(RESEARCH ARTICLE)

Relationship between body weight and linear body measurements in the Cobb broiler chicken

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Abstract

The study was carried out at the poultry section of the Department of Animal Science farm, University of Education Winneba (Mampong - Ashanti campus, Ghana) from July, 2018 to September, 2018. Data were collected from fifty randomly selected and tagged birds. The data were collected weekly for eight weeks., Head length (HL), Beak length (BL), Body length (BL), Wing length (WL), shank length (SL), shank circumference(SC) and height(H) were taken randomly on five birds in each replicate at a day in every two weeks using tape measure and Vernier calipers. The data collected were analyzed using simple linear regression analysis. The results from the study indicated that, all linear body measurements were significantly (P<0.01) effected for the model, intercepts and slopes of the regression lines with linear response with the best predictor of body weight indicated for shank circumference. It was concluded from the study that; linear body measurements could be used to predict the body weight of broiler chickens. It is recommended that in areas, especially rural areas, where weighing balance or scale may not be readily available, a tailor's tape can be used to measure linear body parameters and thereafter used to estimate body weight of chickens from the predictive equation.

Keywords: Linear body measurements; Shank Circumference; Body Weight; Broiler Chicken

1. Introduction

The use of linear body measurements from farm animals could serve as a basis in poultry and livestock production for pricing of farm animals and also for selection of chicks for breeding. A number of conformation traits are known to be good indicators of body growth and market value of chickens apart from body weight [1]. Chick weight and morphometric traits like chick body length and shank length have great influence on growth performances of broiler as these parameters positively affect slaughter yield at market age [2]. The skeleton determines the general shape of the body, which carries the body and is closely related to the muscles [3]. The relationship existing among linear body parameters provides useful information on the performance and carcass value of animals [6]. Relationships between body weight and linear body measurements are important for predicting body weight and can also be applied speedily in selection and breeding programmes [3]. In most rural areas where weighing scales are unavailable and farmers resort to other means of determining the weight value of farm animals by using some vital parts of the animal [1] Several studies have been conducted in using linear body measurements in determining the weight of farm animals. For example, the use of linear body measurements to determine the weight of some chicken strains in Iraq has been reported [1]. Evaluation of body weight and body linear measurements of broad and narrow helmeted French broiler guinea fowl in the semi-arid condition of Nigeria has been reported [4]. The use of morphostructural characteristics have been used to determine the weight of three varieties of grey breasted helmeted Guinea fowl in Nigeria has been

documented [5]. There is limited information on the use of morphometrics to determine the body weight of Cobb broiler chicken in Ghana and hence necessitates this study.

The purpose of the study was to predict the weight of Cobb broiler chicken using linear body measurements.

2. Material and methods

2.1. Study Location

The study was carried out at the poultry section of the Department of Animal Science farm, University of Education Winneba (Mampong - Ashanti campus, Ghana). Mampong -Ashanti lies within the transitional zone between the Guinea savanna region of the north and the tropical rain forest of the south of Ghana.

2.2. Experimental birds

One hundred day-old Cobb broiler chicks were used for the study. The birds were managed for two months under the same housing and management practices at the Animal Research farm of the Department of Animal Science, University of Education Winneba (Mampong- Ashanti Campus).

2.3. Management of experimental birds

Feeding, watering and medication of the birds were done in accordance with that of the Animal Science farm of the University of Education, Winneba.

2.4. Data collection

Data were collected from fifty randomly selected and tagged birds. The data were collected weekly for eight weeks on head length (HL), beak length (BL), body length (BL), wing length (WL), shank length (SL), shank circumference (SC) and height (H) using tape measure and Vernier calipers.

2.4.1. Live Body weight

The experimental birds were weighed with their individual body weight taken weekly by catching them into an empty box. The weight of the box was nullified by tarring the electronic weighing scale that was used to zero with the empty box still on it. The birds were put into a box and weights recorded.

2.4.2. Head length

This was measured as the distance between the insertion of the beak and the end of the head (occiput) using tape measure.

2.4.3. Body length

This was measured from the insertion of the neck into the body to the beginning of the tail at the back side of the bird using tape measure.

2.4.4. Wing length

This was measured by stretching the wing and measuring from the armpit of the bird to the end of the wing using tape measure.

2.4.5. Beak Length

It was measured from the tip of the beak to the end of the beak using tape measure.

2.4.6. Height

The height of the bird was recorded from the back of the bird to the feet as the animal is standing.

2.4.7. Shank length

The shank length was taken from the hock joint to the metatarsal pad using tape measure.

2.4.8. Shank circumference

This was taken as the distance around the shank of the bird using a Vernier caliper.

2.5. Statistical data Analysis

Linear regression of body weight on linear body parameters was performed using simple linear regression model.

$Y = \alpha + \beta X$

Where Y= dependent variable (body weight)

    X= independent variable (HL, BL, NL, THOD, BOL, etc.)

    α = the intercept

    β = regression coefficient

3. Results and discussion

Table 1 Prediction of body weight from linear body measurements

Nature of response	Equation	R^2	Probabilities	Probabilities
		Model	α	β
		Shank length (SL)	<0.0001	<0.0001
Linear	- 95.287+186.27x	0.71 <0.0001		
		Beak length (BL)	<0.0001	<0.0001
Linear	478.55+386.88x	0.41 <0.0001		
		Head length (HL)	<0.0010	<0.0006
Linear	-111.33+189.05x	0.63 <0.0001		
		Body length (BL)	<0.0009	<0.0001
Linear	-2.33+42.919x	0.59 <0.0001		
		Wing length (WL)	<0.0001	<0.0001
Linear	-119.29+59.08x	0.66 <0.0001		
		Height (H)	<0.0001	<0.0001
Linear	-187.47+62.151x	0.72 <0.0001		
		Shank circumference (SC)	<0.0001	<0.0007
Linear	-132.1+395.07x	0.75 <0.0001		

R^2 = coefficient of determination, α = intercept, β = regression coefficient

From Table 1, the best prediction equation is given by shank circumference. This was followed by height and shank length. The poorest prediction equation was recorded by beak length. The polynomial orthogonal contrast (linear) on the average indicated significant ($P<0.01$) effect for the models, intercepts and slopes of the regression lines with linear nature of responses. This indicated that, all morphological characteristics of the chicken broilers increased with increasing body weight. The coefficient of determination (R2) ranges from 41 to 75%. This implies that 41 to 75% of the variation in body weight was accounted for by the linear body measurements.

3.1. Shank length

The coefficient of determination recorded in shank length in this study was 71% indicating that, shank length can accurately be used to predict the body weight of broiler chicken. The present study is in agreement with the findings of [1], who reported the shank length to have a correlation coefficient of 65%. Similar observation was made in the indigenous chicken in Nigeria when [3] reported a correlation coefficient of 76%. However, the present study differs from the reports made by [7], who reported a coefficient of determination of 50% in the French broiler in Nigeria. Again, the present study differs from the findings of [8] who reported shank length to have a very lower coefficient of determination (19%) in the French broiler Guinea fowl in Nigeria. The contradictions between the present study and the previous reports could be attributed to the specie of avian used in the studies.

3.2. Beak length

The coefficient of determination for beak length recorded in the present study was 41%. Similar observation was recorded by [8] who reported a coefficient of determination of 39% in the French Broiler Guinea fowl in Nigeria. Similar reports were made by [7] who reported beak length to have coefficient of determination of 30% in the French Broiler Guinea fowl in Nigeria. However, the present study differs from the findings of [3] who reported a coefficient of determination of 79%. The differences observed in the present and previous study could be attributed to the type of chicken used (exotic chicken in the present study and local chicken in the previous study).

3.3. Head length

The present study recorded a coefficient of determination of 63% for head length. This implies that, 63% of the body weight could be predicted from head length. Similar observations were made by [7] who reported that the coefficient of determination of head length in the French broiler Guinea fowl is 56%. However, the magnitude of variability (coefficient of determination) introduced into the body weight of the local chicken in Nigeria was very low (19%) [3]. Similarly, the coefficient of determination recorded in a study by [4] using multiple regression approach on the relationship between body weight and head length reported a coefficient of determination of 18%. The lower coefficient of determination reported in the previous studies could be attributed to the procedure of the analysis (multiple regression) used.

3.4. Body length

The coefficient of determination reported in the study was 59%. The present study agrees with the findings of [7] who reported a coefficient of determination of 54% in the French broiler guinea fowl in the semi-arid condition of Nigeria and further stated body length to be a moderate linear predictor of body weight. The present study differs from the findings of [3] who reported that, the coefficient of determination introduced into the body weight of the Nigerian local chicken is 79% and hence a very good predictor in determining the body weight of chicken. The contradictions observed could be attributed to the differences in the type of chicken used in both studies. The present study again disagrees with the findings of a lower coefficient of determination of 15.5% reported from the study conducted by [4] to determine the relationship between linear body measurements and the body weight in the French broiler Guinea fowl in the humid tropics of Nigeria. The contradiction could be attributed to the species of poultry used in both studies (chicken and Guinea fowl in both present and previous studies respectively).

3.5. Wing length

The coefficient of determination for wing length was 66%. The present reports on the wing length agrees with the findings of [3] who reported a coefficient of determination of 65.9% in the local chicken in Nigeria using statistical modelling (linear regression). Again, the present study is in harmony with the findings from the study conducted by [4] who reported a coefficient of determination of 64.8% for wing length in the French broiler Guinea fowl in Nigeria using simple linear regression method. Similarly, the present study agrees with the findings of [7] who reported a coefficient of determination for wing length to be 63% and further reported wing length as a good predictor of body weight of the French broiler Guinea fowl.

3.6. Height of chicken

The coefficient of determination of 72% was recorded in the present study which indicated that, the height of broiler chicken could be accurately used to predict the body weight of broiler chickens. Similar report was made that the height of the Guinea fowl could be conveniently be used as a good predictor of body weight in northern Nigeria [9]. Again, the present study is in harmony with the report from [6] that height of the Sudanese shugor sheep is a good predictor for

predicting the body weight in sheep. The authors further noted that, height of sheep could be used as a morphological marker or as selection criteria in selecting for body weight in sheep.

3.7. Shank circumference

The highest coefficient of determination was recorded for shank circumference (75%). This implies that, the shank circumference of broiler chicken could accurately be used to predict the body weight. There is limited information on the use of shank circumference in predicting the body weight in chicken. Similar observation was made in the local chicken when shank length was reported to be the best predictor of body weight with coefficient of determination of 80% in Nigeria [3]. Similarly, shank length and shank diameter were singled out as the best predictors of body weight in the white leghorn chicken with coefficient of determinations of 80% and 66% respectively in Iraq [1].

In general shank circumference and shank length were found to be the best predictors of broiler body weight whiles beak length was found to be the poorest predictor of body weight of chicken. The present study agrees with the findings of [1] who reported shank length as the best predictor for body weight in the white leghorn chicken in Iraq. Similar report was made by [4] and [3] who stated shank length to be the best morphological trait used to accurately predict the body weight of the French broiler Guinea fowl and indigenous chicken respectively in Nigeria.

This finding differs from the findings of [5] who reported heart girth as the best predictor of body weight of the Helmeted Guinea fowl in Sudan. The differences observed in present and previous reports could be attributed probably to the differences in species of poultry used in both studies (broiler chicken and Guinea fowl respectively).

4. Conclusion

It was concluded from the study that; linear body measurements could be used to predict the body weight of Cobb broiler chickens.

Recommendation

It is recommended to farmers to use shank circumference to determine the weight of broiler chicken in Ghana in the absence of weighing scale.

Compliance with ethical standards

Acknowledgments

Disclosure of conflict of interest

Authors have declared that, no conflict of interests exist.

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