

Hatching Characteristics of Local and Exotic (Egg Type) Chickens using a Locally Fabricated Incubator

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Abstract

Fertility and hatchability rates were studied in 10 lines established from three strains of the domestic chickens namely, H and N Brown Nick (strain 1), Black Olympia (strain 2) and Nigerian Local chicken (strain 3). The incubator used for the study was a locally fabricated hand turner with a capacity of 250 eggs. Four of such incubators were used at a time. Strains 1 and 2 had higher hatchability rate of 78.09% and 82.64% respectively compared with strain 3 (64.52%). Generally, fertility rate was high and did not differ significantly ($P > 0.05$) between the strains. Chick's embryo mortality was most critical during the periods of 0-7 days and 18-21 days of incubation. Significant ($P < 0.01$) within strain differences in fertility, hatchability and embryo mortality (0-7 days) was observed in strain 1 and only in hatchability in strain 3. The results indicate that within strain selection, good management of the breeding stocks and proper incubation management will improve on fertility and hatchability in poultry.

Keywords: fertility, hatchability, embryo mortality, strains, lines within strain.

Introduction

Poultry production is globally promoted as one of the quickest source of animal protein because of the high prolificacy and faster growth of the fowl. Unfortunately, in Nigeria, poor fertility and hatchability rates among other factors constitute the major threat to the performance of the industry. Consequently, several researchers have investigated on the factors affecting fertility and hatchability in chicken with the aim of combating them. For example, Avigdor *et al* (1986), Say (1987), Agbakoba and Omeje (1989), and Ishola and Ogundipe (1998) have shown that age of the breeders, plane of nutrition, mating ratio as well as poor level of management of breeders affect fertility in chicken while Obioha *et al* (1986), Omeje *et al* (1991), Benneth (1992), Jayarajan (1992) and Abiola *et al* (2008) reported that storage conditions, strain of the birds, shell quality, season of the year incubation conditions and turning frequency affect hatchability of fertile eggs. The present study was undertaken to compare the fertility, hatchability and embryo mortality of the local with those of the exotic strains using a locally fabricated incubator.

Materials and methods

Three strains namely H and N Brown Nick (strain 1), Black Olympia (strain 2) and Nigerian Local chickens (strain 3) were used for the study. The birds were raised from day old to point of lay on deep litter floors. At three weeks of age, four lines were established from the exotic strains based on plumage colour and body size while two lines were created from the local chicken based on body size only. The H and N Brown Nick pullets were separated into light brown and dark brown in colour while Black Olympia pullets were divided into pure black and golden black colours. Individuals within the four groups were further separated on the basis of body weight into light body weight (LBW) and heavy body weight (HBW). Within a group, individual birds weighing 150g and less were classified as LBW while those weighing more than 170g were classified as HBW. No individual was found to weigh between 150g -170g. Within the local strain, individual birds weighing 70g or less were separated as LBW while those weighing more than 70g as HBW. At point of lay, the birds were fed with a commercial breeder ration which on analysis yielded 17.00% CP and 2640.00 Kcal ME/kg up to 40 weeks of age. 'Vitalyte' a vitamin supplement was administered through drinking water during the laying period. Both feed and water were provided *ad libitum*. At 32 weeks of age, two cocks were used in mating 20 hens from each line in two replicate pens. Eggs were collected twice daily in the morning and evening. Eggs for incubation were selected, marked according to lines, fumigated and set in a locally fabricated hand turner incubator. The incubator was powered by electricity while kerosene lantern could be used if electricity is not available. The capacity of the incubator was 250 eggs. Temperature was regulated by means of a thermostat while relative humidity was achieved by means of water tray in the incubator. Four of such incubators were used at a time and the environmental conditions in the four incubators were kept at the same level during the incubation period. The eggs were turned three times daily as recommended by Ishola and Ogundipe (1998) and Abiola *et al* (2008) to ensure maximum hatchability. The eggs were candled on the 7th and 18th days of incubation for fertility and dead embryo respectively. On the 21st day when the eggs hatched, the hatchability as well as the dead embryos was noted. Four replicate hatch data were obtained. A total of 4000 eggs representing 400 eggs from each line were incubated. The data obtained were analyzed using the following model by Winer (1971)

$$X_{ijk} = U + g_i + L_{ij} + e_{ijk}$$

Where:

- X_{ijk} = the k^{th} observation e.g. hatchability in the j^{th} line ($J = 1, 2, \dots, 10$) within the i^{th} strain ($i = 1, 2, 3$).
 U = the estimate of the overall population mean.
 g_i = Effect of the i^{th} strain on the traits (e.g hatchability)
 L_{ij} = Random variable (e.g hatchability) due to the effect of the j^{th} line within the i^{th} strain.
 e_{ijk} = K^{th} error or offspring effect or individual chick differences

Significant mean values were separated using Duncan Multiple Range test (Duncan, 1955).

Results and Discussion

The summary of the analysis of variance for the traits studied are presented in Table I.

Traits	Mean square				Residual	Error df
	Between strains (2)	Lines within strain 1 (3)	Lines within strain 2 (3)	Lines within strain 3 (1)		
Fertility	10.2	109**	10.6	7.34	3.68	10
Hatchability	443**	179**	11.4	237**	22.0	10
Dead germ 1	39.5	97.3*	45.8	26.8	24.5	10
Dead germ 2	102	10.7	17.2	166	38.8	10
Dead germ 3	18.1	27.4	16.2	13.8	89.8	10

* $P < 0.05$
 ** $P < 0.01$
 DF (Degree of freedom) for sources of variance are written in parentheses.

There were no significant ($P > 0.05$) between strain differences in the fertility rate and number of dead germs at different periods of incubation, however highly significant ($P < 0.01$) between and within strain differences were observed in the hatchability rate.

Traits	Strain 1	Strain 2	Strain 3
Fertility %	92.0 \pm 2.66 ^a	90.9 \pm 1.70 ^a	93.7 \pm 3.82 ^a
Hatchability%	78.1 \pm 4.94 ^b	82.6 \pm 4.71 ^b	64.5 \pm 5.72 ^a
Dead germ 1 (0 – 7 days)%	9.44 \pm 2.80 ^a	6.25 \pm 1.97 ^a	11.3 \pm 1.33 ^a
Dead germ 2 (7-18 days)%	2.00 \pm 1.31 ^a	3.72 \pm 1.95 ^a	4.61 \pm 5.22 ^a
Dead germ 3 (18 – 21 days)%	9.08 \pm 2.88 ^a	7.32 \pm 3.9 ^a	11.0 \pm 1.91 ^a

Note: $a < b (P < 0.01)$

As shown in Table 2, strains 1 and 2 registered higher ($P < 0.01$) hatchability than strain3 thereby reaffirming the assertion of Omeje *et al* (1991) that hatchability was mostly governed by the genetic constitution of the animal, other factors notwithstanding. The lower hatchability rate recorded by the local chicken vis-a- vis the exotic strains may be attributed to the small egg size. It has earlier been established by Asuquo and Okon (1993) that eggs within intermediate and large size ranges hatch better than those within small size range. This calls for an improvement in the body size and egg size of the local chicken in order to improve hatchability. It will be observed from Table 2 that embryo mortality was higher during the first 7 days and last 4 days of incubation. This could be attributed to slightly lower and higher incubation temperature and high humidity condition. It may also be a sign of insufficient turning of eggs or nutrient deficiency in the parent birds or as a result of lethal genes (Aremu 1999).

Table 3 presents clearly the lines within strain differences for fertility, hatchability and dead germ traits.

Traits	Lines	1			2			3			
		1	2	3	4	5	6	7	8	9	10
Fertility %		84.5 ^a	87.3 ^a	96.4 ^b	100 ^b	90.4 ^a	87.9 ^a	92.5 ^a	92.9 ^a	92.3 ^c	95.0 ^c
		(4.46)	(1.59)	(3.58)	(0)	(2.92)	(2.15)	(0.15)	(7.17)	(7.71)	(5.01)
Hatchability %		77.1 ^{ab}	73.6 ^a	91.6 ^b	70.1 ^a	85.7 ^a	83.3 ^a	81.2 ^a	80.4 ^a	56.8 ^a	72.2 ^b
		(10.5)	(15.3)	(0.70)	(8.55)	(14.3)	(16.7)	(9.77)	(5.37)	(6.84)	(5.57)
Dead germ 1 %		14.6 ^b	8.34 ^b	0.00 ^a	14.8 ^b	6.79 ^a	5.56 ^a	8.12 ^a	8.31 ^a	8.71 ^c	9.89 ^c
		(2.09)	(3.71)	(0.00)	(0.55)	(3.20)	(1.20)	(3.06)	(3.06)	(2.90)	(4.17)

a, b, c, means for lines within each strain are significantly ($P < 0.01$) different
 Standard errors are in parentheses

In strain 1, the light body weight groups (lines 3 and 4) recorded higher fertility compared with the heavy body weight class (lines 1 and 2). This may suggest that the cocks used for mating the LBW hens were more virile in terms of better semen quality and frequency of mating compared with the HBW cocks. Birds belonging to line 3 recorded the highest hatchability while those of lines 1 and 4 had the highest number of early embryonic death. Also in strain 3, the HBW group (line 10) had better hatchability compared with the LBW category (line 9). The observed differences between the lines in these traits may be attributed to genetic differentiation occurring within strain and the ability of some of these lines to withstand environmental factors affecting incubation than others. (Omeje *et al* 1991).

Conclusion and Recommendation

Whereas the three strains recorded high fertility rate, the exotic strains had better hatchability than the local chicken. It is recommended that the hatchability of the local chicken could be improved either by within strain selection or cross breeding with improved exotic strains.

Since fertility and hatchability rates varies both between and within strains, it is recommended that selection within strain, good management of breeding stocks as well as proper incubation management will improve these traits in poultry. Finally, the use of highly efficient locally fabricated incubator is recommended for our small scale poultry farmers. This will help in increasing the quantity of poultry meat and eggs available for our rural people.

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