16.67	80	26.67
N	41	174.64	25.37	165.71	40.96

AFF = Arbor Acre × Frizzle feather, AFE = Arbor Acre × Fulani ecotype crossbred

Table 3: **Least Square Mean Values of Growth Performance of Pure and Crossbred Chickens as Affected by Breeds and Sex of Chicken at 4,8 and 12 Weeks of Age**

Par/Breed	AA		AFE		AFF	
			Week 4			
N	76		24		48	
FI (g)	250.07±24.10^{a}		154.70±16.99^{b}		114.63±19.80^{c}	
WG (g)	43.80±2.67^{a}		32.47±4.90^{b}		23.78±2.78^{c}	
FCR	5.71±0.10^{a}		4.76±0.09^{ab}		4.82±0.09^{b}	
			Week 8			
FI (g)	614.55±32.47^{a}		201.45±30.75^{b}		205.70±53.30^{a}	
WG (g)	258.35±46.65^{a}		162.58±8.85^{a}		111.73±45.33^{b}	
FCR	2.38±0.06^{a}		1.24±0.00^{c}		1.84±0.19^{b}	
Sex			Week 12			
	M	F	M	F	M	F
FI (g)	1586.85±57.40	1264.52±16.74	1244.75±24.65	1237.69±55.71	646.05±41.60	684.07±31.26
WG (g)	875.40±36.22	661.42±31.42	640.00±21.60^{b}	766.88±4.92^{a}	500.35±87.05	597.89±47.87
FCR	1.81±0.04^{b}	1.91±0.06^{a}	1.94±0.01^{b}	1.61±0.07^{a}	1.29±0.04^{b}	1.14±0.04^{a}

^{ab}Mean along the same row at each subclass with different superscripts are significantly (P<0.05) different
N = Number of Observation, FI = Feed Intake, BWG = Weight gain, FCR = Feed conversion rate, AA = Arbor Acre crossbred, AFE = Arbor Acre × Fulani ecotype crossbred, AFF = Arbor Acre × Frizzle feather, M= Male, F= Female.

Tables 1 and 2 revealed the data obtained on eggset, fertility and hatchability of egg laid by different crosses. The proportion of fertility was higher for the eggs obtained from AFF (91.30%) followed by eggs of AFF (83.34%). Hatchability percentage for AFF and AFE were 85.71 and 80 respectively. Similar observation was reported under the study of Ajayi and Agaviezor, (2016), the hatchability of the pure normal feathered chicken is 86.36%, whereas lower values of 62.09 and 66.90% was recorded for pure frizzle and naked neck strains of Nigeria, respectively. The hatchability percentage of Ajayi and Agaviezor, (2016) revealed higher for pure normal feathered Nigerian chickens and which is comparable for pure frizzle and naked neck while comparing report of current study.
Crossbreeding programs with specialized meat-type or egg type chickens has been shown by several workers to improve their productivity significantly and growth traits components, such as bodyweight

and morphometric measurements, are key factors to both poultry breeders and meat processors (Adedeji *et al.,* 2015a). The results 3 revealed significant genotype and sex effect of growth performance birds at 4, 8, 12 weeks respectively. This is expected because of variations in the genetic constitutions of birds, and it is a major determinant of growth and physiological development and is also consistent with the reports of Adedeji *et al*. (2015b). The current study on the growth performance of crossbred chickens produced from Arbor acre sires and Nigerian indigenous chicken dams affirmed that chickens' genotype of AFE had highest feed intake and weight gain with higher feed conversion rate than its counterpart crossbred chickens and this observation was in line with the earlier documentation of Assefa and Mellese (2018); Amao (2018a); Amao (2018b) and Ojedapo *et al*. (2018).There were better utilization of feeds by both crosses of AFE and AFF as they had least feed conversion ratio since the lower the feed to gain ratio the better the diet and this in the line with the report of Amao *et al.* (2019), however AFE had a better body weight for both sex.

CONCLUSION AND RECOMMENDATION

The study had demonstrated that both fertility and hatchability were better for the eggs collected from Arboracre×Frizzle feather cross and Arboracre×Fulani ecotype cross while Better bodyweight was recorded in for Arboracre×Fulani ecotype over Arboracre×Frizzle feather cross. It can therefore be recommended that progenies of chickens produced through crossing of Arbor acre and Fulani ecotype (AFE) chickens can be selected for its better growth performances characteristics. Also the relationship between these traits can be exploited in the planning scheme for improvement of indigenous chickens.

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