Comparism of the Genetic makeup in Growth Parameters of Nigerian Indigenous Normal, Frizzle Feathers and Their Crossbreds Chicken Progenies

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ABSTRACT

This study evaluated the body parameters of some Nigerian indigenous chickens, ISA-Brown and their crossbreds. The experimental birds consisted of fifteen sires and sixty dams used as parent stocks and distributed in the ratio of 5 cocks to 20 hens. Five genotypes were generated from Pure and crossbreeding using Artificial Insemination in a Completely Randomized Design. The crosses include; Normal Feather x Normal Feather (NN), Frizzle Feather x Frizzle Feather (FF), ISA-Brown x ISA-Brown (IB), ISA-Brown x Normal Feather (INF) and ISA-Brown x Frizzle Feather (IFF). The experiment lasted for 20 weeks. A total of three hundred progenies were generated from all the crosses having 20 males and 40 females in each genotype. Data on Body Weight (BW), Body Length (BL), Chest Girth (CG), Keel Length (KL), Shank Length (SL), Thigh Length (TL), and Wing Length (WL) were collected on weekly basis till 20 weeks. Data generated from growth were analyzed using General Linear Model ($P < 0.05$) of SAS (2003). Genotype, sex and genotype × sex interactions significantly influenced ($P<0.05$) growth parameters of the progenies at all ages. The crossbreds of ISA-Brown × Frizzle Feather (IFF) had the highest body weight (1640 ± 13.50g) at 20 weeks. The crossbreds of ISA-Brown × Normal Feather (INF) male chickens had the highest growth parameters when compared with other crossbred males. Conclusively, since IFF and INF males could be reared and selected as meat birds.
Word count: 228

Keywords: *Genotype, Growth, Reproductive, Crossbred, Parameters*

INTRODUCTION

Poultry is the general term for the species of birds domestically raised primarily for the economic purpose of producing egg, meat and for pleasure (Laseinde, 2002). Chickens are the most widely distributed of all livestock species in Nigeria with a population of 166 million birds (Adebambo *et al.,* 2010). Chicken can multiply very fast, amount of capital outlay for their production is very small and generation interval is shorter than any other animals (Ojedapo *et al.,* 2008). The Nigerian local chickens constitute between 80-90% of chicken population and 80% of these chickens are traditionally managed in the villages compared to other animals (Adedeji *et al.,* 2006). The Nigerian local chickens are kept predominantly as source of protein and income for the rural dwellers. The local chicken has unique adaptive features which influence their adaptability to the local environment better than their exotic counterparts (Egahi *et al*., 2010).

There are three major genes identified in Nigerian local chicken population namely, frizzle, naked neck and sex- linked dwarfism. Local chickens had been characterized along genetic lines of feather and plumage colour (such as, naked neck, dwarf types) and colour variants such as black, white, brown, mottled etc. Naked-neck and frizzle genes have been found to reduce environmental heat stress. Reports have shown that the indigenous fowl possesses great genetic potentials for improvement which could be achieved through breeding program such as selection and or crossbreeding (Peters, 2000; Adedeji *et al*., 2008, Adebambo *et al*., 2009).

Growth is a complex and dynamic physiological process that begins immediately after zygote is formed and it continues until maturity. Components of growth, such as body weight and morphometric measurements, are important factors to both poultry breeders and meat processors (Adeniji and Ayorinde, 1990). Morphometric measurements are useful in contrasting size and shape of animals (Mc Cracken *et al*., 2000).

Materials and Methods

Experimental Site

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso (LAUTECH), Oyo state, Nigeria. The site is situated in the Derived Savanna zone of Nigeria on longitude 4° 15' East of the Greenwich meridian and latitude 8° 15'North-East from Ibadan, the capital of Oyo State. The altitude is between 300 and 600m above the sea level. The mean annual temperature is 27°C and the annual rainfall is 1,247mm respectively (Google Earth Map, 2024).

Experimental Birds and Management

The experimental birds consisted of sire and dam strains of Isa Brown (exotic), Nigerian Frizzle feather and normal feather chickens (local chickens). The indigenous chickens (frizzle and normal feather) were sourced at maturity from pre- existing flock at LAUTECH Teaching and Research Farm, while Isa Brown chickens were also acquired at maturity from a reputable farm and were quarantined for two weeks. A total of fifteen sires and sixty dams were used as parent stocks and distributed as 5 cocks to 20 hens in each genotype. All experimental birds were individually wing tagged for identification purposes. Sires and dams were caged in an open-sided poultry house of 11.162m^2. Each bird was confined in a cell space of 0.381m^2. Prior to stocking, the whole pen and cages were washed and disinfected using Lysol/formalin and Morigad at mixing ratio of 5ml per 10ml of Littre of water and rested for ten days before the birds were acclimatized in separated cages for a period of two weeks. A total number of three hundred (300) progenies were generated from all the crosses having 20 males and 40 females each from all the genotypes. Occasional medication and vaccination were ensured as at when due throughout the experiment.

Experimental Feeds and Feeding

The parent cocks were fed *ad-libitum* with the commercial grower mash containing 15.0% crude protein and 2500 kcal/kg metabolizable energy while layers were fed with commercial layer mash containing 16.50% and 2700 kcal/kg metabolizable energy. Clean cool water was also supplied *ad-libitum.*

Experimental Mating Procedures

Mating of the birds was done using artificial insemination two weeks after acquisition. Hand massage technique involving application of gentle slight hand pressure at the back (massage) of the cock towards the tail was adopted in training the cock for semen production. This massaging was done twice a day for 4 weeks. Semen collection was diligently done to avoid contamination from feaces and blood. Semen insemination was done by applying a slight pressure to the left side of the abdomen around the vent of each hen which caused the cloaca to protrude to form a doughnut shape and 0.1ml of semen was deposited into the left opening of the oviduct. Each hen was inseminated thrice a week in the evening (1700). The inseminators together with the collection tube were sterilized after each usage.

The mating design followed the pattern below:

Sire	Dam	Progeny (Genotype)
Pure breeding:		
Frizzle Feather × Frizzle Feather		(FF)
Normal Feather × Normal Feather		(NN)
ISA-Brown × ISA-Brown		(IB)
Crossbreeding:		
ISA-Brown × Frizzle Feather		(IFF)
ISA-Brown × Normal Feather		(INF)

Egg Collection and Incubation

Four hundred and thirty eggs were collected from all the five genotypes. Frizzle Feather, Normal Feather, ISA-Brown, ISA-Brown × Frizzle Feather, ISA-Brown × Normal Feather. Eggs collected were pedigreed along genotype lines and accrued in a cool room for five days before the eggs were taken to the hatchery. In the hatchery, the eggs were set in a cabinet type of incubator at a commercial hatchery. The eggs were set along sire and dam genotype lines at a temperature between 27^{0}C to 39^{0}C and relative humidity of 55- 56% for eighteen days. Afterwards, the temperature was increased to 29^{0}C -40^{0}C at a relative humidity of 70-75% from nineteenth day to hatching time. The eggs were also turned automatically through 90^0 in the incubator.

Brooding, Chick Rearing and Management

A week before the arrival of day-old chicks (DOC), the brooder pens were washed with formalin and disinfected. The brooder pens were covered with sacks to prevent rodents from attacking the chicks and to conserve the heat. The dimension of each brooder pen was 8m by 10m tagged along sire and dam genotype lines. Wood-shaving was spread on the floor of each brooder pen and heat source was placed at a corner in the

brooder pen to provide warmth for the chicks. Thermometer was used to monitor the temperature in each of the brooder pen. The heat was supplied for 4 weeks. A total of 300 progenies were generated from all the crosses. At the arrival of DOC, they were vaccinated against New Castle disease by administering Lasota vaccine intra-ocularly. Commercial chick mash containing 22.0% crude protein and 2900 Kcal/kg metabolizable energy were fed to the chicks from day old till eight weeks of age. Commercial grower mash containing 15.0% crude protein and 2500 Kcal/kg metabolizable energy was introduced to the chicks from eight weeks till eighteen weeks. The layers were fed with commercial layers mash containing 16.0% crude protein and 2800 Kcal/kg metabolizable energy from eighteen weeks. Clean cool water was supplied *ad-libitum* to the birds. The litter was changed at intervals of 3 days to prevent accumulation of ammonia gas. Spillage of water on the litter was prevented as much as possible. All chicks remained on deep-litter till 12 weeks of age before they were transferred to the cage. In this cage, the hen and cock were housed singly in a cage size of $0.381m^2$.

Duration of the Experiment

The experiment lasted for a period of 20 weeks

Growth Parameters

Total number of three hundred and ten (300) chicks were generated and measured. Data were collected on weekly basis on the following growth parameters: body weight, body length, keel length, shank length, chest girth, thigh length and wing length of the progenies starting from day old till 20 weeks of age. Progenies belonging to each cross were individually weighed using sensitive weighing scale while tailor's tape rule was used to measure other body dimensions. The measurements were carried out as follows;

Body weight (BW): This was measured as the actual weight of the bird in grams (g) using an electronic sensitive scale with maximum capacity of 5kg.

Body length (BL): This was taken as the distance between the base of the neck and the cloaca using a tape rule in (cm).

Chest girth (CG): This was taken as the circumference round the deepest region of the breast. Tape rule calibrated in centimeter was used to take the measurement (cm).

Keel length (KL): This was taken as the length of the sternum using a tape rule calibrated in centimetres.

Shank length (SL): This was measured as the distance between the hock joint to the tarso-metatarsus. A tape rule was used to take the measurement (cm).

Thigh length (TL): This was taken as the length from the pelvic bone to the hock joint. A tape rule was used to take the measurement (cm).

Wing length (WL): This was also measured as the distance between the shoulder joint to the tip of the wing with the use of tape rule (cm) (Adedeji *et al.,* 2015).

Data Analysis

Data obtained on growth parameters were subjected to the fixed effects of genotype, sex and their interactions and analyzed using General Linear Model of SAS (2003).

Growth Traits

$Y_{ijk} = U + S_i + Se_j + (SSe)_{ij} + e_{ijk}$

Where;

$Y_{ijk=}$parameter of interest

U= Overall mean for the parameter of interest

S_i= Fixed effect of i^{th} geotype (i=1, 2, 3,4,5)

Se_j= Fixed effect of j^{th} sex (j= 1,2)

$(SSe)_{ij}$= Interaction effect of i^{th} genotype and j^{th} sex.

e_{ijk}= Experimental errors which is evenly distributed.

Results

The mean values of growth parameters as affected by genotype and sex of chicken at day old is presented in Table 1. The results showed that the genotypes differed significantly ($P < 0.05$) in terms of body weight and other body linear measurement while sex had no significant effects ($P > 0.05$) on all the body parameters except body weight (Female 58.16±3.39g, Male 52.18±4.46g). Crossbreds of Isa brown × Frizzle feather progenies had the highest mean value of body weight (56.64 ± 3.06g) when compared with other genotypes. However, crosses of ISA-Brown × Frizzle feather and purebred ISA-Brown were not significantly different ($P > 0.05$) in body length (7.34± 0.06cm, vs 7.38± 0.09cm), chest girth (8.14± 0.08cm, vs 8.12± 0.08) and shank length (2.32± 0.05, vs 2.34± 0.07) respectively. The highest values of keel length (1.19± 0.09cm), thigh length (3.38± 0.08cm) and wing length (5.46± 0.26cm) were observed in purebred Isa brown progenies. The lowest mean

values were obtained in purebred frizzle feather progenies for body weight (28.29±0.60g), body length (6.80± 0.14cm), chest girth (7.87± 0.09cm) and thigh length (3.15± 0.11cm). Female chicken had higher body weight than their male counterparts (58.16 ±3.39g vs 52.18 ± 4.46g).

Table 2 expressed the mean values of growth parameters as affected by genotype and sex of chicken at 4 weeks of age. Significant fixed effects of genotype and sex ($P < 0.05$) were obtained in all the growth parameters. IB progenies had the highest mean values of body weight (181.81± 8.40g), body length (15.82± 0.21cm), chest girth (17.96±0.29cm), keel length (7.52±0.12cm), shank length (6.44±0.14cm), thigh length (10.16±0.18cm) and wing length (26.36±0.60cm) followed by the values obtained for ISA-Brown × Normal feather crosses. However, the progenies of IFF had the least values for all the body morphometric measurements. Female birds had higher body parameters than male counterparts except the wing length (25.51±1.03 vs 27.20±0.62cm).

The mean values of growth parameters as affected by genotype and sex at 8 weeks of age is shown in Table 3. Genotype and sex significantly ($P<0.05$) effected body weight. The highest mean values of body weight and other body parameters were obtained in IB chicken progenies followed by IW. However, IFF had the least mean value of body weight (354.35±4.78g) and other body morphometrics except wing length (22.96±0.54cm) that was not statistically different ($P > 0.05$) from the value obtained from IW (22.96±0.54cm).

Table 4 shown the mean values of growth parameters as affected by genotype and sex of chicken at 16 weeks of age. The Table showed significant ($P < 0.05$) main effects of genotype and sex on all the body parameters recorded. The Isa brown × Normal feather chicken progenies were superior in all the body parameters obtained except body weight (816±28.40g), shank length (10.24±0.15cm) and thigh length (14.24±0.22cm). However, the least mean values for the same body parameters were obtained in the Normal feather chicken progenies. Male progenies had comparative higher body weight (822±19.27g), however, other body parameters were not significantly ($P > 0.05$) different from their female counterparts.

The mean values of growth parameters as affected by genotype and sex of chicken at 20 weeks of age are shown in Table 5. The Table showed that the growth parameters were significantly affected ($P < 0.05$) by genotype and sex of chicken. Progenies of IFF were significantly superior in body weight (1640±13.50g), keel length (13.86±0.39cm), shank length (14.21±1.74cm) and thigh length (16.81±0.64cm). Consistently, male birds had higher values for all the body parameters.

The mean values of interaction effect of genotypes-by-sex on body parameters of chicken is as shown in Table 6. Results showed that chicken progenies that were males in each genotype were more superior in body weight, body length, thing length and wing length compared than their female counterparts. FF Male progenies had the higher mean value of body weight, body length, chest circumference, keel length, shank length, thigh length and wing length. However, FF female progenies had the least mean values of body weight, keel length and shank length.

Table 1: Mean Values of Growth Parameters as Affected by Genotype and Sex of Chicken at 1st Day

Parameters	OBS	BDW (g)	BDL (cm)	CH (cm)	KL (cm)	SHK (cm)	THG (cm)	WL (cm)
Genotype								
FF	21	28.29±0.60^{e}	6.80±0.14^{b}	7.87±0.09^{c}	1.00±0.00^{c}	2.38±0.08^{a}	3.15±0.11^{c}	4.88±0.10^{c}
NN	25	31.17±0.95^{d}	6.89±0.16^{b}	7.98±0.17^{c}	1.12±0.09^{b}	2.21±0.04^{c}	3.20±0.10^{c}	4.79±0.27^{c}
INF	19	37.88±1.60^{c}	7.28±0.11^{a}	8.01±0.17^{b}	1.00±0.00^{c}	2.37±0.09^{a}	3.24±0.10^{b}	5.11±0.18^{b}
IFF	25	56.64±3.06^{a}	7.34±0.06^{a}	8.14±0.08^{a}	1.00±0.00^{c}	2.32±0.05^{b}	3.24±0.10^{b}	5.11±0.18^{b}
IB	30	55.17±2.80^{b}	7.38±0.09^{a}	8.12±0.08^{a}	1.19±0.09^{a}	2.34±0.07^{b}	3.38±0.08^{a}	5.46±0.26^{a}
Sex								
Female	19	58.16±3.39^{a}	7.43±0.09	8.21±0.09	1.20±0.10	2.41±0.08	3.30±0.09	5.37±0.31
Male	11	52.18±4.46^{b}	7.34±0.11	8.03±0.12	1.18±0.14	2.27±0.11	3.46±0.12	5.54±0.41

^{a,b,c,d,e}mean occupying the same column having different superscript are significantly different (P<0.05). OBS: number of observation, BDW: body weight, BDL: body length, CH: chest girth, KL: keel length, SHK: shank length, THG: thigh length, WL: wing length, FF: Frizzle Feather, W: Whole Feather, IW: Isa brown ×Whole Feather, IFF: Isa brown× Frizzle Feather, IB: Isa brown.

Table 2: Mean Values of Growth Parameters as Affected by Genotype and Sex of Chickens at Week 8

Parameters	OBS	BDW(g)	BDL (cm)	CH (cm)	KL (cm)	SHK (cm)	THG (cm)	WL (cm)
Genotype								
FF	20	362.20±20.60^{e}	14.50±0.26^{d}	17.05±0.25^{d}	6.38±0.16^{d}	5.46±0.14^{d}	9.87±0.55^{b}	25.27±0.42^{b}
NN	25	366.26±13.85^{c}	14.94±0.23^{c}	17.97±0.27^{b}	6.73±0.12^{c}	5.87±0.12^{c}	7.89±0.16^{d}	23.98±0.39^{c}
INF	19	459.74±34.29^{b}	15.96±0.48^{b}	17.95±0.55^{c}	7.24±0.32^{b}	6.04±0.22^{b}	8.47±0.28^{c}	22.96±0.54^{d}
IFF	25	354.35±4.78^{d}	11.90±0.10^{e}	12.78±0.16^{e}	5.06±0.11^{e}	5.47±0.11^{e}	6.20±0.13^{e}	22.96±0.54^{d}
IB	30	721.13±26.58^{a}	18.22±0.30^{a}	19.30±0.35^{a}	11.06±2.55^{a}	8.29±0.12^{a}	11.14±0.45^{a}	31.790.45^{a}
Sex								
Female	18	745.67±37.59^{a}	18.51±0.42^{a}	19.61±0.50^{a}	13.69±3.61^{a}	8.33±0.18^{a}	10.93±0.63^{b}	32.01±0.63^{a}
Male	11	696.60±37.59^{b}	17.93±0.42^{b}	18.99±0.50^{b}	8.43±3.61^{b}	8.24±0.18^{b}	11.35±0.63^{a}	31.57±0.63^{b}

^{a,b,c,d}mean occupying the same column having different superscript are significantly different (P<0.05)
OBS: number of observation, BDW: body weight, BDL:body length, CH: chest girth, KL:keel length, SHK: shank length, THG: thigh length, WL: wing length, FF: Frizzle Feather, W: Whole Feather, IW: Isa brown× Whole Feather, IFF: Isa brown × Frizzle Feather, IB: Isa brown.

Table3: Mean Values of Growth Parameters as Affected by Genotype and Sex of Chickens at Week 16

Parameters	OBS	BDW(g)	BDL(cm)	CH (cm)	KL (cm)	SHK (cm)	THG (cm)	WL(cm)
Genotype								
FF	19	840±36.79^{a}	20.63±0.31^{c}	22.76±0.32^{b}	9.71±0.12^{c}	8.28±0.15^{d}	14.58±0.16^{a}	33.36±0.50^{c}
NN	25	823±27.25^{c}	18.91±0.27^{e}	21.25±0.35^{e}	9.48±0.42^{e}	8.16±0.14^{e}	11.79±0.21^{e}	32.07±0.48^{d}
INF	19	816±28.40^{d}	22.60±0.35^{a}	24.61±0.35^{a}	11.41±0.17^{a}	10.24±0.15^{b}	14.24±0.22^{b}	35.64±0.85^{a}
IFF	10	828±15.18^{b}	21.73±0.51^{b}	22.46±0.55^{c}	11.30±0.88^{b}	11.84±0.57^{a}	13.09±0.49^{d}	29.23±0.82^{e}
IB	25	812±19.37^{e}	20.45±0.32^{d}	22.16±0.34^{d}	9.67±0.13^{d}	9.14±0.11^{c}	13.81±0.24^{c}	34.85±0.39^{b}
Sex								
Female	16	812±11.83^{b}	20.42±0.42	22.21±0.45	9.67±0.17	9.05±0.15	13.81±0.32	34.91±0.51
Male	9	822±19.27^{a}	20.48±0.48	22.12±0.52	9.66±0.19	9.24±0.17	13.80±0.37	34.79±0.58

^{a,b,c,d,e} mean occupying the same column having different superscript are significantly different (P<0.05)
OBS: number of observation, BDW: body weight, BDL: body length, CH: chest girth, KL: keel length, SHK: shank length, THG: thigh length, WL: wing length, FF: Frizzle Feather, W : Whole Feather, IW: Isa brown× Whole Feather, IFF :Isa brown ×Frizzle Feather, IB : Isa brown.

Table4: Mean Values of Growth Parameters as Affected by Genotype and Sex of Chickens at Week 20

Parameters	OBS	BDW(g)	BDL(cm)	CH (cm)	KL (cm)	SHK (cm)	THG (cm)	WL(cm)
Genotype								
FF	19	1602±44.24^{b}	22.27±0.34^{d}	24.33±0.37^{b}	11.00±0.21^{c}	8.39±0.18^{e}	15.16±0.24 ^{c}	35.96±0.56^{a}
NN	15	1514±28.03^{d}	20.99±0.61^{e}	16.70±0.41^{e}	9.94±0.30^{d}	8.96±0.44^{e}	13.74±0.54^{e}	35.02±1.08^{e}
INF	14	1377±72.88^{e}	26.58±0.41^{a}	28.29±0.41^{a}	13.63±.19^{b}	12.02±0.24^{b}	16.36±0.30^{b}	39.79±0.64^{a}
IFF	10	1640±13.50^{a}	23.47±0.89^{b}	23.18±2.30^{d}	13.86±0.39^{a}	14.21±1.74^{a}	16.81±0.64^{a}	37.40±1.93^{b}
IB	15	1516±79.21^{c}	22.79±0.52^{c}	23.87±0.49^{c}	11.03±0.26^{c}	8.56±0.30^{d}	14.50±0.39^{d}	35.26±0.66^{d}
Sex								
Female	15	1278±29.35^{b}	22.40±0.85^{b}	23.40±0.80^{b}	10.72±0.43^{b}	8.38±0.49^{b}	13.94±15.06^{b}	34.60±1.08^{b}
Male	8	1773±91.46^{a}	23.17±0.60^{a}	24.33±0.57^{a}	11.34±0.30^{a}	8.73±0.35^{a}	15.06±0.45^{a}	35.92±0.76^{a}

^{a,b,c,d,e}mean occupying the same column having different superscript are significantly different (P<0.05)
OBS: Number of observation, BDW: body weight, BDL: body length, CH: chest girth, KL: keel length, SHK: shank length, THG: thigh length, WL: wing length, FF: Frizzle Feather, W: Whole Feather, IW: Isa brown × Whole Feather, IFF :Isa brown ×Frizzle Feather, IB: Isa brown.

Table5: Interaction of Genotype × Sex on Growth Parameters of different Chicken Breeds

Genotype	Sex	OBS	BDW(g)	BDL(cm)	CH(cm)	KL(cm)	SHK(cm)	TH(cm)	WL(cm)
FF	Female	157	484±13.5^{b}	15.57±0.17^{b}	17.51±0.20^{b}	6.42±0.18	5.95±0.09^{b}	10.84±0.13^{b}	25.09±0.34^{b}
NN	Male	264	585±10.41^{a}	16.18±0.13^{a}	18.10±0.15^{a}	6.55±0.16	6.36±0.08^{a}	11.06±0.10^{a}	26.79±0.27^{a}
	Female	270	485±10.29^{b}	15.07±0.13^{b}	18.43±0.26^{a}	7.53±0.23	6.07±0.07^{b}	8.91±0.10^{b}	24.23±0.26^{b}
INF	Male	233	736±16.57^{a}	15.65±0.14^{a}	17.99±0.48^{b}	7.36±0.39	6.68±0.08^{a}	9.41±0.10^{a}	25.74±0.29^{a}
	Female	281	734±10.35^{b}	17.74±0.13^{b}	19.44±0.15	6.73±0.25	7.53±0.07	10.42±0.10	26.99±0.26^{b}
IFF	Male	110	736±16.57^{a}	18.15±0.21^{a}	19.84±0.24	6.73±0.25	7.50±0.11	10.52±0.15	27.48±0.42^{a}
	Female	184	706±13.47^{b}	16.12±0.17	17.11±0.20	7.73±0.34^{b}	8.35±0.09	9.52±0.12	24.66±0.34
IB	Male	222	733±11.87^{a}	16.27±0.15	17.21±0.18	8.50±0.30^{a}	8.46±0.08	9.75±0.11	24.69±0.30
	Female	287	736±10.08^{b}	17.96±10.08^{b}	19.72±0.15	6.59±0.59^{b}	7.32±0.07	11.37±0.09	28.06±0.26^{b}
	Male	293	750±10.04^{a}	18.10±0.12^{a}	19.65±0.15	8.46±1.24^{a}	7.43±0.07	11.53±0.09	29.04±0.26^{a}

^{a,b} mean occupying the same column having different superscript are significantly different (P<0.05)
OBS: number of observation, BDW: body weight, BDL: body length, CH: chest girth, KL: keel length, SHK: shank length, thigh length, WL: wing length, FF: Frizzle Feather, W: Whole Feather, IW: Isa brown× Whole Feather, IFF: Isa brown ×Frizzle Feather, IB: Isa brown.

Discussion

ISA-Brown × frizzle feather crossbred performed better in body weight at day old and this had consequential effects on body length and chest girth of the chickens at later ages. It was seen that purebred Isa brown chicken progenies had similar statistical results for the same parameters studied except in body weight The values obtained for Isa brown × frizzle feather and purebred Isa brown progenies on growth dimensions at day old are not in agreement with the findings of Adebambo *et al*. (2011) for broiler improvement programs and Khawaja *et al*. (2012) for purebreds Rhode Island Red, and crossbreds Rhode Island Red × Fayoumi. Sola Ojo and Ayorinde (2011) also reported that newly hatched chicks from the pure and crosses of Dominant black × Fulani ecotype were not different in body weight. However, the present study contradicts the opinion of Adebambo *et al*. (2011).

At 4 weeks, body weight and all other linear body measurements were higher in purebreds Isa brown (IB) than either the pure local and crossbreds. However, this trend was repeated till 8 weeks old. The superiority of the ISA-Brown could be as a result of this chicken possessing improved genes for growth and egg production. With these genes, the feed conversion ratio and feed efficiency will increase impacting positively on growth. This present study is in line with the findings of Amao *et al*. (2017) who reported that purebreds Rhode Island Red genotype had highest values for all growth parameters measured.

At 16 and 20 weeks of age, crossbreds of Isa brown × Frizzle feather and ISA-Brown × Normal feather recorded highest body weight, body length, chest girth, keel length, shank length and thigh length at various ages except purebred FF progenies. This is in agreement with

the works of Amao *et al.* (2017). From the results obtained, it could be deduced that the performance of the crossbred chickens could be due to possession of the mixed genes from both local and exotic parents, therefore, conferring better adaptation of the crossbreds to hot tropical environment. (Deeb and Cahaner, 2001, Peters *et al.*, 2002, Adedeji *et al.*, 2004 & Amao, 2017b).

Observations of significant effect of sex was noted in all the body parameters recorded at all ages except at day old. Chicken progenies that were females constantly had higher values of body growth parameters from 0-8weeks compared with their male counterparts. The present findings contradict the works of Adedeji *et al*. (2006) who reported that male progenies had higher mean values of growth parameters than their female counterparts. The authors attributed this to age, breed and rate of feed consumption. However, male progenies from 12 to 20 weeks of age were seen to possess noticeable body growth parameters when compared with their female counterparts. This is in line with the findings of Adedeji *et al*. (2006) on crossbred of naked neck, Fulani ecotype with an exotic purebred (white leghorn) chicken where the male had higher mean values than their female counterparts. The authors attributed this to the male hormonal factors and aggressiveness while feeding. Sola Ojo *et al.* (2011) while working on body weight and linear measurements of some chickens opined that male and female chickens could be separated for uniform growth at eight weeks and this leads to prevention of indiscriminate mating among the birds before attaining the age of sexual maturity and this could further help in the selection and improvement of chickens for meat and egg production.

Genotype-by-sex interaction on body parameters of chickens showed that male chicken progenies from each genotype were favoured than their female counterparts except at day old where there is inconsistency, and this could be attributed to the size of the eggs and parental influence that produced (hatched) the chicks rather than the sex of the chicks. Moreso, male progenies in all genotypes were heavier than their females and this is in line with works of the earlier authors (Adedeji *et al.,* 2006).

Recommendation

It is recommended from the results of this experiment that the crossbred progenies resulting from crosses of ISA-Brown × Frizzle Feather could be reared and selected for better body weight and other body parameters. While, ISA-Brown × Normal Feather males could be reared for sales as meat birds.

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