Variation in Growth Performance of Local Black and Exotic White Broad Breasted Meat Type Turkey

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Abstract

Turkey farming is one of the most important and highly beneficial poultry enterprise with the raising global demand. But, unfortunately, the Nigeria indigenous turkey are poor in body weight (BWT) and linear body dimensions (LBD) compare to exotic breed. The experiment was conducted to determine the variation in growth performance in (BWT) and (LBD) of local (Black) and exotic (White Broad Breasted) breeds' meat type turkey. A total of one hundred poults of Day-old weighed between (61g and 63g), comprised [50 black turkeys (BT) and 50 White Broad Breasted turkeys (WBBT)]. Commercial turkey starter and grower diets was used in feeding the birds for 12 weeks. The result revealed that mean BWT of BT bird value 530.33g. The result also revealed that mean BWT of WBBT bird value 1191.81g. The CV of LBD ranged from 2.48% - 9.95%. The results showed that variability was prominent between the two sex of turkey which favoured the male as an expression of sexual dimorphism for all traits while the WBBT breed was superior over the BT in traits of body weight and neck length. The highest correlation was shank length (SL) value (0.97); followed by wing length (WL) (0.96) and the least neck length (NL) value (0.29). All the values of body length (BDL) were also significant except when correlated with WL (0.61) and toe length (TOL) (-0.02). In conclusion, the findings showed that BT breed indicated poor growth and development. The WBBT performed better for both BWT and LBD than BT breed.

Key words: Variation, growth, poults, dimensions, and dimorphism

Running title: Variation in growth performance

Variation des performances de croissance des dindes locales noires et des dindes de type chair exotiques blanches à large poitrine

Résumé

L'élevage de dindes est l'une des entreprises avicoles les plus importantes et les plus bénéfiques avec la demande mondiale croissante. Mais, malheureusement, les dindes indigènes du Nigeria sont faibles en poids corporel (BWT) et en dimensions corporelles linéaires (LBD) par rapport à la race exotique. L'expérience a été menée pour déterminer la variation des performances de croissance en (BWT) et (LBD) des races de dindes de type chair locales (Noires) et exotiques (Blanches à Large Poitrine). Un total de cent dindonneaux d'un jour pesant entre (61g et 63g), composé de [50 dindes noires (BT) et 50 dindes blanches à large poitrine (WBBT)]. Des aliments commerciaux pour dindes démarreur et grower ont été utilisés pour nourrir les oiseaux pendant 12 semaines. Le résultat a révélé que la moyenne du BWT des oiseaux BT était de 530,33g. Le résultat a également révélé que la moyenne du BWT des oiseaux WBBT était de 1191,81g. Le CV des LBD variait de 2,48 % à 9,95 %. Les résultats ont montré que la variabilité était prononcée entre les deux sexes de dinde, ce qui favorisait le mâle comme expression du dimorphisme sexuel pour tous les traits, tandis que la race WBBT était supérieure à la BT pour les traits de poids corporel et de longueur du cou. La corrélation la plus élevée était la longueur du jarret (SL) (0,97) ; suivie par la longueur de l'aile (WL) (0,96) et la plus faible était la longueur du cou (NL) (0,29). Toutes les valeurs de la longueur du corps (BDL) étaient également significatives sauf lorsqu'elles étaient corrélées avec WL (0,61) et la longueur des doigts (TOL) (-0,02). En conclusion, les résultats ont montré que la race BT

indiquait une faible croissance et développement. La WBBT a obtenu de meilleures performances à la fois pour le BWT et les LBD que la race BT.

Mots-clés : Variation, croissance, dindonneaux, dimensions, et dimorphisme.

Introduction

Turkey farming is considered as among the most important and highly profitable agricultural productions with the raising international demand (Yakubu *et al*., 2013). Consumers desire turkey meat due to its lean nature. Turkey meat has dietary and astounding properties which provides a lean and nutritious protein source, contributing to food security and economic growth. The CP (24%), Fat (6.6%), and ME value (162 calories per 100gm) of turkey meat as reported by Asaduzzaman *et al*., (2017). Despite this, turkey is not regarded as common poultry growers in Nigeria. Farmers are now beginning to breed the bird at commercial level to improve meat production in the country. Large scale production is concentrated in the city and are gradually spreading even to village farms. The exponential growth in the enterprise requires an intensive research approach to boost its production especially considering the potential associated with it (Ogah, 2011 and Anna *et al.*, 2011).

Sexual dimorphism refers to the distinct physical differences between the male and female, these differences extend to various physical traits like body weight, length, and certain measurements like shank length, wing span, and breast girth are usually greater in males. In size, male's turkey generally has a larger body mass and taller than females' counterparts due to sex differential hormonal effect (Fayeye *et al.,* 2019). Males develop a prominent fleshy wattle under the chin and a fleshy protuberance on the forehead, called a snood, which are not as prominent or absent in females.

Poultry consumers used body size or type as criteria for judging market turkeys. A quantitative measure of conformation will no doubt enable reliable genetic parameters for the traits to be estimated but also make it possible to include conformation in breeding programme (Ayeoye *et al.,* 2017). Body weight has been commonly used to assess physical characteristics and track growth and development. Determination of BWT and LBDs have been found useful in quantifying body size and shape (Musa *et al.*, 2015). Linear body dimensions are also used to predict LWT in poultry (Gueye, 1998; Amos, 2006; Sonaiya, 2007 and Das *et al.*, 2018).

Various breeds of turkey have gradually been discussed as a potent factor affecting live weight (LWT). Researchers reported that local turkey (LT) thrive better under arid condition, has better heat tolerance, ranges farther and has better meat quality (Yakubu *et al*., 2013; Maikasuwa *et al.*, 2014 and Adeoye *et al*., 2017). Nigeria has a total poultry population of 180 million; turkey is the smallest (0.2 million) when compared to other poultry species (FAO, 2018). The local turkeys are non-descript, have multi coloured plumage and sometimes may appear black or white (Ngu *et al*., 2014).

Phenotypic characterization of Animal Genetic Resources (AnGR) is the process of identifying distinct breed populations and describing their external and production characteristics in a given environment and under given management, taking into account the social and economic factors that affect them. The information provided by characterization studies is essential for planning the administration of AnGR at local, national, regional and global levels. The Global Plan of Action for Animal Genetic Resources (FAO, 2018) recognizes that "A good understanding of breed characteristics is necessary to guide decision-making in livestock development and breeding programmes." Farmers hesitate to rear LT due to its slow growth

rate compared to exotic turkey (ET). Therefore, this current study is to ascertain the variation in growth performance of BWT and LBD of BT and WBBT meat type.

Materials and Methods
Experimental Site
The experiment was carried out at the Faculty of Agriculture (FOA), Department Research Center (DRC), SDU, Ozoro. Latitude 5^0 32^I N and Longitude 6^0 15^I E of Greenwich meridian place the center in mid-western Nigeria's rainforest. Humidity averages 2500-3000 mm per year and 27.4^0C and 85 % are the mean temperature and Relative Humidity (SDU, 2024).

Sex Determination
The turkey poults vent sexing were determined by examining the genital papillae (two small raised bumps) located in the ventral (lower) wall of the vent (cloaca). In male turkey poults, these papillae are typically two firm, hemi-ellipsoidal structures that may be engorged with blood, making them prominent. In contrast, female poults will have a flat vent or have a slightly depressed area instead of the distinct papillae seen in males. The number of males and females were recorded.

Experimental Birds and Design
One hundred poults serve as starting point for the experiment, 50 BT (10 males and 40 females) and 50 WBBT (10 males and 40 females). They were purchased from a commercial and reliable hatchery. The local and exotic turkey birds were weighed, tagged and separated at the beginning of the experiment. CRD was used as experimental design. Two (2) treatments (local and exotic breed) with 50 replicable for each treatment. The experiment lasted for 12 weeks.

Management of the Birds
A deep litter housing system was used for this experiment. The dimension of the house is 3.66m x 3.66m. The brooding house was sealed to prevent predators and excess air, wood shavings and newspaper were used as litter material for some time after which only wood shavings was used. Two chick trays and two plastic drinkers were used at early stage and were later changed to larger feeding and drinking troughs.

The turkeys were fed commercial turkey starter (0-8 weeks) and grower diet (8-12 weeks). The birds were fed twice per day. The ingredients for the commercial starter of the vital feed products are cereals, vegetable protein, premix (vitamins/minerals), essential amino acids, salt, antioxidant, anti-toxins, prebiotics and enzymes. The calculated compositions are CP (28%), fats (10%), CF (12%), Cal. (1.0%), available phosphorus 0.45%, ME 3000 kcal/kg. Glucose was given to the turkeys when they arrived, it was administered to them orally and it was kept for about 2 hours then the drinking water was changed and antibiotic was given to them. Routine drugs and vaccines were given to the birds.

All birds were intensively managed. The turkeys were given the same treatment throughout the experimental period under the same managerial conditions. Some routine preventive hygiene was done regularly such as providing clean water, feeding, changing of litter material when due, observing the behaviour of the birds, signs or symptoms of any disease condition were also observed by physical examination of birds daily. The turkey was given proper medications from the day they arrived till the end of the experiment.

Data Collection
The birds were properly identified with a tag on their wings labeling LT1, LT2, LT3…for local and ET1, ET2, ET3… for exotic breed. Birds were individually weighed with an electronic scale calibrated in grammes to obtain the BWT. The LBD were measured with a tap gauged in cm.
BWT: The body weight of the turkey was taken with an electronic scale on a weekly basis.
THL: Measured the length from the knee joint to the hock.

NL: Measured was taken with a measuring tape and it was taken from the neck to the head

BKL: Measured the length between the tip of the beak and the base

TAL: It was taken from the tip tail to the end.

WL: This is a linear dimension taken from the caput humeri to the end of the third carpal digit, when taking measurement of the wings, rope was placed on the wing after stretching the wing then the rope already marked was placed on a tape to know the actual measurement

WS: The wingspan was taken by stretching the 2 wings out. A rope was placed on the stretched and the already marked rope was placed on a tape to know the actual measurement

BDL: This is between the first cervical vertebra and the pygostyle. This was taken with a measuring tape.

TOL: This is the length between *genu* and *regiotarsalis*. All body linear dimensions were done with measuring tape. Sex was determined by visual examination.

Statistical Analysis

The collected data was analyzed using general linear body model of SPSS 11.0 with sex and feed as fixed factors. Significant means were separated by the DMRT (1955). Correlation between measurements was determined by the person's correlation coefficient separate models (linear and multiple) and for LBD singly and combined was enumerated.

The regression model adopted was as follows:

$$Y = a + b_1 X_1, + b_2 X_2, + b_3 X_3$$

Where

Y = body weight (kg)

X_1 - X_3 = body measurement

a = intercept

$b_{(1-3)}$ = Régression coefficient Y on X (1=1,2,3)

Results

The mean (x), SD and CV of BT birds are presented in Table 1. The result revealed that mean BWT of BT bird value was 530.33g. Mean BWT ranged from 400.30g - 632.10g. The CV of LBD ranged from 3.59% - 7.34%. BDL had a higher CV value (7.34%), followed by TAL (7.30%) and NL had the least value (3.59%).

Table 1: Mean (ẍ), Standard Deviation, and Coefficient of Variance of Black Turkey

Parameters	Female	Male	Mean	SD	CV (%)	P-value
BWT (g)	400.30 ±20.12[b]	632.10±28.04[a]	530.33	92.24	17.39	0.04
WL (cm)	28.60±3.79[b]	32.80±4.03[a]	30.32	1.67	5.52	0.03
TAL (cm)	9.70±0.04[b]	11.50±1.32[a]	10.77	0.79	7.30	0.04
NL (cm)	10.20±1.26[b]	11.40±1.14[a]	10.92	0.39	3.59	0.05
BKL (cm)	3.00±0.01[a]	3.85±0.02[a]	3.18	0.15	4.73	0.04
SL (cm)	6.10±0.02[b]	7.20±0.01[a]	6.71	0.40	5.97	0.04
THL (cm)	8.30±0.05[b]	9.70±0.05[a]	9.23	0.56	6.04	0.05
TOL (cm)	5.25±0.01[b]	6.00±0.01[a]	5.64	0.30	5.33	0.03
WS (cm)	58.10±5.20[b]	64.10±4.53[a]	60.65	2.35	3.87	0.05
BDL (cm)	35.90±3.25[b]	44.00±5.05[a]	40.67	2.99	7.34	0.04

[ab] Means in the same row with different superscripts are significantly different (p<0.05)

The mean (ẍ), SD and CV of WBBT birds are presented in Table 2. The result revealed that mean BWT of WBBT bird value was 1191.81g. The BWT ranged from 997.30g - 1361.90g. The CV of LBD ranged from 2.48% - 9.95%. THL had the highest value (7.87%), followed by NL (7.38%) and has least value (2.48%) for BKL. The result on sex effects showed that all the traits had significant (p<0.05) differences there by been ascribed to sexual dimorphism.

Table 2: Mean (ẍ), Mean (ẍ), Standard Deviation, and Coefficient of Variance of White Broad Breasted Turkey

Parameters	Female	Male	Mean	SD	CV (%)	P-value
BWT (g)	997.30±36.20[b]	1361.90±30.22[a]	1191.81	118.60	9.95	0.05
WL (cm)	33.60±4.05[b]	41.40±7.42[a]	36.77	2.46	6.70	0.04
WS (cm)	70.40±6.04[b]	79.00±6.10[a]	74.47	2.82	3.78	0.04
TAL (cm)	11.90±1.35[b]	14.80±1.42[a]	13.36	0.82	6.16	0.05
NL (cm)	11.00±1.14[b]	14.00±1.32[a]	13.39	0.99	7.38	0.05
BKL (cm)	3.05±0.02[a]	3.80±0.01[a]	3.72	0.09	2.48	0.04
SL (cm)	7.95±0.04[b]	9.70±1.01[a]	8.58	0.55	6.42	0.04
THL (cm)	10.50±1.13[b]	13.20±1.03[a]	12.02	0.95	7.87	0.05
TOL (cm)	6.20±0.03[b]	7.90±0.04[a]	7.50	0.36	4.82	0.04
BDL (cm)	45.30±5.26[b]	51.40±5.41[a]	49.46	2.26	4.57	0.04

[ab] Means in the same row with different superscripts are significantly different ($p<0.05$)

Table 3 showed the pooled descriptive statistics. The pooled effect by breed showed that BWT, TAL, NL and BDL were significantly ($p<0.05$) different with the exotic (WBBT) breed been superior. There was no significant ($p<0.05$) difference in WL, WS, BKL, SL, THL and TOL between BT and WBBT.

Table 3: Pooled descriptive statistics of body weight and linear body dimensions (±SE) of two breeds of Turkey

Traits	Black Turkey	White Broad Breasted Turkey	CV (%)	P - value
BWT (g)	1243±37.30[b]	2750±48.03[a]	15.65	0.04
WL (cm)	37.41±4 05[ns]	38.00±5.07[ns]	5.28	0.14
WS (cm)	82.63 ±4.63[ns]	85.05±6.84[ns]	22.42	0.06
TAL (cm)	15.36±1.02[b]	19.24±1.03[a]	7.45	0.02
NL (cm)	14.58±1.05[b]	18.85±1.02[a]	6.62	0.04
BKL (cm)	7.37±0.03[ns]	8.25±0.07[ns]	9.34	0.07
SL (cm)	12.65±1.04[ns]	14.96±1.07[ns]	10.41	0.08
THL (cm)	15.12±1.04[ns]	18.54±1.20[ns]	8.32	0.12
TOL (cm)	13.74±1.02[ns]	15.46±1.07[ns]	6.21	0.06
BDL (cm)	50.36±4.56[b]	57.03±6.13[a]	7.74	0.04

[ab] Means in the same row with different superscripts are significantly different ($p<0.05$)
[NS] = Not-significant

Table 4 showed the correlation matrix of BWT and LBD of BT birds. The result revealed that NL, SL, THL, and TOL are significantly different to BWT. The correlation of LBD ranged from 0.29 - 0.97. The correlation has a higher value (0.97) THL, followed by WL (0.96) and had the least correlation value (0.29) for BKL. Between BWT and LBD, BDL and WL (0.91 and 0.96 respectively) had the highest correlation values.

Table 4: Correlation Coefficients among Body Weight and Linear Body Dimensions of Black Turkey

	WL	TAL	NL	BKL	SL	THL	TOL	WS	BDL
WL	1.000								

TAL	0.73NS	1.000							
NL	0.72NS	0.92**	1.000						
BKL	0.85**	0.71NS	0.50NS	1.000					
SL	0.38 NS	0.57NS	0.50NS	0.30NS	1.000				
THL	0.95**	0.86**	0.87**	0.76NS	0.59NS	1.000			
TOL	0.89**	0.63NS	0.51NS	0.91**	0.42NS	0.82**	1.000		
WS	0.89**	0.96**	0.92**	0.80NS	0.50NS	0.95**	0.78NS	1.000	
BDL	0.75NS	0.51NS	0.74NS	0.29NS	0.31NS	0.79NS	0.44NS	0.65NS	1.000
BWT	0.96**	0.81NS	0.75NS	0.85**	0.61NS	0.97**	0.92**	0.67NS	0.91** 1.000

NS= Not Significant (p<0.01) ** = Significant (P > 0.01)
BWT = Body Weight, WL = Wing Length, WS = Wingspan, TAL = Tail Length, NL = Neck Length, BKL = Beak Length, SL = Shank Length, THL = Thigh Length, TOL = Toe Length, BDL = Body Length.
LBD = Linear Body Dimensions, BT = Black Turkey

Table 5 showed correlation coefficients of BWT and LBD of WBBT birds. The result revealed that all the values for BKL were remarkably ranged from 0.78 - 0.84. All the values of BWT were also appreciable except when correlated with WL (0.61) and TOL (-0.02). SL and TAL (0.92 and 0.86 respectively) were only significant when correlated with WS. Between BWT and LBD, SL, when correlated with WS and BDL correlated with TAL (0.92 and 0.87 respectively) had higher correlation values.

Table 5: Correlation Coefficients among Body weight and Linear Body Dimension of White Broad Breasted Turkey

	WL	WS	TAL	NL	BKL	SL	THL	TOL	BDL
WL	1.000								
WS	0.63NS	1.000							
TAL	0.64NS	0.56NS	1.000						
NL	0.59NS	0.46NS	0.78**	1.000					
BKL	0.56NS	0.54NS	0.68NS	0.78**	1.000				
SL	0.79**	0.80**	0.78**	0.79**	0.84**	1.000			
THL	0.51NS	0.48NS	0.92**	0.52NS	0.55NS	0.68NS	1.000		

TOL	0.69[NS]	0.54[NS]	0.84**	0.84**	0.73**	0.88**	0.72**	1.000		
BDL	-0.09[NS]	0.19[NS]	-0.17[NS]	0.18[NS]	0.07[NS]	0.01[NS]	-0.38[NS]	-0.29[NS]	1.000	
BWT	0.78**	0.61[NS]	0.92**	0.87**	0.84**	0.86**	0.75**	-0.02[NS]	0.84**	1.000

NS= Not Significant (p<0.01) ** = Significant (P > 0.01)

Discussion

The male (toms) were superior to the female (hens) for BWT and all the LBD traits. The mean BWT for BT and WBBT birds were 530.33g and 1191.81g respectively.

The exotic males BWT ranged from 1.9 - 2.2kg at 10 weeks of age (WOA) while the BT males BWT ranged from 1kg - 1.3kg at 10 WOA. The male turkey birds mature at 19th week with BWT between 7.2kg - 10.8kg. Larger males weighed up to 18.1kg but take more weeks to mature (Bolla, 2006 and Case et al., 2010). This assertion is in accordance with the findings in the present study, owing to the fact that the birds were reared for 10 weeks and not 19 weeks.

Males were superior in BWT, as ascertained in this study. This agrees with Ogah (2011) who reported that the BWT of the BT birds were critically affected by sex. The result showed that there was an increase in BWT trait in both sex of BT and WBBT birds at different ages and the results obtained from this study revealed the huge effect of different sexes at different ages on BWT dimensions showed. The differences and superiority exerted by WBBT suggested that it had a better growth potential than its BT counterparts. This was because the breed had gone through intense selection for higher growth rate. This agrees with the report by Ogbonna et al., 2012). This revealed that a variance with that of Fayeye et al., 2019 who reported lower values for BWT, TAL, NL and BDL in BT.

The result of the correlation between BWT and LBD of WBBT birds revealed that all the values of BKL were notable and ranged from 0.54 - 0.78. All the values of SL were also significant except when correlated with WS (0.61) and TOL (-0.02). The implication here is that BWT can be estimated from LBD except for the WS and TOL in WBBT birds. This is in accordance with the reports of Nestor et al., 2010; Ogah, 2011 and Onwuzuruike et al., 2024. The summary statistics of the correlation of BWT and LBD of turkey birds in general shows that the values of the BWT and LBD for the WBBT were higher than that of BT. This could be attributed to the genetic materials of the undeveloped nature of the local breed.

Breed effect was observed in all the growth traits considered with higher values in favour of the exotic breed. This could be attributed to the undeveloped nature of the local breed. Sex effect was appreciable (P<0.01) in all the traits considered, the significant effect observed in BWT is in line with the observations of Ogah (2016). Higher values were noted in the male in contrast to female in all the variables which indicate sexual dimorphism. This observation is similar to the report of Ogah (2016) and Ilori et al., (2010) that accorded sex effect on NLT.

Conclusion

From the descriptive analysis, it was discovered that the various traits between the sexes supports the sexual dimorphism phenomenon. The high, positive and major correlation between BWT and LBD indicates that these easily measured parts can be used as criteria for assessment and selection of BWT. The results in this present study showed that BT genotypes radically affected growth. WBBT performed better for BWT and LBD than BT. Further research that would involve a cross breeding between exotic vs local breed will therefore be a good base population for improvement for meat production.

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