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Egg Weight, Fertility, Embryonic Mortality, Hatchability and Keets Survival Rate after Brooding of the French Broiler Guinea fowl Raised in the Humid Tropics of Nigeria

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Abstract

This study was carried out to evaluate fertility, embryonic mortality, hatchability and early survival rate the French broiler guinea fowl (FBGF) raised under the Nigerian humid tropics. About 116 hatching eggs of the FBGF were sourced from Songhai Agricultural Research Center in Funtua, Katsina State, Nigeria. The eggs were incubated using an automated incubator. Fertility, Embryonic mortalities, Hatchability and keet survival rate were investigated. The result indicated that fertility was 94.5%, early embryonic mortality, late embryonic mortality and hatchability were 12.2%, 8.6% and 91.4% respectively. Average keet hatch weight was 22 g and keet survival at brooding was 72.1%.

Keywords: Broiler-guinea-fowl; Embryonic-mortality; Fertility; Hatchability; Keet survival rate

Introduction

Meat and meat products are concentrated sources of high quality protein and amino acids that compensate nutrient deficiencies in the staple foods [1]. Intake of quality protein provides good health and strengthens man power needed to alleviate poverty and ensure food security for socio-economically rural households [2]. In the sub-Saharan Africa, there are several species of poultry, they are mainly represented by indigenous chicken (*Gallus gallus domestica*), guinea fowls (*Numuda meleagris*), ducks (*Cairina* Spp.), and turkeys (*Meleagris gallupavo*) [3]. The guinea fowl has the potential to increase meat and egg production at rural levels considering their management systems. It grows, reproduces and performs well in cold and hot climatic conditions [4]. Compared to the chickens, guinea fowls are economically more stable to tropical conditions because of their disease resistance and adaptation to traditional breeding systems [4].

Guinea fowls are valuable source of both meat and eggs. They are a significant source of food for the masses, as well as a source of substantial supplement income and job creation [5]. The birds thrive under all conditions, forages well, requires little attention and has no cultural barriers against the consumption of its products [6]. The guinea fowl has a very beautiful plumage which is used in decorations and the bird has wide acceptance due to its value and table bird with a game type flavor and high meat to bone ratio [7]. They have a higher productive life of 4-5 years which is about twice that of domestic chicken [8]. Tasty meat and can produce a substantial number of eggs [6]. However, the seasonal breeding nature of the bird leads to seasonal supply of its products. Guinea fowls are good watch animals as they have fantastic eye sight, with a harsh alarm cry and shrieks at the slightest provocation [6]. They are useful in controlling insect pests on vegetable crops [6]. Unlike chickens, they do not scratch to get insects out of the soil, so they are less destructive to the garden.

In poultry, efficiency of production and profitability depends largely on traits like fertility, egg number, egg quality traits and hatchability among others [9]. Guinea fowls are valuable sources of both meat and egg. They can also be used to control insect pest on vegetable crops. In parts of Queensland (UK) and Australia, many farmers keep a few guineas to assist with controlling grasshoppers in crops and gardens as well as cattle ticks in and around the cattle yard in addition, the birds do no harm to gardens or crops because; unlike chicken, they do not scratch the ground [6]. They are free from poultry diseases that are worrisome to most poultry farmers and scientists [10]. Also, Moreki [5] and Sayila [11] reported that guinea fowls are tolerant to common poultry diseases (Newcastle disease, Gumboro and Salmonellosis) and require less labour cost [11]. On the contrary, Tye and Gyawn [12] in Ghana noted that although the guinea fowl is reported to be less susceptible to most poultry diseases, colossal losses deprived farmers the full benefit of the guinea fowl. These authors attributed majority of these losses to high keet mortalities, loss of eggs and theft of adult birds. Sayila [11] reported that take-off rate and mortality of the guinea fowls in Botswana was only 3.4% and 3.2% respectively against 10.6% and 6.8% for chickens. This gives the guinea fowl under local conditions a better chance to becoming a favorite in future. Ikani and Dafwang [10] reported that the guinea fowl eggs in Nigeria commanded premium prices because of their gamy flavor and have better storage life than chicken eggs as their shells do not crack easily due to its thickness.

Compared with the backyard chickens, the guinea fowls have low production costs, premium quality meat, greater capacity to utilize green feeds, better ability to scavenge for insects and grains, better ability to protect itself against predators and better resistance to common poultry parasites and diseases (for example, Newcastle disease and fowl pox) [6]. This semi domestic bird, which has been farmed for centuries, retains the characteristics (feather morphology, hardiness and social behavior) of its wild ancestors even when subjected to most modern intensive rearing methods employing battery cages and artificial insemination [6]. These birds have a significant source for food for the masses, a source of substantial

income supplement and employment creation [5]. The bird thrives well under all conditions, forages well and requires little attention [6]. It grows, reproduces and yields in both cool and hot conditions; there are no cultural barriers against consumptions of guinea fowl products. It is also relatively disease free and requires little water or attention and almost as easily raised as chickens, their meat is tasty and they produce substantial number of eggs [5,6].

The guinea fowl has very beautiful plumage and the feathers are used in decorations [7]. Its attractive plumage and value as a game bird with game-type flavor and high meat to bone ratio has ensured its wide acceptance. Its meat is highly priced in Africa and is mainly served in markets [7,13]. The seasonal breeding nature of bird leads to seasonal supply of its products. They have relatively low maintenance lifestyle; they also are used in controlling ticks. Guinea fowls have long been considered as game birds. Compared to chicken, their meat is darker and leaner, rich in vitamins and lower in cholesterol smith [13] reported that farmers keep guinea fowls mainly as source of income as they sell breeding stock and eggs to other farmers and traders. Culled growers are the main class of guinea fowls that is marketed [13]. They have a higher productive life than domestic chicken of 4-5 years; this is about twice that of chicken [8]. This bird can also be kept as a source of food (meat and egg), farmers reported that the manure excreted by guinea fowl was used as a source of organic fertilizer for gardening projects. Similarly, Moreki [5] reported that guinea fowl also commands a premium price. Other advantages of rearing guinea fowl include, low production costs, greater capacity to utilize green feeds, control of ticks and other pests and better ability to protect itself against predators. In addition, guinea fowls and its egg are for scientific research notably in physiology [10]. These advantages make the guinea fowl suitable to the rural areas where commercial chicken production has failed due to high input costs and inadequacies in health management. The efficiency of poultry production and profitability depends largely on traits and hatchability among others [9]. There is paucity of information on the quantitative egg characteristics, fertility, embryonic and keet mortality and hatchability rates of the French broiler guinea fowl in Nigeria. Therefore the objectives of this study were to asses/evaluate the egg weight, fertility, embryonic mortality, hatchability and post brooding keet survival rates of the French broiler guinea fowl reared in the humid tropics of Nigeria.

Materials and Methods

Location of study

The study was conducted at Funtua, Funtua local government area, Kastina, Nigeria State from the month of September to November. Funtua lies geographically on latitude 11°32"N and longitude 7°19"N with an average temperature of 32°C, relative humidity of 44% and annual rainfall of 1024 mm having peak and lowest precipitation in August and January respectively. It has two distinct seasons; the wet (January to September) and dry (October to May).

Experimental design and animal management

The experimental design was a randomized complete block design (RCBD). Hatchable eggs of the French broiler guinea fowl were sourced, incubated and hatched to obtain day old broiler keets of the French broiler guinea fowl. During brooding, the keets were given an anti-stress (Vitalite®) through drinking water. A coccidiostat was administered at in drinking water at 3 weeks of age to control coccidiosis. The keets were fed a commercial broiler starter diet containing 21% and water ad libitum for four weeks. Records of brooding mortality were taken and percentage brooding mortality was calculated.

Experimental procedure

Collection of eggs

About 116 fresh hatchable eggs of the French broiler guinea fowl were collected from Songhai Agricultural Research Center in Funtua, Kastina state, Nigeria. The eggs were selected based on shape, cleanliness and uniformity. They were incubated and hatched using a 2000 capacity XM-18D model automatic electric control incubator.

Incubation

Eggs of the French broiler guinea fowl were stored vertically in clean crates with the small end placed downwards at room temperature for 2 days before incubation. Formaldehyde was used to fumigate the hatchery to prevent bacterial infection prior to incubation. Temperature, relative humidity and ventilation were automatically controlled by the automatic electric control incubator. About 116 eggs of the French broiler guinea fowl strain were placed in a 2000 capacity XM-18D model electric automatic incubator at a temperature of 37.6°C and relative humidity of 65%. The eggs were candled at the 10th day of incubation to check for fertile eggs. Consequently, eggs that showed signs of developing embryos by means of a visible network of blood vessels spreading from the center of the eggs outwards were considered to be fertile and recorded.

Fertility was estimated as: Fertility=Number of fertile eggs/Number of eggs set × 100

Candling was carried out on the 14th day to determine early embryonic mortality. Eggs with developing embryos that had blood ring visible on the inside of the egg shell were considered quitters, they were removed, counted and recorded accordingly. Care was taken not to keep the eggs out of the incubator for more than 20 minutes. Percentage early embryonic mortality was calculated using the no of quitters.

% early embryonic mortality=Number of quitters/Number of fertile eggs × 100

Hatching and hatchery management

On the 26th day of incubation, the eggs were transferred to the Hatcher, they eggs were placed on their sides in the hatching trays to allow them move freely after emerging from the shell at hatching. The hatching temperature was reduced automatically to 37.4°C and the relative humidity was also automatically increased to 75% until hatching. Hatched keets were allowed to remain in the incubator until dried and fluffed up, they were removed from the hatcher and transferred into the brooder house within 24 hours of first hatch. At the end of the hatching period, hatched keets was also recorded.

Late embryonic mortality

Late embryonic mortality was estimated as:

Late embryonic mortality=Number of hatched eggs/Number of fertile eggs × 100.

Hatching mortality

At the end of the incubation, the unhatched eggs were carefully cracked to identify the eggs with dead chicks, number of eggs that piped but died were used to estimate hatching mortality using the formula of hatchability.

Hatchability was estimated by:

Hatching mortality=Dead chicks/number set for hatching × 100.

Brooding of keets

Brooding of day old keets was carried out at the brooder house of the poultry unit of Songhai Agricultural Research Center Funtua, Kastina, Nigeria for four weeks. The brooder house was cleaned and washed thoroughly and disinfected prior to brooding. Wood shavings were used as litter materials at a depth of 2 cm. Bright intensity electric bulbs were used as source of heat and light for the brooding keets. Kerosene stoves and lanterns were used to supply heat and lights respectively during power outage.

Brooding mortality

Brooding mortality was estimated as:

Brooding mortality=Number of dead keets/Number of keets at onset of brooding × 100

Parameters that were measured

Parameters that were measured include; Egg weight, fertility, early and late embryonic mortality, hatchability, hatching mortality, hatched weight and keet survival rate post brooding.

Egg weight

Egg weights were taken using a sensitive weighting scale in grams and recorded.

Fertility

Fertility was estimated as:

Fertility=Number of fertile eggs/Number of eggs set × 100.

Early embryonic mortality

Early embryonic mortality was estimated as:

Early embryonic mortality=Number of quitters/Number of fertile eggs × 100.

Late embryonic mortality

Late embryonic mortality was estimated as:

Late embryonic mortality=Number of hatched eggs/Number of fertile eggs × 100.

Hatchability

Hatchability was estimated as:

Hatchability=Number of eggs hatched/Number of fertile eggs × 100.

Brooding mortality

Brooding mortality was estimated as:

Brooding mortality=Number of eggs dead keets/Number of keets at onset of brooding × 100.

Results

Egg weight, fertility, embryonic mortality, hatching mortality and keet survival rate

Egg weight

The Means, standard deviation and variance of the French broiler guinea fowl are presented on Table 1. The mean egg weight was 40.37 ± 0.32 g which ranged from 36 g to 48 g. The mean egg length was 4.86 ± 0.06 cm which ranged from 4.55 cm to 5.95 cm. The mean egg width was 3.9 ± 0.02 cm which ranged from 3.00 cm to 4.10 cm. The mean egg shell index was 78.94 ± 1.18 which ranged from 7.78 to 86.00.

Fertility

Fertility and hatchability of the French broiler guinea fowl is presented on Table 2. The fertility reported in this study was 97.1% (Table 2).

Hatchability

Artificial incubation was used in hatching the French broiler guinea fowl eggs. Hatchable eggs were sourced from Songhai agricultural research center at Funtua, Kastina State, Nigeria and placed in an XM-18D automatic electric incubator at the hatchery unit. Hatchability in this study was found to be 91.4% (Table 2).

Embryonic mortality

Early and late embryonic mortality are reported in Table 2. Early and late embryonic mortality was 12.6% and 8.7% respectively.

Keet survival

Mortality rates of the French broiler guinea fowl are presented on Table 2. In this study, the keets mortality was reported to be 18.9%.

Parameter	Minimum	Maximum	Mean ± SE	Standard Deviation	Variance
Ewt	20	48	40.37 ± 0.32	3.04	9.24
EI	4.55	5.95	4.86 ± 0.02	0.19	0.03
Ewd	3	4.1	3.9 ± 0.02	0.15	0.02
Si	7.78	86	78.94 ± 1.18	11.28	127.14

Ewt=egg weight; El=egg length; Si=egg shell index; SE=Standard error

Table 1: Mean egg weight and egg linear measurement of the French broiler Guinea Fowl.

Age	Mortality %
Fertility	97.5
Hatchability	91.4
Early embryonic	12.2
Late embryonic	8.6
Hatchability	19.8
Brooding	18.9

Table 2: Fertility, hatchability and mortality of the French Broiler Guinea Fowl.

Discussion

Egg weight

Egg size is usually related with body weight of laying hens. In this study, the egg weight of the French broiler guinea fowl strain ranged from 36 g to 48 g while the mean weight was 40.37 ± 0.32. The value was lower than the mean weight of 55.3 g for French broiler guinea fowl and similar to 40.7 g for domestic polish guinea fowl raised in the temperate region reported similar values of 37.67 ± 0.2 and 37.91 ± 0.39 for pearl and black strains of guinea fowls respectively. Ayorinde et al. [14-16] also reported similar range of between 38 g to 45 g for indigenous guinea fowl in Nigeria. The difference observed in this study may be due to differences in environmental factors such as uncontrolled mating system over time which must have resulted to the loss in hybrid vigor of the French broiler guinea fowl.

Egg length, egg width and egg shell index

Mean egg length value 4.86 ± 0.02 cm was lower than the value (52.3 ± 0.006cm) reported by Eleroglu et al. [17]. Mean egg width value 3.90 ± 0.02cm was lower than 4.49 ± 0.03 cm reported by Eleroglu et al. [17]. The value for egg shape index reported in this study (78.94 ± 1.18) is close to the value reported by Dudusola [18] for guinea fowl in Nigeria. The lower values of 73.7 and 74.4 for French broiler guinea fowl and polish domestic strains guinea fowl which did not differ significantly. The value for egg shape index observed in this study suggests that eggs are less prone to breakage and can make good for hatchability.

Fertility

Fertility and hatchability are major constraints of the French broiler guinea fowl production and appears to be directly related to egg fertile rate. Fertility in naturally mated stock ranges from 49%-58% while using artificial insemination ranged from 70%- 80% [19]. The result is higher than the value (80%) reported by Khairunesa et al. [20] who investigated fertility in naturally mated guinea fowl and also higher than the values reported by Ayorinde et al. [14] who investigated lay characteristics and reproductive performance of four indigenous guinea fowls in Nigeria and found fertility range of 49% to 58% in naturally mated stock. Surai and Wishart [21] also reported lower values. The fertility in this study was high (97.1%), one could infer that the breeding stock from which the eggs were collected had guinea cocks and hens kept together in the ration 1:1.

Embryonic mortality

Early embryonic mortality reported in Table 2 was similar to those reported by Sekeroglu and Duman [22]. Eleroglu et al. [17] also reported similar values for guinea fowls when hatched artificially in Turkey. However, late embryonic mortality was higher than the values reported by Sekeroglu and Duman [22] and Eleroglu et al. [17]. This could be due to fluctuations in incubation temperatures as a result of unstable power supply.

Hatchability

The result was higher than the values (68% and 60%) reported by Khairunesa et al. [20] for scavenging and housed guinea fowls. Galor [19] reported hatchability rates of 70%-75% under artificial incubation. 74.2% hatchability was reported in grey variety of guinea fowl by Bernarki et al. [23]. The high hatchability observed in this study could be as a result of the short egg storage time, care full handling of eggs and accurate incubator conditions maintained during the hatching period as well as the high fertility of the French broiler guinea fowl [24].

Keet survival

Keet survival is essential for a successful guinea fowl production. In this study, the keet mortality was reported to be 18.9%. The result in this study was lower than the report of Nwagu and Alawa [25] who reported mortality rates of 90%. Bessin [26] also reported higher mortality rates of 50%. However, Galor [19] reported keet mortality rates of 3%-5% of domestic guinea fowl. The low keet mortality rate observed in this study could be as a result of proper management practices carried out in this study [27-29].

Conclusion and Recommendations

Conclusion

Based on the results in this study it can be concluded that hatchability and fertility was high and satisfactory, keet mortality was low. Losses in guinea fowl production from incubation to hatching could be attributed to improper handling of guinea fowl eggs before hatching, prolonged storage resulting to poor hatchability and low brooding temperatures resulting to high keet mortalities.

Recommendation

The use of artificial electric regulating incubators and accurate brooding conditions is recommended use in incubation and brooding of the French broiler guinea fowl eggs and keets respectively as this would provide the required hatching conditions maintained for optimum survival of the hatched keets which translates to high brooding survival.

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