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Influence of Breed and Sex on Body Weight and Conformation Traits of Turkeys

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Abstract

A study was conducted to evaluate the influence of breed and sex on body weight and conformation traits in two turkey breeds: Nigerian Indigenous Turkey (NIT) and Hybrid Commercial Turkey (HCT). Sixty-four poults were randomly assigned to two treatment groups based on breed, with each breed further replicated four times, comprising eight birds per replicate. The birds were reared in deep litter pens for 18 weeks. Conformation traits assessed included body length (BL), breast girth (BG), shank length (SL), thigh length (TL), wing span (WS), wing length (WL), and neck length (NL). Data collected on body weight and conformation traits were analyzed using the Statistical Package for the Social Sciences (SPSS) package. Results revealed significant ($p< 0.05$) differences in body weight between the two breeds. Conformation traits also showed significantly higher values in HCT compared to NIT. Sex had a significant effect ($p< 0.05$) on body weight and conformation traits in both turkey breeds, with male turkeys exhibiting significantly higher values than females. Additionally, there were significant ($p< 0.05$) interactions between breed and sex. It was concluded that variations exist in body weight and conformation traits between the two turkey breeds, suggesting potential for crossbreeding with improved breeds to enhance the performance of Nigerian Indigenous Turkey.

Keywords: Turkey, Body Weight, Conformation Traits, Breed, Sex

1.0 Introduction

Poultry production holds significant importance in Nigeria, contributing approximately 6-8% to the total GDP annually and about 30% to the agricultural GDP (NBS, 2023). Beyond economic contributions, poultry farming sustains livelihoods by providing food (Sam *et al*., 2010; Alphonsus *et al*., 2012; Ebong *et al*., 2023). Poultry meat, renowned for its low cholesterol content and high protein levels (Stangierski and Lesnierowski, 2015), is preferred by consumers. Additionally, poultry farming offers organic manure for crop production and serves as a source

of income and employment, especially in rural areas (Essien and Sam 2018; Efretuei *et al*., 2023; Sam and Okon, 2022).

While chicken farming has received considerable attention, other poultry species, including turkeys, have been overlooked by both researchers and government interventions. Despite its potential for fast growth and size (Ironkwe and Akinola, 2010; Anandah *et al*., 2012; Yakubu *et al*., 2013), the turkey industry remains underdeveloped in Nigeria. Turkey meat, valued for its taste and texture, possesses moderate levels of lipids, saturated fatty acids, and cholesterol, making it a healthy dietary choice (USDA, 2001).To address the growing population's demand for poultry products, there is a pressing need to enhance turkey production. Evaluating productive performance, body size, conformation, and carcass traits is pivotal in improving turkey breeds (Ibe, 1989; Adeoye *et al*., 2007). Body weight and morphometric traits serve as crucial indicators of size and shape, influencing market prices for broilers (Ibe and Ezekwe, 1994). Such information is crucial for designing breeding programs aimed at enhancing indigenous turkey breeds without compromising their unique genetic characteristics.

However, foreign turkey breeds face challenges in tropical climates due to temperature and humidity stresses. Crossbreeding programs involving local and exotic breeds have been proposed to harness hybrid vigor and accelerate genetic progress (Akinokun, 1990; Adebambo *et al*., 2006). Nonetheless, genetic information is scarce on body weight and conformation traits in indigenous turkeys, hindering their effective utilization and improvement.
Therefore, this study aims to provide valuable insights into the body weight and conformation traits of indigenous and Hybrid Commercial Turkey (HCT) breeds.

2.0 Materials and Methods

2.1 Experimental Site

The study was conducted at the Poultry Research and Teaching Farm situated within the Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus. Obio Akpa is positioned between latitudes 4º30ºN and 5º00N, and longitudes 7º30ºE and 8º00E. This location experiences an annual rainfall ranging from 3500 to 5000mm, with an average monthly temperature of 25°C and relative humidity ranging between 60% and 90%. Situated within the tropical rainforest zone of Nigeria, the area's inhabitants primarily rely on livestock and crop production (AKSG, 2022).

2.2 Management of Experimental Birds

Sixty-four one-day-old poults were acquired from a reputable vendor in Uyo, Akwa Ibom State, comprising 32 Nigerian indigenous turkeys and 32 hybrid commercial turkeys. Each poult was weighed and tagged with wing identifiers before being randomly allocated to one of two treatment groups based on breed. Within each breed category, further subdivision occurred into four groups, with 8 birds per group. For the initial three weeks, the poults were housed in the brooding section, where heat was provided by electric bulbs and charcoal stoves. Following this period, they were relocated to the rearing house for an additional fifteen weeks. Standard management protocols for poultry farming were followed diligently, including vaccinations and medication to prevent common poultry diseases. Throughout the 18-week research period, both

treatment groups (the two breeds) were uniformly managed in deep litter pens and were fed similar diets. The diet consisted of poult starter mash (0-6 weeks) and turkey growers' mash (7-18 weeks), formulated to contain 28% and 24% crude protein, respectively, with corresponding metabolizable energy (ME) levels of 2900 and 3300. Feed and water were provided ad libitum to ensure unrestricted access for the birds.

2.3 Data Collection

Body weight and conformation traits were measured following the guidelines outlined by the Food and Agriculture Organization (FAO, 2012) as follows:

- Body Weight (BWT): Individual bird weights were recorded using a Camry weighing balance.
- Body Length (BL): Measured as the length from the base of the neck to the base of the tail around the uropygial gland.
- Breast Girth (BG): Recorded as the region of the largest breast expansion while the bird was positioned ventrally.
- Shank Length (SL): Measured from the hock joint to the tarsometatarsus digit -3 joints.
- Thigh Length (TL): The distance between the hock joint and the pelvic joint was recorded.
- Wing Span (WS): Measured from the shoulder joint to the extremity of the terminal phalanx.
- Wing Length (WL): Recorded from the shoulder joint to the tip of the longest wing feather.
- Neck Length (NL): Considered as the distance between the occipital condyle and the cephalic borders of the caracoids.

2.4 Data Analysis

The data obtained were analyzed using SAS 2000. The model used was as follows:

$Y_{ijk} = \mu + Bi + Sj + (B * S)ij + Eijk$ ……Equation 2.1

Where:
Y_{ijk} = Body weight and morphometric trait measured
μ= Overall means
B_i= Breed effect (i = Exotic and local)
S_j = Sex effect (j= male and female),
$(B*S)_{ij}$ = Interaction between breed and sex
E_{ijk} = Random error

3.0 Results and Discussion

3.1 Mean Values of Body Weight and Conformation Traits in Turkey

Table 3.1 presents the mean values of body weight and various conformation traits for both HTC and NIT. The results revealed that in HCT, BW, BL, BG, SL, TL, WS, WL, and NL were 10.67 ± 1.92 kg, 73.86± 5.63 cm, 63.83 ± 6.22 cm, 10.84± 2.32 cm, 24.13± 2.25 cm, 77.10± 6.34 cm,

37.26 ± 4.36 cm, and 29.00± 2.38 cm, respectively. On the other hand, NIT exhibited values of 3.39± 1.02 kg, 55.56± 1.42 cm, 38.83± 1.52 cm, 7.55± 1.62 cm, 17.55± 1.46 cm, 64.46± 4.28 cm, 26.66± 2.51 cm, and 24.74± 1.21 cm, respectively. The coefficient of variation ranged from 8.20% for neck length to 21.40% in shank length for HCT, while for NIT, it ranged from 2.55% in body length to 30.08% in body weight.

Summary statistics indicated higher values for HCT compared to NIT in terms of body weight and all measured traits. This disparity can be attributed to the selective breeding and development efforts focused on enhancing productivity in HCT, whereas the Nigerian indigenous turkey is still in the process of full development. The results also showed a higher proportion of coefficient of variation for body weight among NIT (30.08%) than the one from HCT (17.99%) which is an indication of possible room for selection for improved body weight among the NIT than the HCT.

Table 3.1: Descriptive Statistics for Body Weight and Conformation Traits in Nigerian Indigenous Turkey and Hybrid Commercial Turkey

Breed	Traits	Means	Minimum	Maximum	CV(%)
	BW (kg)	10.67 ± 1.92	5.00	15.00	17.99
HCT	BL (cm)	73.86 ± 5.63	61.00	88.34	7.62
	BG (cm)	63.83 ± 6.22	49.52	71.25	9.74
	SL (cm)	10.84 ± 2.32	9.52	14.24	21.40
	TL (cm)	24.13 ± 2.25	18.25	33.38	9.32
	WS (cm)	77.10 ± 6.34	66.00	96.00	8.23
	WL (cm)	37.26 ± 4.36	31.00	46.25	11.70
	NL (cm)	29.00 ± 2.38	25.52	36.10	8.20
NIT					
	BW (kg)	3.39 ± 1.02	2.55	5.75	30.08
	BL (cm)	55.56 ± 1.42	48.25	53.19	2.55
	BG (cm)	38.83 ± 1.52	27.58	48.72	3.91
	SL (cm)	7.55 ± 1.62	6.00	12.50	21.45
	TL (cm)	17.55 ± 1.46	16.00	26.08	8.31
	WS (cm)	64.46 ± 4.28	52.85	78.01	6.63
	WL (cm)	26.66 ± 2.51	24.25	39.51	4.41
	NL (cm)	24.74 ± 1.21	23.75	30.25	4.89

HCT=Hybrid commercial turkey, NIT= Nigerian indigenous turkey, BW= Body weight, BL=Body length, BG= Breast girth, SL= Shank length, TL= Thigh length, WS=Wing span, WL= Wing length, NL= Neck length, kg =Kilogram, cm= Centimeter.

3.2 The Main Influence of Breed on Body Weight and Conformation Traits of Turkeys

Table 3.2 illustrates the influence of breed on body weight and other conformation traits examined. Results revealed significant ($p<0.05$) disparities in body weight and various traits between the two breeds investigated, with HCT displaying significantly higher values compared to NIT. For HCT, body weight, body length, breast girth, shank length, thigh length, wing length, wing span, and neck length were recorded as 9.50 ± 1.45kg, 72.65 ±0.90cm, 59.25 ±0.28cm, 9.27 ± 0.33cm, 24.64 ± 1.21cm, 35.26 ± 0.51cm, 77.15 ± 1.71cm and 27.28 ± 0.55cm, respectively while NIT exhibited corresponding values of 4.50 ± 1.11kg, 58.21 ± 1.61cm, 37.12 ± 0.34cm, 7.97 ± 1.41cm, 20.55 ± 1.20cm, 31.52 ±0.75cm, 67.25 ± 1.45cm, and 24.26 ± 0.85 cm, respectively.

The findings from this study highlight significant ($p < 0.05$) variations in body weight and conformation traits between the two breeds, corroborating earlier reports by Ilori *et al*. (2010), Adeoye *et al.* (2017), Ogah (2011), Channa *et al.* (2018), and Sola-Ojo *et al*. (2017) in tropical regions. The observed differences and superiority demonstrated by HCT suggest its greater growth performance potential compared to NIT. Dudusola *et al*. (2020) reported that exotic turkey breeds underwent rigorous and structured selection for higher growth rates across numerous generations. The relatively lower values obtained for body weight and conformation traits of NIT breed could be attributed to their lack of genetic improvement. These birds have undergone natural selection for survival in the tropics rather than artificial selection for enhanced productivity (Ibe, 1998).

Furthermore, differences in body weight and conformation traits may also stem from variations in the geographical origins of the two breeds, as indigenous birds are more adaptable to hot and humid tropical environments, whereas exotic breeds originate from temperate regions (Yakubu *et al*., 2011). According to Mulyono *et al.* (2009), as cited by Dudusola *et al*. (2020), differences in geographical origin contribute to phenotypic responses based on the potential for additive genes controlling the body measurements of each bird's genotype, affecting growth, development, and osteogenesis.

Table 3.2: The Main Effects of Breed on Body Weight and Conformation Traits of Turkey

TRAITS	HCT	NIT
BW (kg)	9.50 ± 1.45^{a}	4.50 ± 1.11^{b}
BL (cm)	72.65 ± 0.90^{a}	58.21 ± 1.61^{b}
BG (cm)	59.25 ± 0.28^{a}	37.12 ± 0.34^{b}
SL (cm)	9.27 ± 0.33^{a}	7.97 ± 1.41^{b}
TL (cm)	24.64 ± 1.21^{a}	20.55 ± 1.20^{b}
WL (cm)	35.26 ± 0.51^{a}	31.52 ± 0.75^{b}
WS (cm)	77.15 ± 1.71^{a}	67.25 ± 1.45^{b}
NL (cm)	27.28 ± 0.55^{a}	24.26 ± 0.85^{b}

[ab]Means with different superscripts along the row are significantly different ($p<0.05$). HCT=Hybrid commercial turkey, NIT= Nigerian indigenous turkey, BW= Body weight, BL=Body length, BG= Breast girth, SL= Shank length, TL= Thigh length, WS=Wing span, WL= Wing length, NL= Neck length, kg =Kilogram, cm= Centimeter.

3.3 The Main Influence of Sex on Body Weight and Conformation Traits of Turkeys

Table 3.3 presents the effect of sex on body weight and various conformation traits of turkeys. The results indicate that male turkeys significantly ($p < 0.05$) exhibited higher values for body weight and other conformation traits compared to their female counterparts. Specifically, males displayed values of 6.15 ± 0.61kg, 69.27 ± 1.55cm, 50.50 ± 1.53cm, 10.95 ± 1.40cm, 25.18 ± 1.45cm, 35.58 ± 2.13cm, 78.65 ± 2.13cm and 31.27 ± 2.01cm for body weight, breast girth, shank length, thigh length, wing length, wing span, and neck length respectively. In contrast, females exhibited values of 4.70 ± 0.55kg, 62.45 ± 0.57cm, 44.68 ± 1.42cm, 8.75 ± 1.95cm, 20.58 ± 1.28cm, 30.28 ± 0.38cm, 67.28 ± 1.02cm and 26.47 ± 1.02cm for the same traits respectively. These findings align with reports by Garcia *et al.,* (1991), Adeoye *et al.* (2017), Channa *et al*., (2018) and Dudusola *et al.,* (2020), indicating sexual dimorphism where males outperform females in the studied parameters. Differences in growth rate, metabolic rate, and nutrient requirements between male and female turkeys likely contribute significantly to the observed variations between the sexes.

An earlier report by Baeza *et al*. (2001) suggested that the observed performance differences between males and females could stem from variations in hormones, which act differently on growth and development processes, leading to distinct growth and developmental rates. Additionally, differences in these traits between the sexes could be attributed to sexual activities such as aggressiveness and dominance, particularly during co-rearing, as noted by Ibe and Nwosu (1999).

Table 3.3: The Main Effects of Sex on Body Weight and Conformation Traits of Turkey

TRAITS	Male	Female
BW (kg)	6.15 ± 0.61^{a}	4.70 ± 0.55^{b}
BL (cm)	69.27 ± 1.55^{a}	62.45 ± 0.57^{b}
BG (cm)	50.50 ± 1.53^{a}	44.68 ± 1.42^{b}
SL (cm)	10.95 ± 1.40^{a}	8.75 ± 1.95^{b}
TL (cm)	25.18 ± 1.45^{a}	20.58 ± 1.28^{b}
WL (cm)	35.58 ± 2.13^{a}	30.28 ± 0.38^{b}
WS (cm)	78.65 ± 2.13^{a}	67.28 ± 1.02^{b}
NL (cm)	31.27 ± 2.01^{a}	26.47 ± 1.02^{b}

[ab]Means with different superscripts along the row are significantly different ($p<0.05$). HCT=Hybrid commercial turkey, NIT= Nigerian indigenous turkey, BW= Body weight, BL=Body length, BG= Breast girth, SL= Shank length, TL= Thigh length, WS=Wing span, WL= Wing length, NL= Neck length, kg =Kilogram, cm= Centimeter.

3.4 Interactive Effect of Breed and Sex on Body Weight and Conformation Traits of Turkeys

Table 3.4 indicates the interaction between sex and breed. Significant interactions ($p<0.05$) were observed between breed and sex. Exotic males exhibited significantly ($p<0.05$) higher values compared to others, while local females displayed the lowest values. These findings are consistent with the report of Sola-Ojo *et al*. (2017), who also noted significant interaction effects ($p<0.05$) between sex and genotype on body weight and other linear body measurements studied.

Table 3.4: Interactive Effect of Breed and Sex on Body Weight and Conformation Traits of Turkey

	HCT		NIT	
Traits	**Male**	**Female**	**Male**	**Female**
BWT	9.51 ± 0.41^{a}	8.30 ± 1.23^{b}	4.94 ± 0.12^{c}	2.45 ± 1.21^{d}
BL	78.21 ± 0.15^{a}	69.85 ± 0.01^{b}	64.25 ± 0.31^{c}	55.25 ± 0.65^{d}
BG	62.51 ± 1.87^{a}	56.55 ± 0.68^{b}	42.35 ± 0.15^{c}	38.15 ± 0.25^{d}
SL	10.85 ± 0.65^{a}	9.95 ± 1.15^{b}	9.01 ± 0.95^{c}	7.58 ± 0.25^{d}
TL	25.40 ± 0.82^{a}	23.45 ± 1.05^{b}	21.48 ± 0.52^{c}	19.96 ± 0.51^{d}
WL	37.25 ± 1.85^{a}	34.93 ± 0.15^{b}	32.42 ± 1.02^{c}	29.85 ± 0.45^{d}
WS	82.35 ± 0.81^{a}	73.95 ± 0.51^{b}	65.21 ± 0.15^{c}	71.92 ± 1.62^{d}
NL	25.15 ± 0.81^{a}	23.95 ± 0.65^{b}	23.18 ± 2.01^{c}	21.52 ± 1.31^{d}

^{abcd}Means with different superscripts along the row are significantly different ($p<0.05$). HCT=Hybrid commercial turkey, NIT= Nigerian indigenous turkey, BW= Body weight, BL=Body length, BG= Breast girth, SL= Shank length, TL= Thigh length, WS=Wing span, WL= Wing length, NL= Neck length, kg =Kilogram, cm= Centimeter.

4.0 Conclusion

This study investigated the influence of breed, sex, and their interaction on body weight and conformation traits of turkeys. Significant differences were observed between the Nigerian indigenous turkey and hybrid commercial turkey, with the hybrid commercial turkey displaying higher body weight and conformation traits. Additionally, sexual dimorphisms were evident in both breeds of turkey studied. Based on these findings, it is suggested that crossbreeding the two breeds could be implemented in a breeding program to enhance the performance of the Nigerian indigenous turkey.

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