



## Shank Colour Effect on Zoometric Traits of Indigenous Normal Feathered Chickens

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### ABSTRACT

The study was aimed to evaluate the shank colour effect on zoometric traits of indigenous normal feathered chickens. Two hundred adult chickens of both sexes comprising of black, white, yellow, cream and grey shank colours under smallholder flock in Lafia, were randomly sampled. Data were collected at four locations: Azuba centre, Keffi wambai, Agyaragu and Adogi. Nine zoometric traits: Comb Length (CL), Body Length (BDL), Breast Circumference (BC), Thigh Length (TL), Thigh Circumference (TC), Wing Length (WL), Foot Length (FL), Shank Length (SL) and Total Leg Length (TLL) were measured on each chickens. The General Linear Model (GLM) of SPSS was employed for the data analysis. There was significant differences ( $P < 0.05$ ) recorded for grey shank coloured chickens for comb and foot length. Cream, white and yellow shank coloured chickens recorded significant differences ( $P < 0.05$ ) for body length. Also cream shank coloured chickens recorded significant differences ( $P < 0.05$ ) for breast circumference and wing length. Cream and white shank coloured chickens recorded significant difference ( $P < 0.05$ ) for thigh circumference. Shank length and total leg length were highly influenced ( $P < 0.05$ ) by the white shank coloured chickens. Thigh length was also influenced ( $P < 0.05$ ) by white and yellow shank coloured chickens. Female chicken had higher ( $P < 0.05$ ) values of comb length and foot length compared to their male counterpart. Male chickens were superior to their female counterparts for body length, shank length, thigh length and total leg length. The sex variations in the zoometric traits of the chickens of this study would provide basis selection and improvement.

**Keywords:** Shank, Zoometric traits, Colour, Chickens

### INTRODUCTION

Shank colour remained a complex genetic character in chicken and it is controlled by polygenic gene loci and other factors such as species, nutrition, gender, age and so on (Chang *et al.*, 2006). The genetic and physiological mechanisms of pigment formation remain unclear, and there are scarcity of information about the chicken pigment related traits (Yang *et al.*, 2004). Genealogy records of generations are important in identifying the genetic factors of

pigment-related traits, which remain difficult to achieve in practice specifically for the rare traits (Chang *et al.*, 2006).

In chicken, the shank colour is mainly affected by epidermal melanin, dermal melanin and carotenoids, including yellow, flesh-coloured, red, black, blue, cyan and so on (Kang *et al.*, 2002).

Yin *et al.* (2001) assumed that the light shank was completely dominant to the dark shank with the effect of sex and age, which was

slightly divergent from different mating combinations.

Kang *et al.* (2002) observed the shank and plumage colour and the feather growth in a slow-feathering pure line of Gushi chicken. They found that the shank colour gradually changed from light to dark with the increasing of week-age while the plumage colour did from dark to light. While both positive and negative cross mating were carried out to produce F2 population using White Leghorn, Shouguang and Tibetan chicken. Wang *et al.* (2006) found that Id / id gene showed a sex-linked inheritance in the shank colour and the id gene had expressed step by step in the recessive homozygous and they confirmed that the genotype of shank colour was homozygous dominant in the white leghorn rooster.

Studies recently have revealed that there were multiple alleles in Id locus, five alleles were found up to now but their genetic mechanisms remained unclear.

Body growth in livestock may be evaluated with body components (zoometrics) such as live weight and body measurements (Saatci and Tilki, 2007).

Examining relationships between live weight and zoometric measurements of chicken especially in rural communities where weighing scales may not be readily available can assist in the selection. Therefore this study was designed to evaluate the shank colour effect on zoometric traits of indigenous normal feathered chicken.

## MATERIALS AND METHODS

### Study Location

This study was conducted in Lafia, Nasarawa State, Nigeria. Nasarawa State lies within the Guinea savanna zone of Nigeria at Latitude 8.49° N and Longitude 8.52° E. It is positioned

at altitude 181.35m above sea level with an average rainfall of 1182mm annually (Wikipedia, 2025). It enjoys two separate seasonal periods namely; rainy season (April-September) and dry season between (October-March).

### Experimental Birds and Sampling

A total of two hundred (200) adult chickens with different shank colours comprising of black, white, yellow, cream and grey of both sexes reared by smallholder flock farmers with similar management system in Lafia, Nasarawa State, were randomly sampled. Data were collected at four (4) different locations as thus: Azuba centre, Keffi Wambai, Agyaragu and Adogi respectively. In each location a total of fifty (50) chickens were sampled.

### Zoometric Measurements

Nine (9) zoometric traits: body length (BDL), breast circumference (BC), thigh length (TL) thigh circumference (TC), shank length (SL), foot length (FL), total leg length (TLL), wing length (WL) and Beak length (BKL) were measured on each bird following the standard procedure as adopted by Yakubu *et al* (2017).

**Body length (BL):-** Body length was taken between the tip of the Rostrum maxillare (bill) and that of the Cauda (tail, without feathers).

**Breast circumference (BC):-** Was taken under the wings at the edge of the sternum.

**Thigh length (TL):-** This was taken at the distance between the hock joint and the pelvic joint

**Thigh circumference (TC):-** Was measured as the circumference of the drumstick at the coxa region.

**Shank length (SL):-** Length from the hock joint to the tarso-metatarsus of any leg (cm).

**Foot length (FL):-** Was taken as the distance

from the shank joint to the extremity of the *Digitus pedis*.

**Total leg length (TLL):** Was taken as the length of the femur, shank and metatarsal.  
**Wing length (WL):** Was taken from the shoulder joint to the extremity of the terminal phalanx, digit 111.

**Comb length (CL):-** This was measured by placing a tape rule from where the comb starts on the head to where its end (cm).

**Statistical Analysis**

The General Linear model (GLM) of SPSS version 22 (2015) was adopted to test the fixed effect of shank colour on zoometric traits [(BDL), (BC), (TL) (TC), (SL), (FL), (TLL), (WL), (CL), (BKL)]. The following linear model was employed:

$$Y_{ij} = \mu + P_i + e_{ij}$$

Where;

**Table 1:** Descriptive statistics of Shank colours, location and zoometric traits of indigenous normal feathered chickens in Lafia, Nasarawa State.

Variables	Mean	Min	Max	Range	SEM	SD	Variance
Shank colours	3.00	1.00	5.00	4.00	0.10	1.42	2.01
Locations	2.50	1.00	4.00	3.00	0.08	1.12	1.26
<b>Zoometric traits (cm)</b>							
Comb Length (CL)	2.42	1.10	3.60	2.50	0.06	0.85	0.72
Body Length (BDL)	32.75	16.00	43.70	27.70	0.39	5.53	30.53
Breast Circumference(BC)	22.78	13.00	34.20	21.20	0.29	4.14	17.11
Thigh circumference (TC)	11.79	15.40	5.00	10.40	0.18	2.52	6.34
Wing Length (WL)	21.37	15.00	33.00	18.00	0.17	2.40	5.79
Foot Length (FL)	3.08	2.40	4.10	1.70	0.02	0.31	0.09
Shank Length (SL)	3.94	3.10	4.30	1.20	0.03	0.36	0.13
Thigh Length (TL)	5.89	5.60	6.40	0.80	0.01	0.19	0.04
Total Leg Length (TLL)	12.91	11.50	14.40	2.90	0.03	0.48	0.24

SEM- Standard error of mean; SD- Standard deviation  
 Min-Minimum; Max- Maximum

Y= individual observation

$\mu$  = general mean of the population

$S_i$ = Shank colour (i=1, i=2,i=3, i=4, i=5) i.e  
 1= Black, 2= White, 3=Yellow, 4= Cream,  
 5=Grey

$e_{ij}$ = error term.

**RESULTS**

**Zoometric traits of indigenous normal feathered chickens**

The results showed the mean, minimum and maximum, range, standard error of mean, standard deviation and variance. The mean for shank colours was (3.00), locations (2.50), comb length (2.42), body length (32.75), breast circumference (22.78), thigh circumference (11.79), wing length (21.37), foot length (3.08), shank length (3.94), thigh length (5.89) and total leg length (12.91) respectively (table 1).

**Effect of shank colours on zoometric traits of indigenous normal feathered chickens**

There were significant differences ( $P < 0.05$ ) recorded for all the zoometric traits investigated. The grey shank coloured chickens recorded the highest values for comb length (3.36) whereas white (1.88) and cream (1.84) shank coloured chickens recorded the least values. White (35.43) and Cream (34.99) shank coloured chickens recorded higher values for body length whereas grey coloured chickens recorded the least value of 26.11. The highest value (25.48) for breast circumference was recorded for cream shank coloured chickens whereas black (22.29) and grey (19.27) recorded the least values. Cream (13.60) and white (12.78) shank coloured chickens while the grey shank coloured chickens recorded the least values for thigh circumference.

Cream shank coloured chickens recorded the highest value for wing length (22.79) while

black and grey recorded the least of 20.81 and 19.36. Grey shank coloured chickens recorded the highest value for foot length (3.43) whereas black shank coloured chickens recorded the least of 2.81. The highest value (4.16) of shank length was recorded for white shank coloured chickens and the least value (3.73) was recorded for cream shank coloured chickens. Grey shank coloured chickens had higher values of 6.00 for thigh length whereas white shank coloured chickens recorded the least of 5.79. Grey and white shank coloured chickens had higher value (13.45 and 13.28) for total leg length whereas cream and black shank coloured chickens recorded the least values of 12.58 and 12.46 (table 2).

Grey shank coloured had impact on the comb length, foot length, total leg length and shank length; Breast circumference and wing length were impacted by cream shank colour while white and cream shank colour had impacts on the body length and thigh length.

**Table 2:** Effect of Shank colours on zoometric traits of indigenous normal feathered chickens in Lafia, Nasarawa State.

Traits (cm)	Black	White	Yellow	Cream	Grey	SEM
Comb Length (CL)	2.58 <sup>b</sup>	1.88 <sup>c</sup>	2.48 <sup>b</sup>	1.84 <sup>c</sup>	3.36 <sup>a</sup>	0.06*
Body Length (BDL)	33.79 <sup>b</sup>	35.43 <sup>a</sup>	33.40 <sup>ab</sup>	34.99 <sup>a</sup>	26.11 <sup>c</sup>	0.39*
Breast Circumference(BC)	22.29 <sup>c</sup>	24.42 <sup>b</sup>	22.45 <sup>b</sup>	25.48 <sup>a</sup>	19.27 <sup>c</sup>	0.29*
Thigh circumference (TC)	11.49 <sup>b</sup>	12.78 <sup>a</sup>	11.66 <sup>b</sup>	13.60 <sup>a</sup>	9.41 <sup>c</sup>	0.18*
Wing Length (WL)	20.81 <sup>c</sup>	22.17 <sup>b</sup>	21.71 <sup>b</sup>	22.79 <sup>a</sup>	19.36 <sup>c</sup>	0.17*
Foot Length (FL)	2.81 <sup>d</sup>	3.23 <sup>b</sup>	2.96 <sup>c</sup>	2.96 <sup>c</sup>	3.43 <sup>a</sup>	0.02*
Shank Length (SL)	3.86 <sup>c</sup>	4.16 <sup>a</sup>	3.93 <sup>c</sup>	3.73 <sup>d</sup>	4.02 <sup>b</sup>	0.01*
Thigh Length (TL)	5.79 <sup>c</sup>	5.89 <sup>b</sup>	5.89 <sup>b</sup>	5.89 <sup>b</sup>	6.00 <sup>a</sup>	0.01*
Total Leg Length (TLL)	12.46 <sup>c</sup>	13.28 <sup>a</sup>	12.78 <sup>b</sup>	12.58 <sup>c</sup>	13.45 <sup>a</sup>	0.03*

<sup>abcd</sup>Means on the same row with different letters are significant ( $P < 0.05$ ), SEM- Standard error of mean, \*Significance at 95%.

**Effect of Location on Zoometric Traits of Indigenous Normal Feathered Chickens**

There were significant differences ( $P < 0.05$ ) recorded for all the zoometric traits investigated. Chickens of Adogi had the

highest value of comb length (3.06). Higher values for body length (34.73, 34.11 and 33.16) were observed for chickens in Azuba centre, Agyaragu and Keffi wambai. Chickens in Agyaragu and Azuba centre had higher

values for breast circumference (24.42 and 23.12) and thigh circumference (12.36 and 12.54). Wing length value (22.35) was highest for chickens in Agyaragu, chickens of Adogi recorded the highest value (3.48) for foot length. Shank length value (4.21) was highest

for chicken in Azuba centre. The highest Thigh length value (6.0) was recorded for both chickens in Azuba centre and Agyaragu. Chickens of Azuba centre had the highest value (13.38) for total leg length (table 3).

**Table 3:** Effect of Location on zoometric traits of indigenous normal feathered chickens in Lafia, Nasarawa State.

Traits (cm)	Keffi Wambai	Azuba Centre	Agyaragu	Adogi	SEM
Comb Length (CL)	2.36 <sup>b</sup>	2.02 <sup>c</sup>	2.24 <sup>bc</sup>	3.06 <sup>a</sup>	0.66*
Body Length (BDL)	33.16 <sup>a</sup>	34.73 <sup>a</sup>	34.11 <sup>a</sup>	28.99 <sup>b</sup>	0.39*
Breast Circumference(BC)	21.82 <sup>b</sup>	23.12 <sup>ab</sup>	24.42 <sup>a</sup>	21.77 <sup>b</sup>	0.29*
Thigh circumference (TC)	11.38 <sup>b</sup>	12.54 <sup>a</sup>	12.36 <sup>a</sup>	10.88 <sup>b</sup>	0.18*
Wing Length (WL)	20.32 <sup>c</sup>	21.83 <sup>b</sup>	22.35 <sup>a</sup>	20.98 <sup>bc</sup>	0.17*
Foot Length (FL)	2.86 <sup>c</sup>	3.07 <sup>b</sup>	2.90 <sup>c</sup>	3.48 <sup>a</sup>	0.02*
Shank Length (SL)	3.93 <sup>b</sup>	4.21 <sup>a</sup>	3.98 <sup>b</sup>	3.64 <sup>c</sup>	0.03*
Thigh Length (TL)	5.89 <sup>b</sup>	6.00 <sup>a</sup>	6.00 <sup>a</sup>	5.68 <sup>c</sup>	0.01*
Total Leg Length (TLL)	12.68 <sup>c</sup>	13.38 <sup>a</sup>	12.88 <sup>b</sup>	12.80 <sup>bc</sup>	0.03*

<sup>abc</sup>Means on the same row with different letters are significant ( $P < 0.05$ ), SEM- Standard error of mean. \*Significance at 95%.

**The effect of sex on Zoometric Traits of Indigenous Normal Feathered Chickens**

There were significant differences ( $P < 0.05$ ) observed for all variables except for breast circumference, thigh circumference and wing length. Female chickens had higher values of comb length (2.64) and foot length (3.28)

compared to their male counterpart (2.31 and 3.00). In a reverse case, the male chickens were superior to their female counterpart for body length (34.28 versus 30.93), shank length (4.13 versus 3.72), thigh length (5.98 versus 5.77) and total leg length (13.10 versus 12.79) (table 4).

**Table 4.** Effect of sex on zoometric traits of indigenous normal feathered chickens in Lafia, Nasarawa State.

Traits	Male	Female	SEM
Comb Length (CL)	2.31 <sup>b</sup>	2.64 <sup>a</sup>	0.06*
Body Length (BDL)	34.28 <sup>a</sup>	30.93 <sup>b</sup>	0.44*
Breast Circumference(BC)	23.24 <sup>a</sup>	22.99 <sup>a</sup>	0.31 <sup>NS</sup>
Thigh circumference (TC)	12.33 <sup>a</sup>	11.62 <sup>a</sup>	0.20 <sup>NS</sup>
Wing Length (WL)	21.67 <sup>a</sup>	21.60 <sup>a</sup>	0.18 <sup>NS</sup>
Foot Length (FL)	3.00 <sup>b</sup>	3.28 <sup>a</sup>	0.02*
Shank Length (SL)	4.13 <sup>a</sup>	3.72 <sup>b</sup>	0.03*
Thigh Length (TL)	5.98 <sup>a</sup>	5.77 <sup>b</sup>	0.01*
Total Leg Length (TLL)	13.10 <sup>a</sup>	12.79 <sup>b</sup>	0.04*

<sup>ab</sup>Means on the same row with different letters are significant (P<0.05), SEM- Standard error of mean. \*Significance at 95%. NS- Not significant.

**Relationship Among the Zoometric Traits of Indigenous Normal Feathered Chickens**

The highest strong positive correlation (r=0.875) was observed between Body length (BDL) vs Thigh circumference (TC) followed by strong positive correlation (r=0.816) between Thigh circumference vs Wing length

(WL). There was strong positive correlation (r = 0.810) between Shank length (SL) vs Total leg length (TLL), r = 0.775 (BC vs TC), r = 0.739 (BDL vs WL), r = 0.728 (BDL vs BC) and r = 0.693 (BC vs WL). The highest negative correlation (-0.412) was observed between FL vs TL.

**Table 5:** Correlation among the zoometric traits of indigenous normal feathered chickens from the four selected locations in Lafia, Nasarawa State

Traits	CL	BDL	BC	TC	WL	FL	SL	TL	TLL
CL	-								
BDL	-0.398**	-							
BC	-0.258**	0.728**	-						
TC	-0.354**	0.875**	0.775**	-					
WL	-0.242**	0.739**	0.693**	0.816**	-				
FL	0.337**	-0.303**	-0.084	-0.141*	-0.056	-			
SL	-0.156*	0.411**	0.283**	0.320**	0.269**	-0.123	-		
TL	-0.322**	0.196**	0.111	0.072	0.100	-0.412**	0.352**	-	
TLL	-0.027	0.193**	0.202**	0.179*	0.205**	0.382**	0.810**	0.388**	-

\*\*Correlation is significant at the 0.01 level (2-tailed).

\*Correlation is significant at the 0.05 level (2-tailed).

**DISCUSSION**

The effect of shank colour on zoometric traits of this study was significant. There was significant differences recorded for grey shank coloured chickens comb length and foot length. Cream, white and yellow shank coloured chickens recorded significant differences for body length. In chicken, the shank colour is mainly affected by epidermal melanin, dermal melanin and carotenoids, including yellow, flesh-coloured, red, black, blue and cyan (Chang *et al.*, 2006). Cream shank coloured chickens recorded significant differences for breast circumference and wing length. This colours differences recorded in this study is an indication of the effect of

colours in the adaptation mechanism of animals at a given environment (Chang *et al.*, 2006). Cream and white shank coloured chickens recorded significant difference for thigh circumference. Shank length and total leg length were highly influenced by the white shank coloured chicken. Thigh length was also influenced by white and yellow shank coloured chicken.

Yin *et al.* (2001) thought that the light shank was completely dominant to the dark shank with the effect of gender and age, which was slightly divergent from different mating combinations.

The effect of location on zoometric traits of this study was significant. The differences in

the zoometric traits across the location of this present study could be due to the micro environmental differences (Faith *et al.*, 2018). Such variation in the production environments had earlier been reported for birds in five agro-ecological zones of Nigeria (Yakubu *et al.*, 2019). Although there were some zoometric measurements that are more adapted to one location than the other (Yakubu *et al.*, 2019).

The higher zoometric measurements of male birds could be attributed to sexual dimorphism. It indicates that male birds are more muscular. This is consistent with the report that female chickens are always significantly smaller than their male counterparts (Geibel *et al.*, 2016; Brown *et al.*, 2017). Growth regulation in chickens is affected by sex-specificity (Johnsson *et al.*, 2018). The significant differences in the shank length, thigh length and total leg length in the present study are in consonance with the report of Faith *et al.* (2018), an indication that male birds have relatively longer legs and wing than their female counterparts. The shorter legs of females are associated with small body size and could be exploited in minimizing the demand for work and power (Rose *et al.*, 2016). The sexual dimorphism observed in the present study may aid sexual selection and facilitate understanding of eco-evolutionary dynamics (Fryxell *et al.*, 2019) considering the selective adaptive advantage of sex in response to environmental stressors (Geffroy and Dou, 2019).

The strong positive correlation of the zoometric traits of this study is in agreement with the work of Yakubu *et al.* (2022) who reported varied relationships between body weight, morphometric and thermo-physiological traits of indigenous pigs under tropical conditions. The strong relationship existing between body weight and zoometric

traits of this study may be useful as selection criterion, since positive correlations of traits suggest that the traits are under the same gene action (Mallam *et al.*, 2024).

## CONCLUSION

Grey shank coloured had significant impact on the comb length, foot length, total leg length and shank length; Breast circumference and wing length were significantly impacted by cream shank colour while white and cream shank colour had significant impacts on the body length and thigh length. Male chickens were superior to their female counterparts in some body traits. The sexual differences of the chickens of this study would aid in selection and improvement of the chickens.

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