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Comparative Evaluation of Spurred and Spurless Male and Female Indigenous Nigerian Chicken in the Three Administrative Zones of Niger State

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ABSTRACT

The study was carried out using 750 indigenous Nigerian chickens comprising 543 males and 207 females brought to the market by farmers for sale in the three administrative zones of Niger state, Nigeria. Parameters measured were Body Weight (BW), Body Length (BL), Body Girth (BG), Wing Length (WL), Shank Length (SL) and Shank Thickness (ST). Results revealed that there's a great preponderance of spurred (sI) indigenous Nigerian chickens in Niger state. The gene frequencies of spurred (sI) and spurless ($SI^{+}/-$) gene in the three administrative zones of Niger State were as follows; zone A: (males, 0.93 vs. 0.07 and females, 0.69 vs. 0.31); zone B: (males, 0.93 vs. 0.07 and females, 0.74 vs. 0.26) and zone C: (males, 0.92 vs. 0.08 and females, 0.87 vs. 0.13), respectively. Spur gene significantly ($p<0.05$) imparted on all the metric parameters evaluated in the three zones except for BG and SL in zone B which were not significantly ($p>0.05$) affected by the presence of the gene. Birds from zone C (males and females) performed better than those from the other zones in all the parameters measured. They had better BW (2.28; 1.98), BL (44.79; 41.47), BG (26.41; 25.24), WL (24.83; 23.79), SL (12.04; 11.00) and ST (1.30; 1.20), respectively. Results from the combined analysis showed that spurred females were better than the spurless males in BW, BG, WL and ST. It was concluded that the presence of spur in the local chickens conferred some advantages on the birds' exhibiting the trait as they performed better than the ones not having it.

Key words: Administrative zones, spur, indigenous Nigerian chicken, spur gene

INTRODUCTION

The indigenous Nigerian chicken constitutes a large percentage of the total chicken population of the country, about 80% of the 120 million poultry found in Nigeria (RIM, 1992). It has been much maligned as a low productive, nondescript entity with low genetic potential compared to its exotic cousins. This is rather unfortunate as it has some intrinsic characteristics which makes it hardier, adaptable, disease resistance and hence with a higher survivability to the existing ecological niche that is Nigeria. These indigenous chickens have existed for centuries as scavengers reared in backyard in rural conditions. It is possible that their adaptability to the tropical environment has been through reduction in body size and improved flightiness which has helped in greatly reducing maintenance feed requirement, increased feed efficiency and increased their survivability from attacks by their common enemies.

Indigenous chickens are more preferred by the populace as its meat is said to be tastier and tough. Although, output is low compared to the exotic ones, production of this type of birds is often the only type affordable by the rural poor. Sales of eggs and live birds are perhaps the only source of earnings available to rural families (Nwagu, 2002). According to Osaiyuwu *et al.* (2010), the indigenous fowl population is considered as a gene reservoir particularly for genes that has adaptive value for the local environment. Genes such as the feather distribution gene, naked Neck (Na), the feather structure gene, Frizzle (F) and the spur gene (sl) are among these major genes which are economically interesting in modern breeding systems as they act as sex marker genes and diseases resistant factors. These genes cause a reduction in tropical heat stress by improving the breed's ability of convection, resulting in improved feed conversion and better performance. Horst (1988) and Mathur and Horst (1990) showed that individuals with F and Na gene both singly and/or in combination were superior to those individuals with normal feathering for egg mass/weight and forty week body weight in tropical environments. According to Ibe (1993), naked and the frizzled genes are associated with early sexual maturity in a tropical environment. This great genetic resource embedded in the indigenous poultry await full exploitation that will provide basis for genetic improvement and diversification to produce breeds that are adapted to local conditions for the benefit of farmers in developing countries (Horst, 1988).

Spur is one of the morphological traits found in indigenous Nigerian chickens. Ijaiya *et al.* (2010) reported that the gene controlling the trait is recessive to its wild allele. Mancha *et al.* (2006) reported 54.4% occurrence of spur in chickens in Plateau state while Oguntunji and Ayorinde (2009) reported 37.15% occurrence of spur in Oyo state. Both authors also reported 100 and 70.73% occurrence of spur, respectively in male indigenous chickens. Ijaiya *et al.* (2010) reported high incidence of the gene (76, 80.80 and 81.20%) in the three administrative zones of Niger state when comparing its incidence in the total population without splitting the population into males and females with spur and males and females without spur respectively. They also reported that the presence of the gene confers some advantages on birds expressing them as they performed better than spurless ones. FAO (2011) reported 98% incidence of spur Bangladeshi chicken. The objective of this study was therefore, to undertake a comparative evaluation of spurred and spurless male and female indigenous Nigerian chickens in the three administrative zones of Niger state with particular reference to its effects on body weight and linear body traits.

MATERIALS AND METHODS

Location: The study was conducted in Niger state, Nigeria. Niger state is located in the southern guinea savanna area of Nigeria and it is the largest state in the country. Niger lies on latitude 3°20' East and longitude 11°30' North of the equator. It has a distinct dry and wet season with rainfall varying from 1100-1600 mm and a temperature range of 23-37°C.

Data collection: Seven hundred and fifty (750) indigenous Nigerian chickens brought to the market for sale were sampled in the three administrative zones (A, B and C) of Niger state. The birds were randomly sampled at Bida, Lavun and Badeggi (representing zone A), Minna, Paikoro and Gwada (representing Zone B) and at Kontagora, Tegina and Rijau (representing zone C), respectively. The birds were raised mostly under semi-intensive system of management; the main feed resources in this system were household wastes and supplements from grasses, worms and insects around the neighbourhood. Provision of other inputs such as housing, additional feed and

health care vary considerably among and within the zones depending mostly on the socio-economic status of the farmers.

Body weight of individual birds was measured using a mechanical hanging balance of 2.5 kg with a precision of 20 g. The following metric measures were recorded using tape rule (cm): Body Length (BL), Body Girth (BG), Wing Length (WL) and Shank Length (SL). Shank Thickness (ST) was measured using a vernier calliper (mm). The metric measurements were as described by Fayeye *et al.* (2006). The measurements are as described below:

- **Body length:** Distance from the tip of the beak, through the body trunk to the tail
- **Body girth:** The circumference of the breast region
- **Wing length:** Length of the wing from the scapula joints to the last digit of the wing
- **Shank length:** Length of the tarso-metatarsus from the hock joint to the metatarsal pad
- **Shank thickness:** Diameter of the tarso-metatarsus just below the spur

Frequency of occurrence of spur gene in the chickens was obtained by using the formula:

$$\text{Phenotypic frequency} = \frac{\text{Number of sample}}{\text{Total number sampled}} \times 100$$

Chi-square analysis was employed to test the observed number of spurred fowls against the expected Mendelian value (25 and 75%), respectively for spur incidences and spurlessness while Hardy-Weinberg principle (Falconer, 1989) was used to estimate gene frequency as given below:

$$q = \frac{vm}{t}$$

Where:

q = Frequency of recessive gene (sI).
m = Number of indigenous chickens expressing spur trait (genotype sI/sI).
t = Total number of local chicken sampled (all genotypes).

Data analysis: All the data collected from the survey were analyzed using the PROC GLM procedure of SAS (2000). Body weight was correlated with the linear body measurements using the same package. Significant level was set at $p<0.05$.

RESULTS

Frequency of spur gene (sI) in Nigerian local chickens in niger state: The distribution and gene frequencies of spurred (sI) and spurless ($SI^{+}/-$) gene in the three administrative zones of Niger State is shown Table 1. The spurred birds were predominant in male chickens (156; 0.86% with calculated genes frequency of 0.93) in Zone A. Spurred female birds were fewer (33; 0.48% with calculated gene frequency of 0.69) while the spurless female birds were more predominantly (36; 0.52% with calculated gene frequency of 0.31). In zone B, the spurred birds were more predominant in males (174; 0.87% with calculated gene frequency of 0.93) while the spurless birds were less predominant (26; 0.13% and with calculated gene frequency of 0.07). Female spurred birds in the zone were more (27; 0.54% with calculated gene frequency of 0.74) while spurless birds

Table 1: Frequency of spur gene in male and female indigenous Nigeria chicken

	Sex	Genotype	N	Obs.freq1%	Exp.freq2%	Cal.gene3	Exp.gene4
Zone A							
Spurred	M+	sI	156	0.86	25	0.93a	0.25
Spurless	M-	SI+/-	25	0.14	75	0.07b	0.75
Total			181				
Spurred	F+	sI	33	0.48	25	0.69a	0.25
Spurless	F-	SI+/-	36	0.52	75	0.31b	0.75
Total			69				
Zone B							
Spurred	M+	sI	174	0.87	25	0.93a	0.25
Spurless	M-	SI+/-	26	0.13	75	0.07b	0.75
Total			200				
Spurred	F+	sI	27	0.54	25	0.74a	0.25
Spurless	F-	SI+/-	23	0.46	75	0.26b	0.75
Total			50				
Zone C							
Spurred	M+	sI	141	0.84	25	0.92a	0.25
Spurless	M-	SI+/-	26	0.16	75	0.08b	0.75
Total			167				
Spurred	F+	sI	62	0.75	25	0.87a	0.25
Spurless	F-	SI+/-	21	0.25	75	0.13b	0.75
Total			83				

N: Number; M+: Males with spur; M-: Males without spur; F+: Females with spur; F-: Females without spur; obs. freq1%: Observed frequency; Exp. freq2%: Expected frequency; Cal. gene3: Calculated gene frequency; Exp. gene4: Expected gene frequency

Table 2: Effect of spur gene (sI) on metric parameters in Nigerian local chickens (zone A)

Parameter	M+ (N = 156)	M- (N = 25)	F+ (N = 33)	F- (N = 36)	X	SD	LS
BW	1.59a	1.08b	1.53a	1.10b	1.46	0.44	*
BL	37.76a	36.77ab	36.25ab	35.13b	37.08	3.77	*
BG	24.52a	22.65b	25.62a	22.91b	24.25	2.55	*
WL	21.52a	20.66bc	21.21bc	20.10c	21.19	1.77	*
SL	10.72a	10.00b	10.63a	9.54b	10.46	1.26	*
ST	1.01a	0.90b	0.94b	0.90b	0.98	0.16	*

Means with different superscripts in the same row differ significantly ($p<0.05$). SD: Standard deviation; X: Mean; N: Number; M+: Males with spur; M-: Males without spur; F+: Females with spur; F-: Females without spur; LS: Level of significance; BW: Body weight; BL: Body length; BG: Body girth; WL: Wing length; SL: Shank length; ST: Shank thickness

were less predominant (23; 0.46% with calculated gene frequency of 0.26). In zone C, spur was predominant in males (144; 0.84% with calculated gene frequency of 0.92) while the spurless birds were less in number (26; 0.16% with calculate gene frequency of 0.08). Female spurred birds were predominant (62; 0.75% with calculated gene frequency of 0.87) while the spurless birds were fewer (21; 0.25% with calculated gene frequency of 0.13), respectively.

Effect of spur gene (sI) on metric parameters in male and female Nigerian chickens in zone A, B and C of Niger state: There were significant ($p<0.05$) differences observe in the BW, BL, WL, SL and ST of the birds (Table 2). Spurred birds (male and female) were better than the spurless birds (male and female) in all the parameters evaluated. There was no statistical difference observed between the spurless males and females in all the parameters measured. Spurred females

Table 3: Effect of spur gene (sI) on metric parameters in indigenous Nigerian chicken (zone B)

Parameters	M+ (N = 174)	M- (N = 26)	F+ (N = 27)	F- (N = 23)	X	SD	LS
BW	1.54a	1.559a	1.36ab	1.20b	1.49	0.39	*
BL	36.42a	36.76a	34.66b	34.40b	36.08	3.53	*
BG	25.83	26.14	26.22	25.38	25.86	2.66	ns
WL	21.40a	21.63a	20.89ab	20.34b	21.27	1.82	*
SL	11.40	10.37	10.10	9.91	11.02	6.61	ns
ST	1.12a	1.12a	10.10b	0.97b	1.10	0.25	*

Means with different superscripts in the same row differ significantly ($p<0.05$). SD: Standard deviation; X: Mean; N: Number; M+: Males with spur; M-: Males without spur; F+: Females with spur; F-: Females without spur; LS: Level of significance BW: Body weight; BL: Body length; BG: Body girth; WL: Wing length; SL: Shank length; ST: Shank thickness

Table 4: Effect of spur gene (sI) on metric parameters in indigenous Nigerian chicken (zone C)

Parameters	M+ (N = 141)	M- (N = 26)	F+ (N = 62)	F- (N = 21)	X	SD	LS
BW	2.28a	1.97b	1.98b	1.60c	2.12	0.27	*
BL	44.79a	42.25b	41.47b	38.26c	43.16	3.16	*
BG	26.41a	25.54b	25.24b	23.76c	25.56	1.06	*
WL	24.83a	23.95ab	23.79b	21.76c	24.22	2.11	*
SL	12.04a	11.17b	11.00bc	10.48c	11.56	1.18	*
ST	1.30a	1.10bc	1.20ab	1.00c	1.23	0.29	*

Means with different superscripts in the same row differ significantly ($p<0.05$). SD: Standard deviation; X: Mean; N: Number; M+: Males with spur; M-: Males without spur; F+: Females with spur; F-: Females without spur; LS: Level of significance; BW: Body weight; BL: Body length; BG: Body girth; WL: Wing length; SL: Shank length; ST: Shank thickness

Table 5: Effect of spur gene (sI) on metric parameters in indigenous Nigerian chickens (combined)

Parameters	M+ (N = 471)	M- (N = 77)	F+ (N = 122)	F- (N = 80)	X	SD	LS
BW	1.78a	1.54b	1.72a	1.26c	1.69	0.48	*
BL	39.37a	38.62a	38.55a	35.74b	38.77	4.76	*
BG	25.57a	24.80b	25.56a	23.84c	25.30	203	*
WL	22.47a	22.10b	22.45a	20.60c	22.23	2.38	*
SL	11.37a	10.52ab	10.70ab	9.90c	11.01	3.95	*
ST	1.14a	1.04b	1.11a	0.95c	1.10	0.26	*

Means with different superscripts in the same row differ significantly ($p<0.05$). SD: Standard deviation; X: Mean; N: Number; M+: Males with spur; M-: Males without spur; F+: Females with spur; F-: Females without spur; LS: Level of significance; BW: Body weight; BL: Body length; BG: Body girth; WL: Wing length; SL: Shank length; ST: Shank thickness

were also observed to have a better body girth than their male counterpart. Table 3 shows the effect of spur gene (sI) on metric parameters in male and female indigenous Nigerian chicken in zone B of Niger State. All the metric parameters were observed to be significantly ($p>0.05$) affected by the presence or absence of spur gene except BG and Sl. The trend of the result is similar to that observed for birds in zone A.

Table 4 shows the effect of spur gene (sI) on metric parameters in male and female indigenous Nigerian chicken in Zone C. All the metric parameters were observed to be significantly ($p<0.05$) influenced by the presence of the gene. The males (with or without spur) had better BW, BL, SL and ST than the females (with or without spur). Spurred females were however, observed to have similar BW than spurless males in this zone. Table 5 shows the effect of spur gene (sI) on metric parameters in indigenous Nigerian chicken in the three zones of Niger State (combined). All the metric parameter were observed to be significantly ($p<0.05$) affected by the gene. The spurred

males had better metric parameters than the spurless males and females (with or without spur). However, spurred females were observed to have better BW, BG, WL and ST than the spurless males.

DISCUSSION

The calculated spur gene frequency of indigenous Nigerian chicken in the three administrative zones of Niger State is significantly ($p<0.05$) higher than the expected Mendelian frequency of 25% and 0.25 gene frequency. This is consistent with earlier reports (Mancha *et al*., 2006; Ijaiya *et al*., 2010). The percentage occurrence of the gene in male chickens in the three zones (86; 87 and 84%) is higher than values reported for the entire state by Ijaiya *et al*. (2010). This means that there is a higher occurrence of spur genes (sI) in male indigenous chickens in Niger State. Sex-linkage might be attributed for the higher frequency of occurrence of spur gene in the male compared to the females sampled. Oguntunji and Ayorinde (2009) reported that leg spur development is a characteristics of male birds and that the trait is partially sex-limited, being more evident in males than females. Percent frequency of spurred females observed in this study (48, 54 and 75%) is higher than the 29.27% reported by Oguntunji and Ayorinde (2009).

Spurred (sI) indigenous chickens (male and female) in the three administrative zones were significantly ($p<0.01$) better in all the parameter evaluated when compared to the spurless ($SI^{+/-}$) ones (male and female). The presence of spur in the indigenous chicken seems to have conferred some advantages on the birds' exhibiting the trait as they performed better than the spurless ones. This might be due to better adaptability as reported by Ibe (1993). Major genes have been reported to have potentially useful effects on productive parameters in the indigenous chicken either because of their direct effect on production or because of their indirect effect on quantitative trait loci (Fayeye *et al*., 2006). Although, the mean body weight of the birds in the state (Table 5) was lower than that reported for exotic chicken (Oluyemi and Roberts, 2000), spurred birds in the study were heavier and had better body dimensions than those of Oyo and Ekiti states respectively (Oguntunji and Ayorinde, 2009; Fajemilehin, 2011). Spurred birds also had better body weight, wing length, body girth and shank length than the naked neck, frizzled, polydactyl, ptylopody and normal chickens studied by Fayeye *et al*. (2006). Spurred indigenous male chickens were statistically similar to the spurred indigenous female chickens in body weight and other body dimension traits which mean that the presence of the gene has an equalizing effect on the traits studied. This is at variance with the report of Oguntunji and Ayorinde (2009). More males were bought to the market for sale than females. This is expected as the females are usually kept back with a few choice males by the keepers for breeding purpose. It is a common practice to slaughter the males to entertain visitors during festive periods, give them out as gift, as well as sell them when the need arises to raise money to meet immediate family need.

CONCLUSION

From the results obtained from this study, the following conclusions could be made:

- There's a great predominance of spurred gene (sI) in indigenous Nigerian chicken in Niger state
- Birds from zone C (males and females) were better than those from the other zones in all the parameters evaluated
- The presence of spur gene (sI) impacted positively on the metric traits evaluated

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