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RESEARCH ARTICLE

Effect of Production System on Growth Performance of Indigenous Guinea Fowls (*Numida meleagris galeata Pallas*)

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ABSTRACT:

In a study to determine the effect of production systems on performance of guinea fowls, birds were raised either on the deep litter or in battery cages. Each group comprised of 200 unsexed keets kept at a stocking density of 0.06m^2/bird and were observed from 4 weeks up to 20 weeks of age. The birds were fed ad libitum and necessary vaccinations were given. Data obtained on feed intake, weight gain, feed conversion ratio and mortality were compared using the unpaired t-test. Production system had significant influence (P<0.05) on body weight at week 20, total feed intake, total weight gain and feed conversion ratio. Birds raised in cages had better weight gain (773.5 and 651.0g for cage and deep litter respectively). While feed intake was higher for birds raised on the deep litter (5602.33 and 5118.60g for litter and cage, respectively), feed conversion ratio was better with birds raised in cages (6.62 and 8.61). Mortality was similar for birds raised under both systems. It was concluded that better body weight can be achieved by raising guinea fowls in cages.

Keywords: ***Cages, Deep litter, Feed intake, Keets, Weight gain***.

INTRODUCTION

In Nigeria, guinea fowl is an important though under-utilized resource second only to the domestic fowl in terms of population and supplier of poultry meat and egg. Domestic chicken population has been estimated to be 166 million (FAOSTAT, 2007) while 54.7million (Biu *et al*., 2012) guinea fowls are said to exist in Nigeria. The meat from guinea fowl is quite nutritive and the carcass fat and cholesterol levels are lower than in chickens. It is higher in protein, minerals and some vitamins, tastier than other poultry meat and has wider acceptability on account of its gamey taste and dark colour (Ayorinde, 1989, 1991a, b, 1996). Guinea fowl egg has a thicker and denser shell which gives it longer shelf-life than eggs of other avian species and reduces losses during transportation (Ayorinde and Okaeme, 1984). However, the contribution of guinea fowl to the national animal protein supply is hampered by a number of factors which include seasonality in breeding, low fertility and poor hatchability, among others.

Guinea fowls have been reported to be slow growing and adult body size of the wild adult guinea fowl averages 980g (Ayorinde and Okaeme, 1984) while body weights of 1000g – 1500g and 1000 –

1270g have been reported on the free range and the semi intensive systems respectively (Ayorinde, 1999). The slow growth has been partly attributed to the small hatch weight by Ayorinde (1987). In the wild, the hens do not come into lay until 36 – 48 weeks of age with each hen laying only 12 – 20 eggs per breeding season (Ayorinde *et al*., 1984) and each egg weighing 37 to 40g (Poultry Hub, 2012) after which they go broody.

The environments to which birds are exposed including the housing system, feed, climatic factors and management systems are reported to affect their performance (Abeke *et al*., 1998; Isiaka, 1998). Guinea fowl have been successfully raised under both the intensive and semi-intensive management systems (Ayorinde and Ayeni, 1986; Ayorinde, 1990) as well on extensive system but with lower performance. Ayorinde and Ayeni (1987) reported that though rearing system did not significantly affect body weight in the first six weeks of life, birds in battery cages had significantly higher body weight gain from the sixth week. Cage rearing of growers resulted in better weight gain, efficiency of feed utilization, lower mortality and higher carcass yields (Ayorinde, 1999). The intensive system of guinea fowl production is not a common practice in Africa except for research purposes, but it is mainly practiced in developed countries where specialized breeds have been developed and the production is commercialized (Robinson, 2000; Embury, 2001).

While growth and performance differ under varying systems of production, the actual causes and level of differences have not been well documented. If it is possible to clearly understand these differences, then they can be applied in production steps to bring about increased performance. This study was therefore designed to systematically elucidate the differences in the growth performance of cage and deep litter raised guinea fowls.

MATERIALS AND METHODS

A total of 1,832 guinea fowl eggs were purchased from guinea fowl keepers in Kebbi and Niger States over a period of seven days in the month of August. The collected eggs were cleaned and stored in a well ventilated room at room temperature in flat trays until required for incubation.

Eggs collected were set in an automatic incubator in the Department of Animal Production, University of Ilorin, at a temperature of 37.7^{o}C and relative humidity of 55 -60% for the first 23days, and thereafter transferred into the hatcher at a temperature of 36.5^{o}C and 98% relative humidity. The eggs were candled at days 10 and 20 of incubation to determine fertility and viability respectively. The keets hatched between days 27 and 30 of incubation and the following were determined from the incubation records:

$$\text{Percent Fertility} = \frac{\text{Number of fertile eggs}}{\text{Total eggs set}} \times 100$$

$$\text{Percent hatchability of fertile eggs} = \frac{\text{Number of hatched chicks}}{\text{Number of fertile eggs}} \times 100$$

$$\text{Percent hatchability of total eggs set} = \frac{\text{Number of hatched chicks}}{\text{Number of total eggs set}} \times 100$$

On hatching, the keets were weighed and transferred to the electrically heated

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brooding house. The keets were brooded on deep litter for four weeks, after which they were divided into two groups. A group was transferred into battery cages allowing space of 0.06m^2/bird and the second group was maintained on deep litter with a floor space of 0.06m^2/bird (15birds per m^2). The birds were fed a formulated starter diet (Table1) containing 26% crude protein and 3000 kcal/kg metabolizable energy till 8 weeks of age. Vaccines administered include Infectious Bursa Disease vaccine at 10 and 24 days, LaSota at 28days, Komorov at 16 weeks and Fowl pox at 18 weeks. Coccidiostat was given for five consecutive days at 4 weeks of age and the birds dewormed at 8 weeks.

The growers (8-20 weeks) were reared on the deep litter and in cages respectively depending on the production type. At 8 weeks of age, a grower's diet containing 20% crude protein and 2800kcal/kg metabolizable energy (Table 1) was fed till 20 weeks of age.

Parameters obtained include the body weight of each bird measured fortnightly in grams from day old using a top loading weighing scale. Feed intake was obtained by weighing feeds into individually labeled bags at the onset of the week for the different groups of birds and the left over was weighed and subtracted from the feed weighed. Efficiency of feed utilization was calculated as ratio of weight gained over a period of time to feed intake over same period.

$$\text{Feed Conversion Ratio} = \frac{\text{Feed intake over a period}}{\text{Weight gained over same period}}$$

Fortnight mean values of each parameter obtained from the deep litter and battery cage groups were compared using the unpaired t-test. Data collected were analyzed using the SPSS Version 21 (SPSS IBM).

RESULTS AND DISCUSSION

Eggs collected from the guinea fowl keepers in the Nigerian Guinea savanna in late August 2008 were incubated to get the foundation stock used for the experiment. The mean weight of egg set was 36.14g with a range of 29.78g to 38.62g. Fertility rate of eggs set was 58.55% (Table 2) with overall hatchability of 27.96%. A total of 489 keets hatched and hatch weight ranged between 20.26g and 24.45g representing 56.06 – 67.65 % of egg weight.

The growth patterns of birds kept under different production systems between 4 and 20 weeks of age are as shown in Figure 1. Birds kept in cages consistently had higher body weights than those kept on the deep litter from weeks 8 to 20. Mean body weight is similar ($P>0.05$) at age 6 weeks (171.75g and 177.26g for cage and litter, respectively), but at 12 weeks, birds kept in cages had higher ($P<0.01$) mean body weight (425.33 ± 24.81g) compared with those on deep litter (407.40 ± 3.09g). However, at other ages body weights were not significantly different ($P>0.05$). Growth rate was fairly constant for birds raised in cages (66.60% for weeks 4 to 8 and 66.70% for weeks 8 to 20), while those raised on deep litter had better growth rate after the 8th week (51.19% for weeks 4 to 8 and 69.11% for 8 to 20).

At week 4, body weight was higher ($P<0.05$) in birds on the deep litter, but by week 8, birds in the cage had higher ($P<0.05$) body weight and this was maintained till week 20. Weight gain

significantly differed (P<0.05) between the two production systems with birds raised in cages weighing 104g more than birds on the deep litter at 20 weeks. For both groups, highest weight change was recorded between 12 and 20 weeks. Rate of weight gain, slowed down as the birds matured (Table 3).

Total feed intake differed significantly (P<0.05) in the two systems (Table 3). Birds raised in cages consumed 5,118.60g while birds on the litter consumed 5,602.33g. Feed conversion ratio was better (P<0.05) with birds raised in cages.

Mortality was similar (P>0.05) for both production systems (Table 3). Cumulative mortality was slightly higher in the birds raised in cages than on the litter. The highest frequency of mortality occurred before the birds were 12 weeks old in both groups although mortality continued till 20 weeks of age for birds raised on the litter.

Correlations between the performance parameters are shown in Table 4. There were no significant (P>0.05) correlations between body weight at week 4 (BW at 4 weeks) and the other performance parameters observed for both production systems. Birds raised on deep litter had body weight at week 4 negatively correlated with body weight at week 20, feed intake, total weight gain and feed conversion ratio. Birds raised in cages had high and positive correlation between body weight at week 4 and body weight at week 20 as well as total weight gain. There was negative correlation between body weight at week 4, feed intake and feed conversion ratio.

Guinea fowls are generally reported to be poor breeders with low fertility and hatchability. The low percent hatchability obtained in this study from the purchased eggs can probably be attributed to either long storage or poor handling before purchase since they were bought from the open market. It could also be attributed to the likelihood of the eggs having been laid by unmated hens. Nwagu (1997) had earlier reported that a wide range of environmental factors that include mating ratio, nutritional deficiencies, poor handling and storage conditions affect fertility and hatchability of guinea fowl eggs. It has also been reported that storing eggs for more than four to seven days results in poor hatchability (Ayorinde, 1987). However the percent hatchability (27%) obtained in this study was higher than the 5–20% (Ayorinde and Ayeni, 1987) reported for eggs collected from the wild, and open market.

Body weights of the birds in both production systems increased with age but did not significantly differ till after 12 weeks when better weight gain was observed for birds kept in cages. This is consistent with the findings of Ayorinde and Ayeni (1987) who reported better weight gain in birds reared in cages as from week 6. This is believed to arise because birds kept in cages are limited by space, and do not expend much energy in moving about and flying as birds on the litter do; this therefore increases the body weight and energy consumed is therefore laid down. However, in Botswana, no significant difference in live weights of guinea fowls at the same stage of growth when raised on concrete and earth floors was reported (Nsoso *et al*., 2003). Body weights obtained in this study were found to be similar to 819.20 ± 149.40 and 790.18 ± 185.65 reported for 20-weeks old indigenous birds raised in battery cages and deep litter (Ayorinde and Ayeni, 1987)

but lower than 1.11kg and 1.29kg reported (Nsoso *et al*., 2006) at 12 weeks for improved guinea fowls raised on concrete and earth floors respectively. Thus the findings in this study support previous studies that production system significantly affects body weight of guinea fowls. The growth pattern in the two production systems follows the typical pattern in most animals.

Feed intake was higher in birds kept on litter; however, birds raised in the cages had better feed efficiency. It has been reported that high feed wastage is peculiar to guinea fowls as they scoop feed with their beaks (Ayorinde and Ayeni, 1987). Alternatively, higher feed intake on litter may reflect greater energy demand for increased locomotion relative to cages. Though higher feed intake was recorded for birds raised on the litter, much of it was likely wasted as the birds had room to run around and pour out the feed from the trough. Birds in cages on the other hand, are restricted and thus able to efficiently use consumed feed. It might also mean that differences exist in the nutritional requirement of birds according to system of production. Feed intake obtained in this study is similar to those in previous works (Ayorinde *et al*., 1988; Sekeroglu *et al*., 2010; Gerzilov *et al*., 2012; Pourouchottame *et al*., 2012) that reported that feed intake is lower in birds kept in conventional cages compared with other housing systems. However, there is contrary report that birds kept in cages had higher feed intake than birds on the litter (Banga-Mboko *et al*., 2010).

Feed efficiency has been reported to be better in cages than in deep litter (Farooq *et al*., 2002) as was recorded in the present study, as the birds expended the nutrients for body building and not on movement and or flight as is common on the deep litter. Feed efficiency was observed to decline as birds got older. The decline in feed efficiency with age can be attributed to the increased feed intake and declining rate of weight gain. Since birds in cages had higher weight gain and lower feed intake, feed efficiency was better. Fast growth rate is required to efficiently utilize feed, and it has been observed that the first 6 weeks signify the period of rapid weight gain after which the rate slowed down, thus the poor feed utilization.

Mortality has been reported to be higher in guinea keets between weeks 0 and 6 (Hien, 1999; Ayorinde, 2004; Ahaotu *et al*., 2013). Most of the mortality that occurred in the cage was as a result of the birds getting stuck in the net of the cages while on the litter was mostly due to smothering when the birds were frightened. However, at older ages, mortality was relatively low, an indication of the hardy nature of the birds.

CONCLUSION

From the results in this study, it is advisable to raise guinea fowls in cages due to the resultant higher body weight gain compared with those raised on deep litter.

CONTRIBUTION OF AUTHORS

AOI and AKL were responsible for the design and supervision of the experiment, write up, managed the literature searches and collected the data. TAA was responsible for the analysis of the data. AOI wrote the first and final write up for this article. All authors read and approved the final manuscript.

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Table 1: Composition of Diets Fed to the Experimental Birds

Ingredients%	Starter (0 – 8 weeks)	Growers (8 – 20 weeks)
Maize	48.00	48.00
Groundnut cake	19.70	4.00
Corn bran	2.30	17.00
Wheat offal	4.50	5.00
Blood meal	2.70	-
Palm kernel cake	2.40	2.50
Soybean cake	15.20	15.00
Fish meal	3.70	7.00
Limestone	0.50	0.50
Bone meal	0.30	0.30
Salt	0.25	0.25
Methionine	0.10	0.10
Lysine	0.10	0.10
Premix*	0.25	0.25
Total	**100**	**100**
Calculated Analysis		
Protein %	26.02	20.09
Energy Kcal/kg	3089	2786

**Provide per kg of diet Vit A: 8,000IU, VitD_3: 1,200IU, Vit E: 3IU, VitK_3: 2mg, VitB_2: 8mg, Vit B_3: 10mg, Manganese: 80mg, Zinc: 50mg, Copper: 2mg, Iodine: 1.2mg, Cobalt: 0.2mg, Selenium: 0.1mg.*

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Table 2: Characteristics of Incubated Eggs

Total eggs collected	1,832
Total eggs set in incubator	1,749
Total Fertile eggs	1,024
% fertility	58.55
% hatchability of fertile eggs	47.75
% hatchability of total eggs set	27.96
Average egg weight (g)	36.14
Average chick weight (g)	22.36

Table 3: Effect of Production System on Performance of Guinea Fowls

Trait	Cage	Litter	SEM
Body weight at week 4 (g)	96.50 ± 4.79	115.0 ± 1.16*	4.93
Body weight at week 20 (g)	870.0 ± 14.42*	766.0 ± 7.29	16.16
Total Feed Intake (g)	5118.60 ± 111.13	5602.33 ± 83.49*	139.00
Average daily intake (g)	45.70 ± 0.99	50.02 ± 0.75*	1.24
Total Weight Gain (g)	773.5 ± 10.05*	651.0 ± 7.69	12.65
Average daily gain (g)	6.91 ± 0.09*	5.81 ± 0.07	0.11
Feed Conversion Ratio	6.62 ± 0.22*	8.61 ± 0.09	0.24
Mortality (%)	4.25 ± 4.13	4.00 ± 2.00	4.58

**Means are significantly different, P<0.05*

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Table 4: Effect of Production System on Pearson's Bivariate Correlation between Performance Traits of Guinea Fowls

Trait	BW @ 4weeks	BW @ 20weeks	Feed Intake	TWG	FCR	Mortality (%)
BW @ 4weeks		-.281	-.942	-.417	-.847	.932
BW @ 20weeks	.940		.587	.989	-.272	-.610
Feed Intake	-.995	-.970		.698	.619	-1.000*
TWG	.872	.987	-.918		-.130	-.718
FCR	-.970	-.995	.990	-.965		-.597
Mortality (%)	.056	-.288	.047	-.440	.189	

**Correlation is significant at the 0.05 level (2-tailed)*
***Correlation is significant at the 0.01 level (2-tailed)*
Cage below diagonal, litter above diagonal
BW: Body weight; TWG: Total weight gained; FCR: Feed conversion ratio

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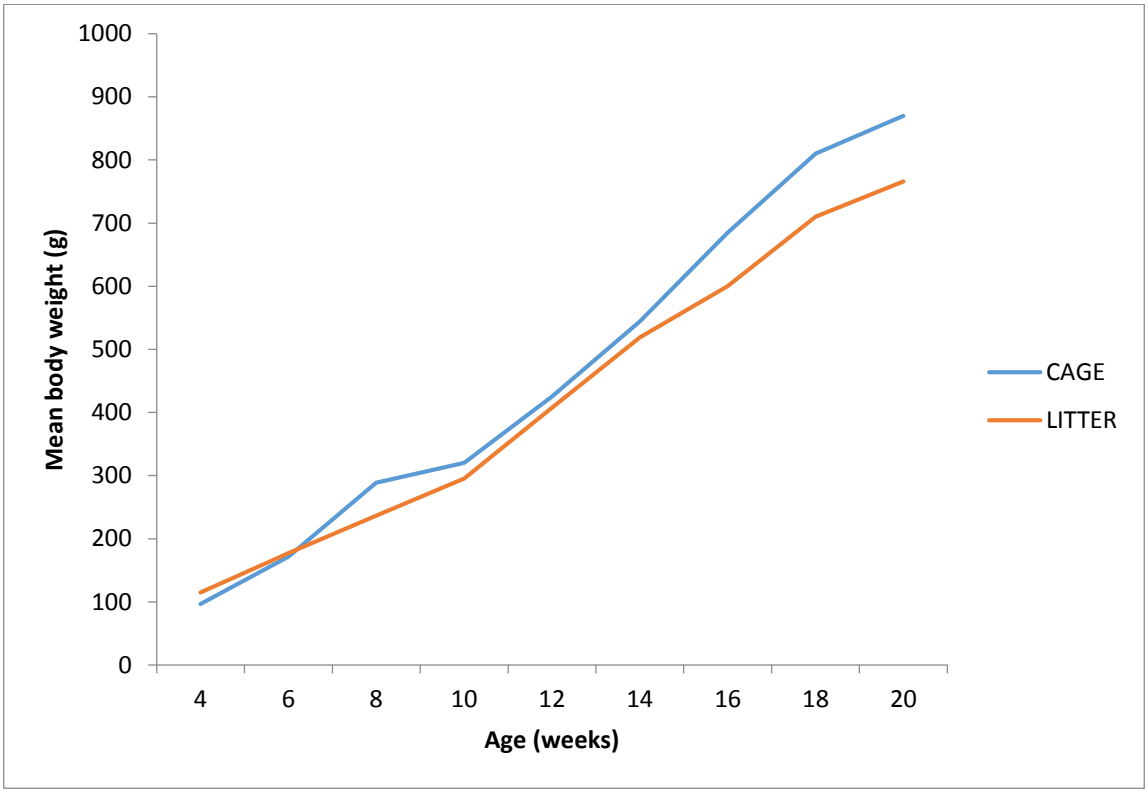


Figure 1: Growth Pattern of Guinea Fowls Raised under Different Production Systems