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Body weight and sex relationships with linear body measurements of four strains of meat type chickens

Short communication

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Abstract

A number of conformation traits are known to be good indicators of body growth and market value of chickens apart from body weight. Poultry breeders have tried to established the relationship that exist between body weight and linear body parameters such as shank length, breast width, keel length, neck length, back length and thigh length among others. The relationship existing among linear body parameters provide useful information on performance and carcass value of animals. Relationships between body weight and linear body measurements are important for predicting body weight and can also be applied speedily in selection and breeding program. The objectives of this study were to determine the effect strains and sex on body weight and to establish the relationships between body weight and linear body parameters in four strains of meat type chickens. Total of (400) meat type chickens (200) each from (Marshall, Cobb 500, Arbor Acres and Noiler) were used for the experiment. The birds were managed intensively from day old to nine weeks of age, the body weights were measured weekly using weighing balance as well as the linear body measurements using tailor tape, thread and ruler on weekly basis which include: shank length, shank circumferences, back length, thigh length, keel length, chest circumference and drumstick length. Data were analyzed using statistical package for the social science (SPSS) version 13.0. The correlation coefficient between body weight and linear body measurements were determined using pearson product moment (r). The body weight increases with increased age of the birds for all the strains, strain had significant effect on body weight (2979.0g, 2696.03g, 2217.0g, and 1193.9g) for Marshall, Cobb 500, Arbor Acre and Noiler respectively. Sexual dimorphism was revealed in favor of males in all the strains. The correlation coefficient ranged from (0.199-0.992) the highest value was observed between body and thigh length in Arbor Acre strain while the least was observed between body weight and shank length in Marshall Strain. However, the high correlation observed in this study proved that linear body measurements could be used in improving body weight in a breeding programme in meat type chickens in this part of the region.

Keywords: body weight, linear body measurements, association, strain, meat type chickens.

Relations Entre Le Poids Du Corps Et Le Sexe Avec Les Mesures Corporelles Linéaires De Quatre Races De Poules De Type Viande

Résumé

Un certain nombre de caractères de conformation sont connus pour être de bons indicateurs de la croissance corporelle et de la valeur marchande des poules, à côté du poids corporel. Les éleveurs de volaille ont tenté d'établir la relation existante entre le poids corporel et les paramètres corporels linéaires tels que la longueur du tarsus, la largeur de la poitrine, la longueur du sternum, la longueur du cou, la longueur du dos et la longueur des cuisses, entre autres. Les relations entre les paramètres corporels linéaires fournissent des informations utiles sur la performance et la valeur de la carcasse des animaux. Les relations entre le poids corporel et les mesures corporelles linéaires sont importantes pour prédire le poids corporel et peuvent également être appliquées rapidement dans les programmes de sélection et de reproduction. Les objectifs de cette étude étaient de déterminer l'effet des races et du sexe sur le poids corporel et d'établir les relations entre le poids corporel et les paramètres corporels linéaires dans quatre

races de poules de type viande. Un total de 400 poules de type viande (200 de chaque race : Marshall, Cobb 500, Arbor Acres et Noiler) ont été utilisées pour l'expérience. Les oiseaux ont été gérés intensivement depuis l'éclosion jusqu'à neuf semaines d'âge. Les poids corporels ont été mesurés chaque semaine à l'aide d'une balance, ainsi que les mesures corporelles linéaires à l'aide d'un ruban à mesurer, d'un fil et d'une règle, sur une base hebdomadaire, comprenant : la longueur du tarsus, la circonférence du tarsus, la longueur du dos, la longueur des cuisses, la longueur du sternum, la circonférence de la poitrine et la longueur de la cuisse. Les données ont été analysées à l'aide du logiciel statistique pour les sciences sociales (SPSS) version 13.0. Le coefficient de corrélation entre le poids corporel et les mesures corporelles linéaires a été déterminé à l'aide du moment du produit de Pearson (r). Le poids corporel augmente avec l'âge des oiseaux pour toutes les races. La race a eu un effet significatif sur le poids corporel (2979,0 g, 2696,03 g, 2217,0 g et 1193,9 g) pour Marshall, Cobb 500, Arbor Acres et Noiler, respectivement. Un dimorphisme sexuel a été observé en faveur des mâles dans toutes les races. Le coefficient de corrélation variait de (0,199-0,992), la valeur la plus élevée ayant été observée entre le poids corporel et la longueur des cuisses dans la race Arbor Acres, tandis que la valeur la plus faible a été observée entre le poids corporel et la longueur du tarsus dans la race Marshall. Cependant, la forte corrélation observée dans cette étude a prouvé que les mesures corporelles linéaires pouvaient être utilisées pour améliorer le poids corporel dans un programme de reproduction chez les poules de type viande dans cette région.

Mots-clés : poids corporel, mesures corporelles linéaires, association, race, poules de type viande.

Introduction

Practical difficulties encountered in the measurements of live weight at field level have led scientist to develop prediction equations to estimate live weight using linear body measurement (Assan, 2013). Quantitative traits are generally the dimension of different body parts and live weight which is directly related to performance parameters, therefore the strong correlation with meat yield body weight is used as a proxy indicator of production in meat type chickens. These traits include measurements of chest circumference, lengths of wing, drum stick, thigh, back, shank and keel length, shank circumference, and body weight, which may vary with the genotype, sex and influenced by the method of data analysis (Assan, 2015). A number of conformation traits are known to be good indicators of body growth and market value of chickens apart from body weight. Poultry breeders have tried to established the relationship that exist between body weight and linear body parameters such as length of shank, keel, neck , back thigh and breast width among others. The relationship existing among linear body parameters provide useful information on performance and carcass value of animals. Relationships between body weight and linear body measurements are important for predicting body weight and can also be applied speedily in selection and breeding program. The use of body measurements to predict body weight of (cattle, sheep and goat) have been done Attah *et al*., 2004; Geo, (2007).

Materials and Methods

The experiment was conducted at the Poultry Unit of the Livestock Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, University of Maiduguri Borno State from May to July 2020. The birds were wing-tagged and fed *ad-libitum* with commercial broiler starter diet containing 21%CP and 3100 kcal ME/kg minimum from day old to 4 weeks of age and commercial finisher diet containing 3000 kcal ME/kg and 17% CP minimum from 5 to 9 weeks of age. Clean water was supplied throughout the experimental period under intensive system. Adequate floor and feeding space and vaccines were also provided.

The body weights and body linear traits of individual birds were recorded early in the morning (8:00hr) before feeding on weekly basis.

The body weight (BWT) was measured to the nearest gram (g) with a 5 kg digital weighing scale.

Growth traits

The body linear traits were taken in cm using a measuring tape on a weekly basis, following the procedure described by. The traits measured included:

Shank Length (SL): This was measured from the hock joint to the base of the three toes.

Breast Width (BRW): This was measured as the circumference of the breast around its deepest region.

Back Length (BL): it was measured as the distance between the bases of the neck to the tip of the tail

Thigh Length (TL): This was measured as distance between the hock joint and the pelvic joint.

Keel length (KL): This was measured as the length of the sternum.

Chest circumference (CC): This was measured as the round the chest region.

Shank circumference: This was measured as the circumference round of the shank.

Drum stick length (DSL): This was measured as the length of the drumstick area.

Statistical Analysis

Data were analyzed using Statistical Package for Social Science (SPSS) version 13.0. The correlation coefficients between body weight and

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

linear body measurements were determined using Pearson Product Moment (r) of the same soft wear package.

Results and Discussion

The effects of strain, sex and their interactions on body weight of meat type chickens are presented on Table1.The results showed that strain had significant ($p<0.05$) effect on body weight of the chickens. Marshall Strain had significantly ($p<0.05$) higher body weight throughout the 9 weeks than the other strain, cobb 500 recorded higher weight compared with Arbor Acre from week 1-3 but later concluded the same weight, while Noiler had the least body weights throughout the experimental period. This could be because the Noiler is a dual purpose bird, unlike the other strains that are purely meat type. This agreed with the report by Okon *et al*. (1996), the authors reported significant strain effect in favor of Lohman over Cobb strain. Furthermore sex had no effect on body weight of meat type chickens from the beginning but significant ($p<0.05$) effect were observed for week eight and nine where male had significantly higher value than female (2522.5 vs 2270.6 g respectively). This agreed with the report by Sola-Ojo *et al. (2008)* these authors reported no significant sex effect in body weight from 1 to 4 weeks of age in meat type chickens. There was significant ($p<0.05$) strain by sex interaction. Marshall male and female had higher body weight than the other strains up to week 7. The least weight was observed in male and female Noiler. This was in concordance with the report by Ojo *et al*. (2003) on growth and some developmental characteristics of Ross and Anak Broilers Strains in the high rainforest zone of Nigeria. Cobb 500 and Arbor Acre had similar interaction effect.

The correlation coefficients between body weight and linear body measurement are presented in Table 2 .The correlation coefficients between body weight and body measurements were generally high, positive and significant ($p<0.05$) for all the strains. The non significant coefficients were low for Cobb 500 and Noiler strains. The correlation between bodyweight and body length (0.932), chest circumference (0.863) and drumstick length (0.791) for Marshall Strain were high, positive and significant ($p<0.01$). Similarly, body weight had high, positive and significant ($p<0.01$) relationship with shank length (0.89), back length (0.77), thigh length (0.95), keel length (0.84), chest circumference (0.83) and

drumstick length (0.73), for Cobb 500 broiler chickens. Similar trend was observed for arbor acre and Noiler strains. The high, positive and significant relationship between body weight and body measurements indicates that selection for increase in the value of measurements will lead to an increase in body weight. This is in agreement with the report by Okoro and Ogundu (2006), which reported that body measurements may be good indicators of body weight in chickens. Furthermore, back length had positive, strong and highly significant relationship with body weight for all the strains. This implies that back length may be a good indicator of body weight in all the strains for breeding purposes. The result of this study was similar with the report by Okpeku *et al*. (2003). There was also positive and strong relationship between thigh length and body weight for all the strains. Keel length was highly correlated with body weight r=0.84, 0.89, and 0.69 for Cobb 500, Arbor Acre and Noiler respectively. Chest circumferences, drumstick length also showed high ($p<0.05$) relationship with body weight in all the strains. This was similar with the research of Okpeku *et al*. (2003).Which reported linear body measurements are good indicator of body weight in meat type chickens.

Conclusions

It could be deduced from this study that body weight increased with age in meat type chickens, male weigh heavier than female. It is clear the result of this study demonstrated a positive relationship between body weight and linear body measurements (TL, DSL and CC) showing that increase in the growth rate of any of these body measurements will lead to the corresponding improvement in body weight gain of meat type chickens in a breeding programme. However, Marshall had a superior body weight compeered to Cobb 500, Abor acres and Noiler respectively which is recommended to be reared in this part of the region. In a situation where sophisticated instruments are not available body weight could be easily predicted by farmers and buyers from (TL, DSL and CC) accurately in these four strains of meat type chickens in this part of the region.

Table 1: The effect of Strain, Sex and their Interaction on Body Weight (g) of Meat Type Chickens at Different Ages.

	Age (Weeks)								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Strain									
Arbor Acre	83.22±2.14^{c}	183.80±4.79^{c}	320.69±7.51^{c}	537.23±11.77^{b}	922.9±20.52^{b}	1322.1±22.43^{b}	1785.1±29.14^{b}	2236.5±33.00^{b}	2217.0±76.76^{b}
Cobb 500	125.99±1.95^{b}	230.78±4.37^{b}	359.32±6.85^{b}	551.88±10.74^{b}	944.03±18.72^{b}	1347.00±20.47^{b}	1820.1±26.58^{b}	2235.02±30.11^{b}	2696.03±70.03^{b}
Marshall	141.87±2.10^{a}	282.61±4.72^{a}	432.88±7.40^{a}	653.95±11.59^{a}	1074.2±20.21^{a}	1593.7±22.09^{a}	2000.5±28.70^{a}	2429.6±32.50^{a}	2979.0±75.59^{a}
Noiler	77.42±2.01^{d}	129.74±4.50^{d}	184.29±7.05^{d}	307.68±11.5^{c}	452.1±19.27^{c}	621.5± 21.07^{c}	745.0±27.37^{c}	938.8±31.00^{c}	1193.9±72.10^{c}
Sex									
Male	107.06±1.58^{a}	208.44±3.53^{a}	330.86±5.54^{a}	519.22±8.67^{a}	864.58±15.13^{a}	1240.6±16.54^{a}	1598.6±21.48^{a}	2017.5±24.33^{a}	2522.5±56.58^{a}
Female	107.19±1.31^{a}	205.22±1.95^{a}	317.73±4.62^{a}	506.15±7.23^{a}	832.19±12.61^{a}	1201.5±13.79^{a}	1576.7±17.91^{a}	1902.6±20.28^{b}	2270.6±42.17^{b}
Strain X Sex									
Arbor Acr M	81.20±3.53^{cd}	188.96±8.02^{c}	322.64±12.56^{cd}	543.64±19.67^{b}	954.2±34.30^{b}	1320.2±37.50^{b}	1773.2±48.72^{b}	2255.8±55.17^{bcd}	2762.9±13.33^{b}
F	85.24±2.45^{c}	178.64±5.26^{c}	318.74±8.24^{d}	530.83±12.92^{b}	891.6±22.52^{b}	1324.0±24.62^{b}	1797.0±31.98^{b}	2217.1±36.22^{cd}	2671.1±84.25^{b}
Cobb 500 M	124.90±2.80^{b}	324.22±6.26^{b}	364.95±9.80^{b}	563.83±15.36^{b}	956.9±26.79^{b}	1372.7±29.29^{b}	1824.3±38.04^{b}	2319.3±43.08^{bc}	2812.2±10.21^{b}
F	127.07±2.72^{b}	237.35±6.11^{b}	353.70±9.57^{bc}	539.93±15.00^{b}	931.8±26.16^{b}	1321.4±28.60^{b}	1816.0±37.15^{b}	2151.1±42.07^{d}	2580.5±97.85^{b}
Marshall M	144.52±3.21^{a}	282.42±7.20^{a}	438.74±11.28^{a}	632.71±17.67^{a}	1051.7±30.81^{a}	1591.3±33.68^{a}	1993.0±43.75^{a}	2480.5±49.55^{a}	3197.5±12.24^{a}
F	139.23±2.72^{a}	282.79±6.11^{a}	427.02±9.57^{a}	675.19±15.00^{a}	1096.7±26.16^{a}	1596.0±28.60^{a}	2007.9±37.15^{a}	2378.8±42.07^{ab}	2760.4±97.85^{b}
Noiler M	77.64±3.00^{d}	138.17±6.68^{d}	197.11±10.46^{e}	336.69±16.40^{c}	495.4±28.59^{c}	678.1±31.25^{c}	803.9±40.60^{c}	1014.3±45.98^{e}	1317.6±11.94^{c}
F	77.20±2.70^{d}	121.32±6.04^{d}	171.48±9.46^{e}	278.66±1483^{c}	408.8±25.86^{d}	564.8±28.27^{d}	686.0±36.72^{d}	863.3±41.59^{f}	1070.3±96.73^{c}

a,b,c Mean in a subset on the same column with different superscript differ significantly ($p<0.05$).M=male, F=female.

Table2: Correlation Coefficients for Body Weight and Linear Body Measurements of Four Strains of Meat Type Chickens.

	Strain			
Parameter	Marshall	Cob 500	Arbor acres	Noiler
Shank Length	0.199	0.889**	0.711*	0.719*
Shank circumference	0.600	0.347	0.922**	0.374
Back length	0.932**	0.765**	0.947**	0.949**
Thigh length	0.596	0.952**	0.992**	0.498
Keel length	0.457	0.841**	0.891**	0.696*
Chest circumference	0.863**	0.825**	0.803**	0.852**
Drumstick length	0.791**	0.725*	0.958**	0.891**

*=$p<0.05$, **=$p<0.001$.

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