# Growth traits and performance of caged Fulani ecotype chickens fed commercial diets meant for broiler and pullet chicks

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**Abstract**

*Two hundred and six day old Fulani Ecotype chicks (FEC) were used to investigate the effect of feeding two types of diet (Chick starter diet and Broiler starter diet formulated to meet standard nutritional requirement of pullets and broiler chicks) on growth traits and performance from 0 to 8 weeks. The Broiler starter diet contained 23% Crude Protein (CP) and 3000Kcal/kg Metabolizable Energy (ME), and the Chick starter diet contained 21% CP and 2800Kcal/Kg ME. The growth traits measured were body weight (BW), body length (BL), body girth (BG), wing length (WL), thigh length (TL), drumstick length (DL), keel length (KL), and shank length (SL), while chicks performance were estimated from feed intake, feed efficiency, growth rate and weight gain. Average body weight of chicks fed broiler starter diet were significantly (P<0.05) higher from week 1 to 8. Chicks fed broiler starter diet exhibited numerically higher BL, BG, WL, TL, DL and KL than those fed chick starter diet at all ages and differences were significant (P<0.05) at some ages. Chicks fed broiler starter diet significantly (P<0.05) consumed more feed at week 1 and 2, and they gained more weight than those fed chick starter diet from 0 to 4 weeks (120.51 vs. 97.89g), and 5 -8 weeks (255.11vs. 239.13g). Feed efficiency in chicks fed broiler starter diet was relatively higher by 13.21% than observed in those fed chick starter diet from day old to 4 weeks and this translated to faster growth rate during the period in the former group (34.30% vs.32.67%). This study shows that the broiler starter diet produced superior growth traits and better feed efficiency in Fulani Ecotype chicks.*

**Key words:** Diets, Fulani ecotype chicks, Growth traits, Performance

## Introduction

Poultry meat is one of major protein sources in the diet of Nigerians and most developing countries. In an effort to supplement the ever increasing demand for animal protein, poultry production must be intensified and coupled with improvement and development of local or indigenous poultry stocks. One of the advantages of poultry production is the ability to attain maximum growth level within a relatively short period of time and capacity to provide the required animal protein for healthy growth to its consumers. In developing countries the average daily animal protein intake is 20g, which is below the recommended optimal daily requirement of 75g (FAO, 1997). Low intake of animal protein diminishes the capacity for most human activities as manifested in reduced productivity, high infant mortality and susceptibility to various types of devastating diseases which are rampant in developing countries (Okubanjo, 1990). However, to meet the demand for animal protein in Nigeria, improved breeds of chicken from developed countries which require expensive imported inputs dominate the commercial poultry sector and yet, sustainability of this improved exotic breed under poor economic condition and high exchange rate is pushing most farmers away from poultry production, and consequently leading to

increase in price of poultry products.

The Nigerian local chickens are diverse in origin, separated by geographical locations and are referred to as ecotypes. They are known for their adaptation and superiority in terms of their resistance to endemic diseases and other harsh environmental conditions (Nwakpu *et al*., 1999), but very low in productivity compared to the exotic stocks. They are highly unimproved and raised under little or no input on free range extensive system (Oluyemi and Roberts, 1979). It is very common to feed all local poultry stock with just any available feed apart from whatever they are able to pick on the range in the scavenging system and determination of their nutrient requirement versus intake satisfaction for growth and production performance is difficult. Therefore, investigating the actual performance of these indigenous poultry under varying environmental and management conditions is important as this could reveal their actual production potential as stated by Pederson (2002).

Fulani Ecotype chickens are one of the indigenous chicken types in Nigeria, and have been reported to have great potentials for genetic improvement in growth and reproductive performance (Atteh, 1990; Tiamiyu, 1999; Olori, 2000; Fayeye *et al*., 2005, Odetunde, 2007; Sola-Ojo and Ayorinde, 2009). Investigating Fulani Ecotype chicken (FE) for ability to perform under a defined environmental and management conditions is one way that will help in the improvement of this class of chicken for meat and egg production. In view of the fact that body parts contribute to overall body weight in chicken (Maciejowski and Zieba ,1982), and live weight changes are more valid reflections of growth in young animals than matured animals (Jack, 1995). Adeniji and Ayorinde (1990) suggested that measurement of body weight, height and body parts are better in judging the overall performance of an animal than using body weight alone. A study of the effects of different dietary composition on the rate of growth and development of body parts in Fulani ecotype chicks will be relevant in any programme design to improve this class of chicken. The present study was therefore designed to determine the performance of the Fulani Ecotype chicks when fed commercial diet optimized for broilers and pullets in terms of body weight and linear body measurements which include, body length, wing length, keel length, drumstick length, shank length and diameter.

## Materials and Method

*Origin of Experimental birds and Experimental design:* A total of two hundred and six (206) day old Fulani Ecotype chicks were obtained through incubation and hatching of Fulani Ecotype eggs from three different Fulani Kraals *(Oke-Ode, Oke-Ose,* and *Malete)* in Kwara State.

*Management of Experimental birds and Experimental Design:* The chicks were wing tagged on arrivals and randomly assigned into two treatment groups each replicated five times (Twenty birds per replicate) from day old to eight weeks age, they were brooded and raised intensively in a chicken metabolic cages set up comprising 20 compartments. The cage was heated using electric current with close monitoring for proper heat regulation during brooding from day old to 4 weeks, and the birds were raised at room temperature thereafter. All necessary vaccination and medication were given to birds as and when appropriate.

*Experimental Diet*

The Fulani Ecotype chicks were placed on two different diets (Broiler starter and chick

starter diet) from day old to eight weeks. The two commercial diets used 'broiler starter and chicks starter mash' were confirmed to conform with Nutrient Requirement Table of the NRC (1994) according to the product labeled and they were purchased from a reputable animal feed producer in Ilorin. The feed sample were subjected to proximate analyses according to method of AOAC (1992) , while the Metabolizable energy (ME) was calculated from the proximate composition of the feed and the values obtained are shown in Table 1.

**Data Collection:**

*Body Weight (BW)*: Body weight in gram (g) were measured and recorded two decimal places. BW was taken by use of a sensitive Scout II electronic weighing scale (600g) capacity from day old to 3 weeks, while 5kg Camry Scale was used thereafter.

*Body Length (BL)*: Body length was measured as the distance from the nostril to the pygostyle in centimeter (cm) with a measuring tape carefully stretched along the neck of the bird through the back to the tip of its pygostyle.

*Body Girth (BG)*: Body girth was taken as the distance in centimetre (cm) units covered when a tape measure was looped round the region of the breast, taking care to run the tape under (rather than over) the wing.

*Shank Length (SL)*: The shank length was taken as the distance in centimeters (cm) between the foot pad and the hock joint, measured by use of a set of Vernier caliper.

*Shank Diameter (SD)*: The shank diameter was measured using a pair of Vernier calliper at the middle of the left shank of each bird.

*Thigh Length (TL)*: Thigh length was taken as the distance between the tip of the tarsus and the ball joint, measured in centimeter (cm) units by use of a tape rule.

*Wing Length (WL)*: Wing length was taken as the distance from the humerus-coracoid junction to the distal tip of the phalanges digits, measured in centimeter (cm) units by use of a tape rule.

*Feed Intake (FI)*: This was obtained as the difference between total feed supplied and the remaining / left over at the end of the week.

*Feed Efficiency* (FE): Feed efficiency was measured as the amount of weight gain over a period of time divided by feed intake over the same period expressed in percentage.

*Growth Rate*: For body weight (g), Growth rate/potential for 1 to 4 week and 5 to 8 week periods were determined by use of an adapted version of the formula of

**Table 1. Percentage proximate composition and calculated Metabolizable energy of the diets**

| Composition | Chicks starter diets (%) | Broiler starter diets (%) |
|---|---|---|
| Moisture Content | 7.20 | 6.25 |
| Dry Matter | 92.80 | 93.75 |
| Crude Protein | 21.12 | 23.45 |
| Crude Fibre | 4.85 | 3.97 |
| Ether Extract | 3.15 | 4.02 |
| Total ash | 5.67 | 5.92 |
| Metabolizable Energy | 2800Kcal/kg | 3000Kcal/kg |

Maciejowski and Zięba (1982),
$I = [(T2 - T1)/(T2 + T1)/2] \times 100$
Where:
I= Growth rate per unit period (%).
T1= Average initial reading for the stated period (g)
T2= Average final reading for the stated period (g)

**Statistical Analysis:**

All data obtained were subjected to Analysis of Variance by use of SPSS Version 17 (IBM SPSS). Significantly different means ($p<0.05$) were separated by use of the Duncan's multiple Range procedure option in SPSS and the following statistical model was applied to examine the effect of diet type on growth traits and feed intake:

$Y_{ij} = \mu_i + a_i + e_{ij}$

Where $Y_{ij}$ = growth traits
$\mu$= overall mean
$a_i$ = effect of $i^{th}$ diet (chick starter or broiler starter)
$e_{ij}$= random residual error.

**Results and Discussion**

In this study, there was no significant ($P>0.05$) difference in the hatch weight of the chicks, but after one week of intensive management significant differences ($P<0.05$) existed in body weight and quantity of feed consumed by Fulani Ecotype chicks fed broiler starter diet and those on chicks diet (Table 2). Those fed broiler starter diet were 27.59 percent heavier compared to those fed with chicks starter diet and they consumed more than twice of the feed consumed by those on

**Table 2: Effects of two diets type on body weight and feed intake of FEC from day old to eight weeks of age**

| Parameters | BW (g/bird/week) | | FI (g/bird/week) | |
|---|---|---|---|---|
| Age (weeks) | Chicks Starter Diet | Broiler Starter Diet | Chicks Starter Diet | Broiler Starter Diet |
| 0 (Hatch wt) | 25.95± 0.01$^a$ | 27.57±0.15$^a$ | 0.00 | 0.00 |
| 1 | 37.81±0.03$^b$ | 52.22± 0.06$^a$ | 16.05±0.34$^b$ | 26.79±0.07$^a$ |
| 2 | 57.69±0.04$^b$ | 69.42± 0.09$^a$ | 36.79±0.51$^b$ | 40.48±0.10$^a$ |
| 3 | 86.29±0.06$^b$ | 108.17± 0.08$^a$ | 69.82.±0.09$^a$ | 70.48±1.29$^a$ |
| 4 | 123.84±0.07$^b$ | 148.08±0.11$^a$ | 114.14±0.13$^a$ | 115.24±1.34$^a$ |
| 5 | 148.64±0.09$^b$ | 155.38±0.08$^a$ | 139.61±0.11$^a$ | 140.95±1.49$^a$ |
| 6 | 214.48±0.09$^b$ | 261.10±0.09$^a$ | 170.74±0.09$^a$ | 172.39±1.57$^a$ |
| 7 | 274.90±0.07$^b$ | 328.94±0.10$^a$ | 188.70±1.19$^a$ | 190.49±1.58$^a$ |
| 8 | 387.77±0.10$^b$ | 410.49±0.13$^a$ | 198.10±1.19$^a$ | 199.90±1.61$^a$ |

a,b, Treatment means within rows in the same column followed by different superscripts are significantly different ($P<0.05$) . BW- Body weight, FI- Feed – Intake.

chick starter diet within the first week. A Similar result was observed in week 2 for feed intake, and there was a significant ($P<0.05$) difference in the body weight of Fulani Ecotype fed chick starter diet and broiler starter (57.69 vs. 69.42g). The significant differences in bodyweight and feed intake could be as a result of higher protein content in broiler starter diet and this suggest that Fulani Ecotype chicks will require similar (or even higher) dietary protein requirements as the exotic broiler chicks. The quantity of metabolizable energy present in the broiler starter diet could also be said to be adequate for the Fulani Ecotype chicks considering the fact the chicks efficiently utilized the protein content in the diet for faster growth rate. Miller (2007) stated that adequate energy must be supplied by a diet before young animals can make efficient use of the dietary protein content of such diet for rapid development.

From weeks 3 to 8, Fulani Ecotype chicks fed with broiler starter diet were significantly ($P<0.05$) heavier than those fed chick starter diet despite the fact that no significant differences ($P>0.05$) existed in the quantity of feed consumed as shown in Table 2. At weeks 3, 4, 5, 6, 7 and 8, chicks fed broiler starter were significantly ($P<0.05$) heavier than those fed chick starter diet with a relative percentages of 20.22, 16.36, 4.34, 17.85 16.42 and 5.53, respectively, this might be due to the differential modulation of the biological growth programme with respect to the quality of feed given to the birds in terms of crude protein and metabolizable energy. The relative percentage differences in the chicks body weight with respects to diet did not follow a definite pattern from weeks 3 to 8 but reduce drastically from week 7 to 8, and during this period the chicks have similar feed intake. This suggest that as the chicks grow older, their protein requirement for rapid growth become minimal to the level that is needed for body maintenance and repairing of damage tissues as it is for other young animals (Jack , 1995).

Chicks fed broiler starter diet had higher percentage feed efficiency (47.63%) from day old to week 4 than those on chick starter diet (41.34%). From week 5 to 8, chicks fed broiler starter diet had 36.25%, while those on chick starter diet had 34.30% feed efficiency (Table 3). This showed that from day old to 4 weeks, Feed Efficiency (FE) was higher in chicks fed broiler starter diet, they consumed more feed and were significantly bigger than those on chick starter diet. This results showed that chicks fed broiler starter diet efficiently utilized their feed from day old to week 4, and this could be responsible for their significantly higher body weight than those fed chicks diets throughout the experimental period. It was also observed that growth rate was higher by 1.63% and 0.26% in chicks fed broiler starter diet than those on chick starter diet from week 1 to 4 and week 5 to 8, respectively. From this observation it could be said that chicks fed with broiler starter diet have enough protein to facilitate their growth rate, thus leading to higher body weight and faster growth rate compare to those fed chicks starter diet. This finding corresponds with the facts that growth is a trait that is influenced by genetics and management, especially nutrition and health and the ability of an animal to grow depends upon its breed, sex and most importantly the level of nutrition as reported by Chambers (1990).

There were significant differences ($P<0.05$) in linear body measurements (body length BL, body girth BG, wing length WL, keel length KL, thigh length TL, shank length SL, shank diameter SD

**Table 3: Performance characteristics of Fulani ecotype chicks fed two diet types**

| | Period of Observation (0-4weeks) | | | | | |
|---|---|---|---|---|---|---|
| FEC fed Chicks starter | 97.89 | 25.95 | 123.84 | 32.67 | 236.80 | 41.34 |
| FEC fed Broilers Starter | 120.51 | 27.57 | 148.08 | 34.30 | 252.99 | 47.63 |
| | Period of Observation (5 -8 weeks) | | | | | |
| FEC fed Chicks starter | 239.13 | 148.64 | 387.77 | 22.28 | 697.15 | 34.30 |
| FEC fed Broiler starter | 255.11 | 155.38 | 410.49 | 22.54 | 703.82 | 36.25 |
| Parameters observed | TWG (g) | IBW (g) | FBW(g) | G R (%) | TFI (g) | FE (%) |

FEC = Fulani Ecotype Chicks, TWG = Total Weight gain, IBW= Initial Body weight, FBW= Final Body weight, GR= Growth Rate, TFI = Total Feed Intake, FE= Feed Efficiency.

and drumstick length DL) of the chicks fed broiler starter and chick starter diets (Table 4 and 5). At week 1, no significant ($P>0.05$) difference was recorded in BL and SD, but significant ($P<0.05$) differences existed in other body measurements, at week 2, WL and SD were not significantly ($P>0.05$) different, at week 3 all body measurements were significantly ($P<0.05$) different, while at week 4 and 5, WL, TL and SD were not significantly ($P>0.05$) different. At week 6, BG and TL were not significantly ($P>0.05$) different, TL was similar ($P>0.05$) at week 7, while SD was not significantly ($P>0.05$) different between dietary groups at the age of 8 weeks. The results also indicated that shank length was significantly ($P<0.05$) higher value in chicks fed chick starter diet than those fed broiler starter diet (Table 5). Generally, it was observed that chicks fed broiler starter diets had higher values for most linear body measurements and overall body weight than those fed with chick starter diet. This study corroborates the report of Moran and Orr (1989) that increment in weight is accompanied by continuing changes in appearances as reflected in changes observed in linear body measurement with respect to different diet fed to chicks of the same genotype. The response of the Fulani Ecotype chicks to utilization of the nutrients in the diet showed that the broiler starter diet is better utilized and leads to a better growth rate than the chick starter diet.

This study also showed that body weight and linear body measurement were significantly ($P<0.05$) affected by different feed composition particularly in terms of crude protein and metabolizable energy of the diet fed to chicks during the first eight weeks of age. Also, it was observed that the body weight value obtained for chicks fed broiler starter diet from day old to 8 weeks (27.57g to 410.49g) were much lower than 36.70g to 1334g reported for exotic broiler fed same diet type from day old to eight weeks of age (Adeniji and Ayorinde, 1990), this showed that the body weight, growth potential and feed efficiency of the Fulani Ecotype chicks is very low compared to that of their exotic counterparts. However, this study revealed that the feed utilization and growth

**Table 4: Effects of two diets types on some linear body measurements in Fulani ecotype chicks**

| Age (Wks) | Body Length Chicks Starter | Body Length Broiler Starter | Body Girth Chicks Starter | Body Girth Broiler Starter | Wing Length Chicks Starter | Wing Length Broiler Starter | Keel Length Chicks Starter | Keel Length Broiler Starter |
|---|---|---|---|---|---|---|---|---|
| 1 | 11.81±1.32$^a$ | 12.46±2.14$^a$ | 7.86±1.43$^b$ | 8.62±1.22$^a$ | 3.87±0.59$^b$ | 4.47±0.20$^a$ | 1.90±0.20$^b$ | 3.60±1.41$^a$ |
| 2 | 13.83±1.55$^b$ | 15.11±2.26$^a$ | 9.13±1.18$^b$ | 9.50±1.45$^a$ | 5.09±1.08$^a$ | 5.34±0.44$^a$ | 2.88±0.44$^b$ | 4.03±1.15$^a$ |
| 3 | 16.31±1.98$^b$ | 18.03±2.72$^a$ | 10.24±1.09$^b$ | 10.96±1.49$^a$ | 5.89±1.15$^b$ | 6.53±0.53$^a$ | 3.98±0.53$^b$ | 4.54±1.41$^a$ |
| 4 | 18.31±1.64$^b$ | 19.70±2.72$^a$ | 12.37±1.95$^b$ | 12.87±1.21$^a$ | 7.32±1.17$^a$ | 7.40±0.72$^a$ | 4.52±0.72$^b$ | 5.03±1.51$^a$ |
| 5 | 20.16±1.64$^b$ | 22.97±2.46$^a$ | 13.64±1.54$^b$ | 14.57±1.48$^a$ | 8.13±1.39$^a$ | 9.12±0.91$^a$ | 5.26±0.91$^b$ | 5.80±1.62$^a$ |
| 6 | 23.65±2.36$^a$ | 24.23±2.56$^a$ | 14.66±1.48$^b$ | 14.79±1.53$^a$ | 9.23±1.48$^b$ | 10.51±0.77$^a$ | 6.12±0.77$^b$ | 6.56±1.71$^a$ |
| 7 | 24.85±2.30$^b$ | 26.04±2.56$^a$ | 15.16±1.72$^b$ | 16.48±1.69$^a$ | 12.01±1.80$^b$ | 14.40±0.63$^a$ | 6.63±0.63$^b$ | 7.32±1.95$^a$ |
| 8 | 27.18±3.20$^b$ | 28.56±2.79$^a$ | 17.45±1.88$^b$ | 17.78±1.88$^a$ | 14.48±1.53$^b$ | 16.66±0.77$^a$ | 6.68±0.77$^b$ | 8.47±2.16$^a$ |

a, b Treatments means within rows in the same column followed by different superscripts are significantly different (P<0.05) .

**Table 5: Effects of two diets type on some linear body measuremeat in the Fulani ecotype chicks**

| Age (Wks) | Thigh Length Chicks Starter | Thigh Length Broiler Starter | Shank Length Chicks Starter | Shank Length Broiler Starter | Shank Diameter Chicks Starter | Shank Diameter Broiler Starter | Drumstick Length Chicks starter | Drumstick Length Broiler Starter |
|---|---|---|---|---|---|---|---|---|
| 1 | 2.19±0.47$^b$ | 2.98±0.90$^a$ | 1.98±0.25$^b$ | 2.95±0.47$^a$ | 0.28±0.14$^a$ | 0.32±0.15$^a$ | 3.38±0.37$^b$ | 5.30±2.12$^a$ |
| 2 | 3.12±0.47$^b$ | 3.38±0.53$^a$ | 3.60±0.87$^a$ | 3.41±0.47$^b$ | 0.38±0.13$^a$ | 0.41±0.13$^a$ | 4.20±0.73$^b$ | 5.96±1.53$^a$ |
| 3 | 3.94±0.51$^b$ | 4.18±0.90$^a$ | 3.92±0.43$^a$ | 3.69±0.52$^b$ | 0.45±0.09$^a$ | 0.49±0.15$^a$ | 5.12±0.58$^b$ | 7.26±2.12$^a$ |
| 4 | 4.74±0.92$^a$ | 4.84±0.52$^a$ | 4.76±0.59$^a$ | 4.08±0.66$^b$ | 0.64±0.18$^a$ | 0.67±0.17$^a$ | 7.84±0.71$^b$ | 8.30±2.48$^a$ |
| 5 | 5.05±0.54$^a$ | 5.71±0.54$^a$ | 5.46±0.77$^a$ | 4.57±0.86$^b$ | 0.66±0.26$^a$ | 0.74±0.16$^a$ | 8.54±1.02$^b$ | 10.12±2.37$^a$ |
| 6 | 6.13±0.80$^a$ | 6.30±0.65$^a$ | 5.88±0.99$^a$ | 4.96±0.64$^b$ | 0.84±0.22$^b$ | 0.89±0.18$^a$ | 9.29±0.87$^b$ | 12.26±2.72$^a$ |
| 7 | 6.82±1.03$^a$ | 6.93±0.66$^a$ | 6.26±0.85$^a$ | 5.58±0.64$^b$ | 0.85±0.26$^b$ | 0.94±0.18$^a$ | 9.74±0.88$^b$ | 14.13±2.82$^a$ |
| 8 | 7.00±1.15$^b$ | 7.54±0.63$^a$ | 6.62±1.10$^a$ | 6.22±0.64$^b$ | 0.89±0.27$^a$ | 0.94±0.15$^a$ | 9.85±0.89$^b$ | 15.79±3.51$^a$ |

a,b- Treatments means within rows in the same column followed by different superscripts are significantly different (P<0.05) .

potential of indigenous chicken can be monitored and utilized under an intensive system management as suggested by Gondwe *et al.* (2002) that exploitation of the growth potential of indigenous chicken will not be fully possible under scavenging or free range condition because of inadequate feed and management procedure.

In conclusion, the influence of dietary utilization was shown from week 1 to 4 ages where Fulani Ecotype chicks fed broiler starter diet recorded higher feed efficiency and better growth rate than those placed on chick starter diet. If based on body weight, feed efficiency and linear body measurement observation in this study, Fulani Ecotype chicken should be fed with broiler diet of 23% CP and 3000Kcal/kg ME for heavier body weight and faster growth rate. The findings here also highlight the utility of contemporaneous tests of the effect of more than one dietary type on the overall body development of the Fulani Ecotype chicken, revealing differences which might otherwise be obscured by seasonal/environmental variation effects. Furthermore, the results of this study suggest that it will be better to investigate the actual nutrition requirement of this chicken ecotype that could possibly lead to a more rapid development as this will help in any improvement programme designed for this indigenous chicken type.

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*Received:15/09/13*
*Accepted: 11/02/14*