

Performance Characteristics and Prediction of Bodyweight using Linear Body Measurements in Four Strains of Broiler Chicken

I. Udeh, J.O. Isikwenu and G. Ukughere

Department of Animal Science, Delta State University, Asaba Campus, Asaba, Nigeria

Abstract: The objectives of this study were to compare the performance characteristics of four strains of broiler chicken from 2 to 8 weeks of age and predict body weight of the broilers using linear body measurements. The four strains of broiler chicken used were Anak, Arbor Acre, Ross and Marshall. The parameters recorded were bodyweight, weight gain, total feed intake, feed conversion ratio, mortality and some linear body measurements (body length, body width, breast width, drumstick length, shank length, thigh length and wing length). Prediction equations relating body weight to linear body measurements at 2 and 8 weeks of age were established for the four strains of broilers using multiple regression method. The results indicated similarity in body weight at 8 weeks, weight gain and feed conversion ratio among Anak, Arbor Acre and Ross broilers. They were however, significantly ($p < 0.01$) superior to Marshall in all these traits. The regression analysis were highly significant ($p < 0.001$) for the two age periods and in all the strains. The coefficient of multiple determinants (R^2) were more than 50% in most of the groups indicating that the prediction equations obtained in this study could be used to predict body weight of broilers.

Key words: Bodyweight, broilers, linear measurements, prediction equations

INTRODUCTION

There has been a rapid increase in the number of farmers owning broiler parent and grand parent stocks leading to an increase in the population of meat type chicken in Nigeria (Adebambo *et al.*, 2005). These farms hatch and sell strains of broilers using different brand names. The broiler parents are usually imported from the temperate region of the world. The performance of these birds is influenced by genotype and environment. The use of unsuitable genotypes in hot regions result in decreased growth rate, reduced protein gain and high mortality (Yalcin *et al.*, 1997). The implication is that broiler farmers should select the strains that are adaptable to the Nigerian environment with good performance. It is also important that the broiler farmer monitor the growth performance of his birds on regular basis to know when they have attained the desired market weight. In places where scales are not available as is the case in most rural African communities (Nesamvuni *et al.*, 2000), linear body measurements such as shank length, drum stick length and wing length can be used in a predictive equation to predict body weight in broilers (Akanno *et al.*, 2007). The objectives of this study are (1) to compare the performance characteristics of four strains of broilers (2) to predict body weight using linear body measurements in broilers.

MATERIALS AND METHODS

The experiment was conducted at the poultry unit of teaching and research farm, Department of Animal science, Faculty of Agriculture, Delta State University, Asaba campus. Asaba is located between 60°45' East and 60°12' North. Annual rainfall in Asaba ranges from 1800-3000 mm while maximum day temperature ranges from 27.5-30.90°C (Federal Ministry of Aviation; Department of Meteorological Services Asaba, 2006). The experiment lasted for 8 weeks from 2nd June 2009 to 28th July 2009. A total of 240 broiler chicks comprising 60 each of Anak, Arbor Acre, Ross and Marshall were procured from a reputable hatchery in Agbor, Delta State. Each strain of broilers were housed in a separate deep litter pen at day old, brooded for four weeks and reared to 8 weeks of age by conforming to standard management procedures as described by Oluyemi and Robert (1979). The birds were fed *ad libitum* with a top feed broiler starter diet from day old to 4 weeks of age and a top feed broiler finisher diet from 4 to 8 weeks of age. Clean drinking water was also provided to the birds *ad libitum*. The birds were vaccinated against new castle disease at day old and 3 weeks of age and against gumboro disease at 2 weeks of age. Occasionally, vitality, a vitamin supplement was given to enhance productivity. The body weight of the birds were taken at 2 and 8 weeks of age, respectively.

Table 1: Mean performance values for four strains of broiler chicken

| Parameters | Anak | Arbor Acre | Ross | Marshal | S.E.M |
|-------------------------------|----------------------|----------------------|----------------------|----------------------|-------|
| Initial weight at 2 weeks (g) | 403.30 ^b | 385.08 ^b | 340.53 ^a | 342.85 ^a | 13.52 |
| Final weight at 8 weeks (g) | 1855.00 ^b | 1880.00 ^b | 1812.50 ^b | 1645.00 ^a | 45.82 |
| Total weight gain(g) | 1451.70 ^b | 1494.92 ^b | 1471.97 ^b | 1302.15 ^a | 37.74 |
| Total feed intake (g/bird) | 2599.90 ^a | 2799.99 ^b | 2799.95 ^b | 2799.91 ^b | 43.31 |
| Feed conversion ratio | 1.79 ^a | 1.87 ^a | 1.90 ^a | 2.15 ^b | 0.07 |
| Mortality (%)* | 1.50 | 2.30 | 1.60 | 0.00 | |

*: Not tested statistically; a, b: mean within a row with different superscripts are significantly (p<0.01) different

Table 2: Regression equation relating body weight and linear body measurements at 2 and 8 weeks of age for four strains of broiler chicken

| Strain type | Prediction equation | R ² | S.E | Sig. |
|-------------|--|----------------|--------|------|
| Anak | BWT ₂ = 858.13 - 12.52BLT - 38.87BRW + 53.44BDW - 7.31DSL - 124.35SHL - 42.18THL + 52.56WGL | 50.86 | 46.92 | *** |
| | BWT ₈ = 6357.16 - 144.22BLT - 231.67BRW + 142.55BDW - 105.51DSL - 54.21SHL + 121.14THL + 41.95WGL | 38.62 | 186.42 | *** |
| Arbor Acre | BWT ₂ = -959.50 - 3.70BLT - 0.88BRW + 114.42BDW + 44.43DSL - 13.74SHL + 30.87THL + 18.61WGL | 67.72 | 36.76 | *** |
| | BWT ₈ = -293.96 + 10.64BLT + 235.02BRW + 30.19BDW + 19.52DSL + 18.39SHL - 93.73THL + 7.80WGL | 8.06 | 197.09 | *** |
| Marshal | BWT ₂ = -226.52 + 0.14BLT + 6.65BRW - 4.80BDW - 46.71DSL + 17.59SHL + 42.07THL + 25.69WGL | 61.22 | 24.51 | *** |
| | BWT ₈ = -4047.25 + 34.98BLT - 114.83BRW - 8.12BDW + 270.27DSL + 112.75SHL + 144.90THL + 37.99WGL | 31.00 | 143.77 | *** |
| Ross | BWT ₂ = 66.44 - 4.24BLT - 15.89BRW + 2.54BDW + 30.58DSL - 25.58SHL - 7.21THL + 38.22WGL | 54.47 | 24.35 | *** |
| | BWT ₈ = 13819.22 - 179.09BLT + 230.07BRW - 334.94BDW - 41.96DSL + 49.98SHL - 198.36THL + 52.63WGL | 55.32 | 96.36 | *** |

BWT₂ BTW₈ = Body weight at 2 and 8 weeks of age, respectively; BLT = Body length; BRW = breast width; BDW = Body width; DSL = drumstick length; SHL = shank length; THL = thigh length; WGL = wing length. R² = Coefficient of multiple determinant, SE = standard error. ***: p<0.001

Feed intake was taken on daily basis. Feed conversion ratio was calculated as feed intake divided by weight gain. The linear body measurements (body length, body width, breast width, drum stick length, shank length, thigh length and wing length) were measured on weekly basis using a tape. The data collected on each parameter were subjected to one way analysis of variance in a completely randomized design. The following statistical model was used in the analysis:

$$Y_{ij} = U + X_i + e_{ij}$$

where,

Y_{ij} = The observation (body weight, feed intake, feed conversion ratio) made on the jth individual belonging to the ith strain of broilers.

U = over all estimate of the population mean.

x_i = Effect of the ith strain of broiler (i = 1,2,3,4.)

e_{ij} = Random error associated with each measurement.

Multiple regression models were fitted to determine prediction equations for the four strains of broilers at 2 and 8 weeks of age respectively.

RESULTS AND DISCUSSION

Table 1 presents the mean performance values for the four strains of broiler chicken. Highly significant (p<0.01) differences were observed among the four strains of broilers in the initial bodyweight at 2 weeks and the final body weight at 8 weeks of age. The Anak and Arbor Acre broilers were heavier at 2 weeks of age compared to Ross and Marshal. At 8 weeks of age, the Anak, Arbor Acre and Ross broilers attained an average body weight of 1855.00, 1880.00 and 1812.50 g, respectively which were higher than that of Marshal (1645.00 g). Akanno *et al.* (2007) recorded an average bodyweight of

1610.00, 1758.21 and 1468.21 g at 8 weeks of age for Anak, Arbor Acre and Ross broilers respectively. Body weight gain at 8 weeks of age were similar among Anak, Arbor Acre and Ross but significantly (p<0.01) higher than the value for Marshal. This implies that Anak, Arbor Acre and Ross broilers had greater genetic potential for growth compared with Marshal. Total feed intake (g/bird) were similar in Arbor Acre, Ross and Marshal but higher than the value for Anak. Marshal broilers were the poorest feed converters as they consumed more feed and gained less weight when compare to the other groups. Feed conversion ratios were similar in Anak, Arbor Acre and Ross broilers. Arbor Acre recorded the highest mortality, followed by Ross and Anak. Marshal did not record any mortality throughout the period.

Regression equations relating body weight to body parameters with their accuracy of prediction (R²) values for the four strains of broilers are shown in Table 2. It will be observed that the regression analysis were highly significant (p<0.001) in all the groups and the R² values more than 50% in most of the groups. This suggests that the body parameters are very good predictors for body weight in broilers. Therefore, in the rural areas where scale is not available, any of these body parameters could be used to predict the body weight of broiler chicken. A similar observation was reported by Akanno *et al.* (2007).

CONCLUSION

It was concluded that Anak, Arbor Acre and Ross broilers showed similarity in body weight at 8 weeks of age, weight gain and feed conversion ratio. They were, however, significantly (p<0.01) superior to Marshal broilers in all these traits. The results of multiple regression analysis showed that it was possible to predict bodyweight of broilers using liner body measurements.

ACKNOWLEDGMENT

The authors were grateful to the Department of Animal science, Delta State University, Asaba Campus for allowing us use their facilities for this research.

REFERENCES

- Adebambo, A.O., O.I. Faybenvo, S.O. Fragite, C.O.N. Ikeobi and O.A. Adebambo, 2005. Preliminary assessment of growth and reproductive data of three strains of chickens for broiler development in Nigeria. Proceeding 1st Nigeria international poultry summit. Ota Ogun State, pp: 9-11.
- Akanno, E.C., P.K. Ole, I.C. Okoli and U.E. Ogundu, 2007. Performance characteristics and prediction of body weight of broiler strains using linear body measurements. Proceeding 22nd Annual Conference Nig. Soc. for Animal Prod. Calabar, pp: 162-164.
- Nesamvuni, A.E., J. Malanzii, N.D. Zamanyimi and G.J. Taylor, 2000. Estimates of body weight in Nguru type cattle under commercial management conditions. South Afr. J. Anim. Scie., Vol. 30.
- Oluyemi, J.A. and F.A. Roberts, 1979. Poultry Production in Warm Wet Climates. 2nd Edn., Macmillan Press Ltd., London.
- Yalcin, S., P. Settar, S. Ozkan and A. Cahaner, 1997. Comparative evaluation of three commercial broiler stocks in hot versus temperate climates. Poultry Sc., 76: 921-929.