# COMPARATIVE EGG PERFORMANCE OF TWO NIGERIAN CHICKEN ECOTYPES UNDER TWO SYSTEMS OF MANAGEMENT

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## ABSTRACT
Genetic study on comparative performance of two Nigerian indigenous chicken ecotypes under two management systems were undertaken using a total of 110 (55 each) birds comprising of 10 hens and 1 cock from five randomly selected locations each for Tiv and Fulani chicken ecotypes. The birds were hatched and raised using standard procedures. The data collected were analysed using SPSS statistical package. The result obtained indicated that ecotype, management and location as well as their interactions had significant ($P< 0.05$) effect on AFE in both ecotypes. AFE had the highest $R^2$ value (0.790) compared to 0.340 and 0.456, respectively for BWFE and WFE. Birds in deep litter system laid eggs earlier compared to those in the battery cage in both ecotypes. Fulani chickens on deep litter laid eggs 12 days earlier compared to their counterpart raised in the battery cage. Similarly, Tiv birds on deep litter laid eggs 40 days earlier than those on battery cage. Also, both the Tiv and the Fulani birds raised in the deep litter laid eggs 27 days earlier compared battery cage (198.30±2.51 days against 224.61±2.20 days). From the findings of this research it was recommended that Tiv and Fulani chickens should be raised on deep litter for commercial egg production.

**Keywords:** Age at first egg, body weight at first egg, location, weight of first egg.

## INTRODUCTION
The genetic variations of the chicken populations in the country need investigation so as to identify existing diversity within and between populations. Poultry, particularly chickens are genetically diverse, so it is important to study the diversity in their populations in order to identify superior populations and individuals with desired trait (Gambo, 2020). Genetic diversity in farm animals is continuously suffering erosion. This is especially true for the chicken industry where very few genotypes contribute their genes for the development of improved breeds used for commercial production. This narrow genetic resource base of improved breed for commercial production in the world is widely increasing because of its efficiency. Genetic resources of indigenous breeds (Momoh, 2005) would in future be required for creating more variations in desired trait, when genetic improvement in the breeding populations of improved breeds would no longer be possible.The uniqueness of their genes for egg and meat production, disease resistance, hardiness and adaptation to local environment would in future be needed to broaden the genetic resource base for breeding of improved commercial birds. The objective of the study was to investigate genetic diversity in BWFE, AFE and WFE within and between populations of the Nigerian Tiv and Fulani chicken ecotypes.

## MATERIALS AND METHODS
The experiment was carried out at the Livestock Teaching and Research Farm of the Faculty of Agriculture, Shabu-Lafia Campus, Nasarawa State University, Keffi, Nasarawa State. The State falls within the Southern Guinea Savannah Zone of Nigeria. Lafia lies between latitude 7º and 9º North and Longitude 7º and 10º East. It has a climate typical of the tropical zone because of its location. It has a temperature ranging from 20ºc in October to 36ºc in March while rainfall varies from 13.73 cm in some places to 14cm in others (Faculty of Agriculture Weather Station, 2022).

### Experimental Birds and their Management
The local chickens for this experiment were procured from ten selected localities. Two ecotypes namely, the Tiv and the Fulani ecotypes were used for the experiment. The locations (1-5) for the Tiv

ecotype were Uikpan, Daudu, Kadarko, Yelwata and Cohor while that of Fulani ecotype were Lafia, Akurba, Adogi, Asakio and Namu. A total of 100 hens comprising of 50 Tiv and 50 Fulani ecotypes as well as 20 breeding cocks comprising 10 (with 5 as reserves in case of mortality) of each ecotype were purchased from five localities for each ecotype and used as the base population. Each ecotype was randomly assigned to five breeding pens in the rearing house. A mating ratio of 1 cock to 10 hens was used. Fertile eggs for hatching were collected when the birds have laid for four weeks so as to attain higher fertility and hatchability. Eggs were collected twice a day and were identified according to localities and ecotypes. The eggs were accumulated for 5 days in egg crates under room temperature with good ventilation. At the end of egg collection, the eggs were transported to PhenabAgro Venture, beside fire service, Bukuru express way, Angul-D Jos for hatching using automatic incubator. On hatching, chicks were weighed, vaccinated using gumboro and lasota. The chicks were then allocated to pens identified according to ecotype and localities. This pens were used as brooding and rearing house. The experimental pens were thoroughly cleaned, scrubbed and disinfected using a disinfectant (Vinkokil) and allowed to dry for two weeks before the arrival of the chicks. Brooding was carried out for a period of 21 days (3 weeks) using stoves and electric bulbs as sources of heat and illumination. Wood shavings were used as litter materials. They were spread at a depth of 5cm. The chicks were brooded at a temperature of $35^0$C with adequate drinker and feeder spaces provided. The temperature was reduced gradually at the rate of $3.5^0$C on weekly basis as brooding progresses. Light was provided for 24 hours during brooding to avoid pilling and death.The chick's phase of the study lasted for 4weeks (28 days). During this phase, the birds were fed formulated chick mash which contained 18% crude protein (CP) and 2800Kcal/kg metabolizable energy. The growing phase lasted for another 14 weeks.At this stage, the birds were fed growers mash containing 15% CP and 2,600 kcal/kg metabolizable energy.Layers mash which contained 16.5%CP and 2,600Kcal/kg metabolizable energy was given to the birds at point of lay. At 16 weeks, the birds were divided into two groups for each ecotype and location. One group reared on deep litter while the second groupwas raised in the battery cage. The birds were then allowed to lay and records taken on age at first egg (AFE), body weight at first egg (BWFE) and weight of first egg (WFE).

**Experimental Design and Statistical Analysis.**

The design of the experiment was Completely Randomized Design (CRD). Stratified random sampling technique was employed for the purchase and distribution of the population. Data collected on all the parameters were analyzed using a multivariate analysisof the SPSS Statistical software version 21. The following statistical models were used:

$Y_{ijkl} = \mu + Ei + M_j + L_k + E*M_{ij} + E*L_{ik} + M*L_{jk} + E*M*L_{ijk} + E_{ijkl}$

Where $Y_{ijkl}$ = Measure of the $j^{th}$ progeny of the $i^{th}$ ecotype, $\mu$ = Population mean, $E_i$ = Effect of Ecotype (I = 1& 2), $M_j$ = Effect of Management (j = 1 & 2), $L_k$ = Effect of Location (k = 1, 2, 3, 4 and 5), $E*M_{ij}$ = Interactive effect of ecotype and management, $E*L_{ik}$= Interactive effect of ecotype and location, $M*L_{jk}$ = Interactive effect management and location, $E*M*L_{ijk}$= Interactive effect of ecotype by management by location, $E_{ijkl}$ = Random error with mean zero and variance that of the population.

**RESULT**

Table 1 shows mean values of the effects of ecotype, management, location and their interactions on body weight at first egg (BWFE), age at first egg (AFE) and weight of first egg (WFE). The results indicated that ecotype, location and ecotypes by location interaction as well as management by location interaction had significant ($P<0.05$) effect on BWFE. However, management, ecotype by management interaction and ecotype by management by location interaction had no significant ($P>0.05$) effect on BWFE. Consequently, ecotype, management, location and all levels of interaction had highly significant ($P<0.001$) effect on AFE. For the WFE, location and ecotype by location interaction had highly significant ($P<0.05$) effect on WFE. Similarly, ecotype by management by location interaction had significant ($P<0.05$) effect on WFE. Management and ecotype by management and management by location interactions had no significant ($P>0.05$) effect on WFE. The $R^2$ value were 0.340, 0.790 and 0.456 respectively for BWFE, AFE and WFE.

The comparative BWFE, AFE, WFE and EW of Tiv and Fulani chicken ecotypes under two systems of management is presented in table 2. In both ecotypes, management system had significant ($P<0.05$) effect on AFE. Birds on deep litter laid eggs earlier, compared to those in the battery cage for both Tiv and Fulani chickens as well as combination of both ecotypes.Tiv birds raised in deep litter laid eggs

40 days earlier compared to their counterparts raised in the battery cage (189.11 days against 229.02 days). Also in the Fulani ecotype, birds raised in the deep litter laid eggs 12 days earlier compared to their counterparts raised in the battery cage (207.76±2.38 days against 219.78±2.85). In a similar fashion, when the eggs laid by both the Tiv and the Fulani birds were combined based on management system, birds (both the Tiv and the Fulani ecotypes) raised in the deep litter laid eggs 27 days earlier compared to birds raised in the battery cage (198.30±2.51 days against 224.61±2.20 days).

**Table 1:** Mean Square Values of Effects of Ecotype, Management, Location and their Interactions on BWFE, AFE and WFE

| Traits | Sources of variation | Df | Mean square | $R^2$ |
|---|---|---|---|---|
| Body weight at first egg | Ecotype | 1 | 99039.96** | 0.340 |
| | Management | 1 | 6886.80$^{ns}$ | |
| | Location | 4 | 44237.87** | |
| | Ecotype* management | 1 | 163.87$^{ns}$ | |
| | Ecotype *location | 4 | 38926.16** | |
| | Management *location | 4 | 35384.64** | |
| | Ecotype* management *location | 4 | 12073.31$^{ns}$ | |
| | Error | 135 | 8430.96 | |
| Age at first egg | Ecotype | 1 | 832.04* | 0.790 |
| | Management | 1 | 23451.12*** | |
| | Location | 4 | 2120.83*** | |
| | Ecotype* management | 1 | 4520.39*** | |
| | Ecotype *location | 4 | 3262.89*** | |
| | Management *location | 4 | 1013.93*** | |
| | Ecotype* management *location | 4 | 2116.63*** | |
| | Error | 135 | 125.19 | |
| Weight of first egg | Ecotype | 1 | 22.25$^{ns}$ | 0.456 |
| | Management | 1 | 1.75$^{ns}$ | |
| | Location | 4 | 60.55*** | |
| | Ecotype* management | 1 | 7.92$^{ns}$ | |
| | Ecotype *location | 4 | 107.16*** | |
| | Management *location | 4 | 1.16$^{ns}$ | |
| | Ecotype* management *location | 4 | 21.01* | |
| | Error | 135 | 6.46 | |

Df = degree of freedom, *=(P<0.05), ** = (P<0.01), *** = (P<0.001), ns = non-significant, $R^2$ = adjusted value, BWFE = body weight at first egg,, AFE = age at first egg and WFE = weight of first egg, Fulani ecotype: location 1-5 = Lafia, Akurba, Adogi, Asakio and Namu, Tiv ecotype: location 1-5 = Uikpan, Daudu, Kadarko, Yelwata and Cohor

**Table 2:** Comparative BWFE, AFE, WFE and EW of Tiv and Fulani Local Chicken Ecotypes under two system of management

| Ecotype | BWFE | AFE | WFE |
|---|---|---|---|
| **Tiv ecotype** | | | |
| Battery cage | 1018.66±21.06 | 229.02±3.20$^{b}$ | 37.24±0.54 |
| Deep litter | 987.00±13.62 | 189.11±3.81$^{a}$ | 35.54±0.73 |
| LOS | NS | * | NS |
| **Fulani ecotype** | | | |
| Battery cage | 1061.87±18.09 | 219.78±2.85$^{b}$ | 37.07±0.40 |
| Deep litter | 1054.00±13.37 | 207.76±2.38$^{a}$ | 37.47±0.50 |
| LOS | NS | * | NS |
| **Both Fulani and Tiv ecotype** | | | |
| Battery cage | 1039.26±14.11 | 224.61±2.20$^{b}$ | 37.16±0.34 |
| Deep litter | 1020.01±10.31 | 198.30±2.51$^{a}$ | 36.49±0.46 |

| | | | |
|---|---|---|---|
| LOS | NS | * | NS |

## DISCUSSION

The mean square values of effects of ecotype, batch of hatch, locations and their interactions indicated a very highly significant ($p<0.001$) effect on AFE as similarly reported by Tule (2005). In both ecotypes, birds on deep litter laid eggs earlier than their counterpart in battery cage. This result strongly agrees with the findings of Tadelle *et al.* (2003) and Gunn (2008) who reported difference in age of pullets in attainment of sexual maturity to system of management and productive traits. The value obtained in days for Tiv and Fulani ecotypes for AFE in this study is higher than the findings of Momoh (2005) who reported 155, 158, 160 and 161 days as AFE for main cross, reciprocal cross, heavy and light ecotype of the Nigerian local chicken. Tule (2005) reported 157 days for both light and heavy ecotypes respectively on deep litter, then reported 156 and 154 days for light and heavy ecotypes respectively raised in battery cages. Gunn (2008) reported that the age at sexual maturity for local chicken ranged between 133-169 days under scavenging condition whereas in cage system, it increases to about 189 days. BWFE is heavier in battery cage than deep litter as similarly reported by Tule (2005). The mean BWFE for the two ecotypes respectively for deep litter and battery cage is higher than the report of Tule (2005) who reported BWFE of the light and heavy ecotype on deep litter as 797.89±1.43 and 876.32±1.2 while the light and heavy ecotype on battery cage had 931.85±2.11 and 962.91±1.17.The mean value for WFE in Tiv and Fulani ecotype respectively is very similar to the findings of Momoh (2005) who reported weight (g) of first egg as 30.42, 38.06, 36.08 and 35.83 for the light ecotype, heavy ecotype, main cross and reciprocal cross respectively.

## CONCLUSION

Ecotype, management and location as well as their interactions had significant ($P< 0.05$) effect on AFE in both ecotypes. AFE equally had the highest $R^2$ value (0.790) compared to 0.340 and 0.456, respectively for BWFE and WFE. In both ecotypes, management system had significant ($P<0.05$) effect on AFE. Birds on deep litter system laid eggs earlier compared tothose in battery cages for both Tiv and Fulani chickens as well as combination of both ecotypes. From the findings of this research it was recommended that Tiv and Fulani chickens should be raised on deep litter for commercial egg production.

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