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EGG PRODUCTION PERFORMANCE OF THREE VARIETIES OF GUINEA FOWLS IN HUMID TROPICS

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ABSTRACT

An investigation into the egg production performance of three varieties of Guinea fowls was studied. The experimental varieties were Pearl (Sake), Lavender (Hurudu) and Black (Angulu). Base populations of 180 guinea fowls were used to generate 144 F1 females comprising 48 birds per variety. Each variety was divided into three randomized replicates containing 16 birds per replicate. Data were collected fortnightly on egg production performance traits. Parameters collected for egg production included Body Weight (BWT), Body Weight Gain (BWG), Feed Intake (FI), Feed per Dozen Egg (FDE), Feed Efficiency (FE), Egg Number (EN), Percent Hen Day Production (% HD). Data collected were treated statistically. The Pearl, Lavender and Black varieties showed some similarities in the trend produced for some parameters. Body weight gain and mortality percent portrayed a decreasing trend as egg number increased, whereas, the daily feed intake, percent henday, and feed per dozen eggs tended to increase with an increase in egg number. The three varieties also demonstrated differences in such traits like feed efficiency, feed per dozen egg and body weight. These differences in phenotypic performance may suggest some level of genetic differences in these varieties and thus further research on the genetic characteristics of helmeted guinea fowl varieties is recommended.

Key Words: Egg production, Guinea fowl, Performance, Humid tropics

INTRODUCTION

Guinea fowl (*Numida meleagris*) are indigenous to West-Africa North of the Equatorial forest where there is an estimated population of about 4.7 million (FDLPS/RIM, 1991). It got the name 'Guinea' because it was believed to have originated from Guinea in West Africa. They are a common game bird in the Savanna Region of Nigeria.

Guinea fowls are seasonal breeders which has been recognized as one of the major drawbacks to large scale Guinea fowl production. In the wild, production starts at 28-42 weeks with 15-20 eggs being laid each season while in captivity, production starts at 28-32 weeks with 50-100 eggs being produced in the first year and more eggs (180) are laid in the second year of production and laying may continue for 7 or more years (Ayorinde, 1990).

Among domestic types which the peasant farmers have long identified and given local names based on their coloration are Pearl (Sake), Lavender (Hurudu), Black (Angulu) and White (Faren Zabi) (Ikani and Dafwang, 2004). The Pearl variety is the most common and probably the first developed from the Wild West African birds (Ikani and Dafwang, 2004).

According to Ikani and Dafwang (2004), the advantages include that, Guinea fowls are more capable of coping with the effects of dry weather conditions prevailing in the Northern Guinea Savanna and Sahelian ecological zones than other domestic poultry; the over 50 million semi-domesticated guinea fowls in Nigeria constitute about 25% of the entire domestic poultry population in Nigeria making it variable source of animal protein which is socially acceptable. Body weight is an attribute of egg size. The poultry producer wants eggs of minimum possible size and weights that will maximize production of standard sized eggs at an economic rate and still maintain market carcass value at the end of the production period (Oke et al., 2004). Ayorinde et al. (1988) reported consistent reduction in body weight, which they attributed to increased body use of physiological reserve to meet the demand for egg production, Oke et al. (2004) reported initial gains in body weight which reduced and in some cases fluctuated with rise in egg produc-

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tion. Farooq et al.(2002), opined that feed consumption and its efficient utilization is one of the major concerns in commercial table egg production as feed cost is one of the major components of total cost of production. Better utilization of feed and avoiding unnecessary feed wastage could be the leading factors in minimizing total cost of production (Elwardanyet al., 1998).

MATERIALS AND METHODS

Location of Study

This study was carried out in the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, located at about ten kilometers from Umuahia, the Abia State capital. Umudike bears the coordinate of 5°28[1] North and 7°32[1] East, and lies at an altitude of 122 meters above sea level. The environment of study was situated within the Tropical Rainforest zone and is characterized by an annual rainfall of about 2177 mm. The relative humidity during the rainy season is well over 72 %. Temperature ranged from 22 ^{0}C - 36 ^{o}C with March being the warmest month, while July to October represents the coolest period with a temperature range of 22 ^{0}C – 30 ^{o}C (Nwachukwu, 2006).

Acquisition and Mating of Base Population

One hundred and eighty adult guinea fowls of three varieties were procured from several markets in Zaria. The base population consisted of 36 adult males, and 144 adult females. Each variety had 12 males and 46 females each. These adults were quarantined for two weeks. A mating ratio of 1 male: 3 females were maintained and the mating scheme adopted was as shown below:

- Pearl male X Pearl female
  - Homozygous Pearl variant main cross
- Lavender male X Lavender female
  - Homozygous Lavender variant main cross.
- Black male X Black female
  - Homozygous Black variant main cross.

Experimental Animals and Management

The eggs laid by the base population were set and hatched at Kanem Hatcheries off Aba-Owerri Road, Aba. A total of two hatches which were one week difference resulted in 350 F_1 keets. The keets were sexed by visualizing the vent and listening to the cry of the birds. The testicles of a male protrude when viewed via the vent whereas none is found in the vent of the females. More so, the males made "kee ke kee ke" sound whereas the females made "buck-wheat buck-wheat" or "put-rock put-rock" sound. All F_1 male keets hatched were culled leaving only 165 F_1 female keets which were used for the experiment. The keets were brooded for six weeks and subsequently reared until the 28th week when they started laying eggs. At the 28th week, 144 adult females were randomly selected out of the 165 females and wing-banded. The 144 adult females consisted of 48 females of Pearl, Lavender and Black each. Each variety was replicated three times, which gave a total of 9 replicates (B1, B2, B3, P1, P2, P3, L1, L2, and L3) for all the varieties, with 16 females per replicate. The guinea fowl varieties were raised in deep litter pens under natural daylight. Feed and water was provided *ad-libitum*. During the laying phase, layers mash containing 2900 kcal/kgME and 20.5 % CP according to Oguntona (1983) was introduced to the guinea fowl varieties. The nutrient composition of the layers diet is shown in table 1 below:

Table 1: The Nutrient Composition of the Layers Diet

Ingredient	Percent composition
Maize	54.90
Groundnut cake	21.40
Wheat offal	8.60
Fish meal	1.73
Soybean meal	3.4
Limestone	2.40
Bone meal	7.00
Salt	0.50
Vitamin premix*	0.27
Total	100

*Vitamin/mineral premix composition: Vit A – 10,000,000 IU, Vit D3 – 2,200,000 IU, Vit.E – 10,000 mg, Vit.K3 – 2,000 mg Vit.B2 – 5,000 mg, Folic acid – 500 mg, Niacin – 15,000 mg, Calpan – 5,000 mg, Vit.B12 – 1,500 mg, Vit.B1 – 1,500 mg, Vit.B6 – 1,500 mg, Biotin – 20 mg, Antioxidant – 125,000 mg; Selenium – 200 mg, Iodine – 1,000 mg, Iron – 40,000 mg, Cobalt – 200 mg, Manganese – 7,000 mg, Copper – 4,000 mg, Zinc – 50,000 mg, Choline chloride – 150,000 mg. Calculated composition: Ca – 3.50, P – 1.11. Energy level 2900 kcal/g; Protein level (20.5 %CP).

Data Collection and Analysis

Data collection started in April when the birds were at the 28th week of age and lasted for 18 weeks. The following parameters were measured for each variety according to Oke *et al.* (2004) and Obike *et al.* (2011).

Egg Production Parameters

- **Body Weight (BWT):** The initial body weight at the 26th week of age was measured and subsequently, fortnightly, using a 5 kg-top loading scale.
- Body Weight Gain (BWG): This was computed on fortnight basis as follows:

$$\frac{\text{Final weight} - \text{Initial weight}}{14}$$

- **Body Weight at Point of Lay (BWPL):** This was measured as the initial body weight of the birds at the start of the experiment at the 28th week.

- **Body Weight at Final Lay (BWFL):** This was measured as the final body weight of the birds at the end of the experiment at the 46th week.
- **Feed Intake (FI):** This was determined as follows; Total feed given – left over.
- **Feed per Dozen Egg (FDE):** This was determined as follows:

$$FDE = \frac{\text{Quantity of Feed Consumed}}{\text{Dozen of egg laid}}$$

- **Feed Efficiency (FE):** This was determined as follows:

$$\frac{\text{Body weight gain}}{\text{Feed consumed}}$$

- Egg Number (EN): This was determined by counting the fortnight number of eggs from the first week to the last week of experiment.
- Percent Hen-day production (HD%): This was calculated as follows:

$$HD\% = \frac{\text{Number of eggs produced X 100}}{\text{Number of Hendays}}$$

STATISTICAL ANALYSIS

Data collected were subjected to Analysis of Variance (ANOVA) in Completely Randomized Design (CRD) using the general linear model described by Steel and Torrie (1980). The statistical model used is as shown below:

$$Y_{ij} = \varepsilon + P_i + e_{ij}$$

Where Y_{ij} = Individual observation

ε = Overall mean

P_i = Random effect of parameter measured

e_{ij} = Random error, assumed to be identically, independently, normally distributed with zero mean and constant variance.

Significant means were separated using Duncan's Multiple Range Test (Duncan, 1955).

Pearson's correlation test was done for the egg production parameters, internal egg quality parameters, and external egg quality parameters for the three varieties.

A regression equation was derived through regression analysis in order to determine a predictive association between internal egg quality parameters and egg weight, external egg quality parameters and body weight, and egg production parameters and body weight. The regression equation was of the type:

$$Y = a + bX + e.$$

Where,

Y = the dependent variable

a = intercept or constant

b = regression coefficient

X = independent variable (Egg weight, Bodyweight).

The above analyses were done using Statistical Software for Social Scientists (SPSS) (2007).

RESULTS AND DISCUSSION

The results are presented in Tables 2 and 3 below. The daily feed intake (DFI) recorded significant increases ($P<0.05$) in each of the three varieties in the first few weeks. The Black variety particularly showed a declining trend from week 42 till the end of experiment. The initial increase in feed intake may be due to initial physiological adjustments for egg production whereas the stable trends may be because these varieties had adjusted to egg production. The decreasing trend in Black variety however may be associated with factors like low resistance to diseases like coccidiosis (Downes, 1999) and other non-genetic factors (Chineke, 2001). The egg number (EN) of the three varieties showed significant differences ($P<0.05$) across the weeks. The three varieties portrayed an increasing trend in EN that fluctuated. Oke et al. (2004) reported an egg number values that increased and then decreased towards the end of lay in Pearl variety of guinea fowl. While Pearl and Lavender obtained their highest egg number in the last fortnight period of lay (week 46), the Black variety obtained its, on week 34. Adeyinka et al. (2007) have shown that progesterone is positively correlated with egg production ($r= 0.89$) in guinea fowls especially from the month of June to August in the tropics. This corresponded with the period of peak production (July ending) for the Pearl and Lavender varieties in this study. A serious fluctuation occurred in week 38 in the three varieties. Fluctuations probably resulted from variations in nutrient metabolism, due to changing weather condition, and differences in disposition or response of the three varieties to stress from either diseases (Ikani and Darfwang, 2004; Downes, 1999) or their flighty action during feeding. The three varieties showed significant differences ($P<0.05$) in their body weight gain (BWG). The three varieties showed decreasing trend with major fluctuations in Black and Lavender. Ayorinde et al. (1988) reported consistent reduction in body weight which agrees with the report of this study. These researchers attributed this reduction to an increased use of physiological reserves to meet egg production demands. No significant difference ($P>0.05$) however was observed in mean BWG in the three varieties. Percent henday (HDP) varied significantly ($P<0.05$) among the three varieties. The three varieties showed an increasing trend which fluctuated particularly in weeks 38 and 44. The following workers have reported increases in henday percent with age: Gerstmayr and Horst, (1990); Austic and Nesheim, (1990); and Asuquo (1994). The feed efficiency (FE) values in Pearl and Lavender were significantly different (P< 0.05) whereas, no significant difference (P> 0.05) was observed in Black. The Pearl variety maintained a decreasing trend. This might be due to the increasing use of its physiological reserve to meet egg production (Ayorinde et al. (1988) and little or nothing for bodyweight gain. The Lavender variety portrayed a decreasing trend up to week 38 and remained stable thereafter. The decrease may be due to some reasons as noted above for the Pearl. The stable trend however, implies that the Lavender gains and produces in an equal manner. The Black variety showed a nearly stable trend with three outstanding peaks. This observation shows that the Black gained or reduced in weight as much as it increased or reduced egg production. The outstanding peaks in Black were associated with reduced egg numbers. This might be due to non-genetic factors (Chineke, 2001) such as diseases (Downes, 1999) and other environmental factors such as stress from management, and climatic factors which probably affected its metabolism and feed conversion to egg. Significant differences (P<0.05) were observed in feed per dozen egg (FDE) in Pearl and Lavender varieties, whereas, no significant difference (P>0.05) was observed in Black variety. The three varieties showed an initial increasing trend and a terminal decreasing trend. Significant differences (P<0.05) were observed in the body weight (BWT) for Black and Lavender varieties whereas, none was observed in Pearl. The Black and Lavender varieties portrayed a fluctuating trend whereas the Pearl variety maintained stable weight values. Oke et al. (2004) reported an increasing body weight in Pearl for the first six weeks which eventually fluctuated and then remained stable towards the end of lay. The variations in body weight might be due to differences in their ability to utilize and metabolize feed for both maintenance and egg production which are also subject to climatic factors and other non-genetic factors. From Table 3, it was discovered that Pearl and Lavender performed higher than the Black variety in terms of mean Egg number and mean Hen day percent. The duo also recorded higher body weight compared to the Black variety.

Table 2: Periodical Egg Production performance Traits in three Varieties of Helmeted Guinea Fowl.

	Weeks									SEM
	30	32	34	36	38	40	42	44	46	
BWG	4.29^{b}	13.33^{a}	4.29^{b}	4.94^{b}	3.90^{b}	3.06^{b}	3.40^{b}	3.12^{b}	2.64^{b}	0.64
BWG	4.29^{bc}	13.33^{a}	5.08^{bc}	6.49^{b}	1.95^{c}	3.22^{bc}	2.68^{bc}	2.68^{bc}	2.12^{c}	0.75
BWG	4.76^{bcd}	9.88^{a}	6.43^{b}	5.95^{bc}	4.20^{bcde}	3.69^{cde}	3.16^{de}	2.89^{de}	2.09^{e}	0.49
MORT	0.00	12.50	0.00	6.25	0.00	0.00	0.00	0.00	0.00	1.53
MORT	0.00	0.00	6.25	6.25	0.00	0.00	0.00	0.00	0.00	0.96
MORT	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69
EN	102.80^{g}	96.40^{h}	144.45^{a}	141.25^{b}	109.20^{f}	141.25^{b}	119.40^{e}	109.85^{f}	122.90^{d}	3.27
EN	119.60^{g}	155.60^{d}	166.50^{d}	127.33^{f}	120.67^{g}	164.93^{c}	180.53^{b}	139.20^{e}	236.93^{a}	6.86
EN	99.60^{h}	136.05^{g}	151.70^{f}	170.90^{d}	136.10^{g}	177.80^{c}	168.00^{e}	188.05^{b}	236.10^{a}	7.13
DFI	40.42^{c}	66.42^{b}	83.36^{a}	94.10^{a}	94.58^{a}	95.83^{a}	96.25^{a}	88.24^{a}	83.98^{a}	3.72
DFI	63.75^{b}	78.30^{b}	104.12^{a}	108.53^{a}	108.84^{a}	107.10^{a}	102.42^{a}	102.13^{a}	99.91^{a}	3.38
DFI	61.88^{c}	85.52^{b}	100.79^{a}	107.30^{a}	105.28^{a}	107.37^{a}	102.90^{a}	99.44^{a}	100.59^{a}	2.87
BWT	1086.67^{d}	1400.00^{ab}	1206.67^{cd}	1303.33^{bc}	1300.00^{bc}	1283.33^{bc}	1563.33^{a}	1376.67^{bc}	1360.00^{bc}	28.84
BWT	1263.33^{d}	1616.67^{a}	1416.67^{bcd}	1566.67^{ab}	1340.00^{cd}	1473.33^{abc}	1466.67^{abc}	1489.33^{abc}	1470.00^{abc}	24.80
BWT	1226.67	1436.67	1430.00	1493.33	1453.33	1470.00	1470.00	1483.33	1423.33	28.68
HDP	15.30^{d}	16.39^{d}	24.57^{a}	25.87^{a}	20.00^{c}	25.44^{a}	21.87^{b}	20.12^{c}	22.51^{b}	0.72
HDP	17.80^{g}	23.15^{de}	26.43^{c}	21.65^{ef}	20.52^{f}	28.05^{c}	30.70^{b}	23.67^{d}	40.29^{a}	1.25
HDP	14.82^{f}	21.60^{e}	24.08^{d}	27.13^{c}	21.60^{e}	28.22^{bc}	26.67^{c}	29.85^{b}	37.48^{a}	1.18
FE	10.75	19.67	5.45	5.29	4.13	3.28	17.45	3.62	3.27	1.80
FE	7.26^{b}	17.23^{a}	4.85^{bc}	5.99^{bc}	1.79^{c}	3.02^{c}	2.61^{c}	2.64^{c}	2.14^{c}	0.97
FE	7.73^{b}	11.88^{a}	6.41^{bc}	5.54^{bcd}	4.00^{cde}	3.44^{cde}	3.08^{de}	2.92^{de}	2.10^{e}	0.63
FDE	3169.34	5266.38	4077.66	4432.21	5993.98	4652.39	4557.82	5304.83	4620.15	393.34
FDE	4306.47^{ac}	4053.48^{bc}	4717.16^{ac}	6013.16^{ab}	6350.33^{a}	4577.41^{abc}	3968.10^{bc}	5133.35^{ab}	2932.20^{c}	264.75
FDE	5016.38^{ab}	4750.01^{ab}	5015.98^{ab}	4746.30^{ab}	5860.14^{a}	4564.06^{b}	4625.29^{b}	3981.30^{bc}	3214.71^{c}	188.52

Values with different superscripts across rows are significantly different at p< 0.05 for the weeks. Means with different superscripts along the mean columns are significantly different at p< 0.05. BWG-Bodyweight gain, MORT- Mortality percent, EN- Egg number, DFI- Daily feed intake, BWT- Average Bodyweight, HDP- Henday percent, FE- Feed efficiency, FDE- Feed per dozen eggs, Blk- Black, Lav- Lavender, Prl- Pearl

Table 3: Mean Egg Production performance Traits in three Varieties of Helmeted Guinea Fowl

Parameter	Black	Lavender	Pearl	SEM
Body weight gain (g)	4.78	4.65	4.78	0.31
Mortality (%)	2.08	1.39	0.69	1.13
Egg number	120.57[b]	156.81[a]	162.70[a]	3.76
Daily Feed Intake (g)	79.60[b]	97.23[a]	96.79[a]	2.61
Body weight (g)	1320.00[b]	1455.85[a]	1431.85[a]	22.57
Initial laying weight (kg)	1.11[b]	1.36[a]	1.34[a]	0.03
Final laying weight (kg)	1.36[b]	1.47[a]	1.42[ab]	0.02
Hen day percent (%)	21.34[b]	25.81[a]	25.72[a]	0.60
Feed efficiency (%)	8.10	5.28	5.23	0.99
Feed per dozen egg (g)	4652.75	4672.41	4641.57	278.51

Means with different superscripts are significantly different at $p<0.05$; SEM = Standard Error of the Mean.

CONCLUSION

Body weight gain and mortality percent portrayed a decreasing trend as egg number increased whereas, the daily feed intake, percent henday, and feed per dozen eggs tended to increase with an increase in egg number. A lot of factors probably interplayed in such manner that they affected the egg production performance of each guinea fowl variety. These factors include from seasonal fluctuations, climatic fluctuations and variations in intensities, physiological factors such as varying progesterone levels, genetic factors, the feral nature of guinea fowls and environmental factors such as varying nutrient metabolism and resistance to diseases. The three varieties showed some similarities in the trend produced for some parameters but also demonstrated differences in such traits like feed efficiency, feed per dozen egg and body weight. These differences in phenotypic performance may suggest some level of genetic differences in these varieties. It is therefore recommended that further research be carried out on the genetic characteristics of helmeted guinea fowl varieties.

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