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Effect of genotype and season on fertility and hatchability of Nigerian Indigenous and Exotic chickens

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Target Audience: *Breeders, Poultry Farmers, Students*

Abstract

A total number of 35 Nigerian indigenous and 8 marshal chickens, 4 sires and 39 dam were used separately according to genotype. Normal-feather had 1 Sire and 14 Dams, Frizzle-feather had 1 Sire and 8 Dams, Naked-neck had 1 Sire and 10 Dams, while Marshal had 1 sire and 7 Dams. Feeding was ad-libitum. Each bird was individually kept in cages and with numbered wing band. Semen was collected thrice weekly. 0.1ml of fresh undiluted semen was inseminated into the left oviduct of individual dam. 8528 eggs were set in an incubator, 3286 eggs for Normal-feathered, 796 eggs for frizzle-feathered, 2928 eggs for Naked-neck while 1518 for Marshal dams. Normal-feathered was affected by ($P<0.001$) genotype but naked-neck, frizzle-feathered and marshal had no significant ($P>0.05$) effect. There was significant ($P<0.05$) differences in season on fertility and hatchability, early wet had the highest hatchability, followed by late wet and late dry, in fertility late wet had the highest value (78.96±24.54), followed by early wet (76.09±2.49) and the least was recorded in late dry (31.44±30.48). The interactive effect of genotype and season were significantly ($P<0.001$) different. Genotypes also was affected significantly ($P<0.01$) affected in fertility and hatchability. It is concluded that Naked-neck genotype is more desirable in improving fertility and hatchability in the production of day-old chicks and they exhibited better adaptability to humid tropical environment than exotic chickens and Seasonal variations on reproductive performance of Nigerian indigenous and the exotic chickens should be studied for a longer period.

Key words: *Indigenous chickens; Exotic chickens; Genotype; Hatchability*

Description of Problem

The evolution of poultry production has resulted in broiler with high efficiency in converting different types of feed into animal protein. Chickens are largely dominated flocks composition and make up about 98 percent (7) of the total poultry numbers or species kept in Africa. Indigenous chickens in Africa are in general hardy, adaptive to rural environments, survive on little or no inputs and adjust to fluctuations in feed availability. They are known to possess qualities such as the ability to brood, and scavenge for their food. They do not have big body weight and so they can easily escape predators (1).

Poultry production is one area of animal production with a significant contribution to human food production, (6). Their products are preferred by the majority of people in Nigeria because of the pigmentation, leanness, taste and the suitability of various species of poultry (8,9).

The taste of the meat and egg of indigenous chickens is more preferred to that of the exotic chickens, (11). The occurrence of major genes of feather type (frizzle-feathered) feather distribution (naked-neck) dwarf conditions and modifier effects in the

Nigerian local chickens had also been reported (12).

It is generally accepted that, although hens and cocks are considered to be equal partners in the outcome of mating, cock reproductive performance has a major impact on the reproductive efficiency of poultry operations (2,1,15). Semen from a high performing cock, with a relatively quick reaction time (11) and ejaculation rate (4) can be used to inseminate a greater number of hens per unit time, compared to semen from very low performing cocks (12,13,10). Reports on the effects of major genes on the fertility and hatchability of Nigerian indigenous chickens diverse from one another (5). A previous study by (16) reported that hatchability of Naked-neck and Normal-feathered chickens did not really differ. Similar observations were made by (2) in Bangladesh.

It has been observed that the Naked-neck chicken had a better hatchability (93.1%) than that of the Normal-feathered chicken (45%). On the other hand, (3) also studied the effect of crossbreeding on fertility, hatchability and embryonic mortality of Nigerian indigenous and exotic chickens found out that Naked-neck chickens had lower hatchability compared to that of the Normal-feathered chickens. They also found out that the Naked-neck chickens had the highest dead in shell embryos than the Normal-feathered chickens, consequently, 20-45% of chickens' eggs fail to hatch.

Season is a specific period(s) set aside for certain schedules in the year, resulting from the earth's changing position with regards to the sun (3). Seasons observed in the South-western Nigeria are firstly the long rainy season which starts in March and lasts to the end of July, secondly the short dry season which is experienced in August for 3-4 weeks.

Materials and Methods

Experimental site

The research was carried out at the Poultry Breeding Unit of the Directorate of University farms (DUFARMS), Federal University of Agriculture Abeokuta. The area lies in the South-Western region of Nigeria between Oyo and Lagos states in Nigeria and it has a prevailing tropical climate with a mean annual rainfall of about 1037mm. the main temperature ranges from 28^{o}C in December to 36^{o}C in February with a yearly average of 34%. Relative Humidity ranges from 60% in January to 94% in August with a yearly average of about 82% (Ikeobi *et al.* 1996).

Experimental birds and their management

Experimental chickens for this study comprised of Marshal and Nigerian indigenous genotypes namely Normal-feathered, Naked-neck and Frizzle-feathered. The chickens were fed *ad libitum* with a breeder's ration that contained 16% crude protein, 2,616.0 kcal/kg metabolizable energy, 2.5% calcium and 0.45% available phosphorous. The birds also had free access to water. Each bird was individually kept in cages and was identified with a numbered wing band. The sire and dam of each genotype were mated using artificial insemination to produce hatchable eggs. The sires were trained for semen collection for 2 weeks. Semen collection was achieved by abdominal massage technique as described by Lake (1962). Data on genotype, fertility and hatchability of Nigerian indigenous and exotic chickens were subjected to two-way analysis of variance (ANOVA) by Duncan Multiple Range Test using (14).

Model

$Y_{ijk} = \mu + G_i + S_j + (GS)_{ij} + e_{ijk}$

Where

Y_{ij} = the parameters of interest

μ = overall mean of the parameters of interest
G_i = effect of i^{th} genotype (i = 1,2,3,4)
S_j = effect of j^{th} season (j = 1,2,3,4)
$(GS)_{ij}$ = effect of the interaction of genotype and season
e_{ijk} = random residual error normally distributed with zero mean variance $\delta^2 e$
Significance was accepted at 0.5% level of probability (14).

Results and Discussion

Result in Table 1 showed that genotype had significant ($P < 0.05$) effects on fertility and hatchability. The least squares mean revealed that there was no significant ($P>0.05$) difference in fertility of Naked neck, Frizzle feather and Marshal Genotypes. They had the mean values of 68.04 ± 8.01%, 63.26 ± 18.93% and 62.91 ± 20.38% respectively. Genotype significantly ($P<0.05$) affected hatchability. The highest hatchability mean was obtained from the Normal feathered (59.44 ± 21.07%) while Frizzle feathered had the least hatchability of 17.73 ± 12.81%. This result is in line with (5). However, (12) reported the highest fertility in eggs sired by Normal feathered chickens, but in this study, the report of (13) was contrary to this present study, because of the management practice and certain inherited genes from their ancestors.

Table 1: Mean ± SD of the effect of genotype on fertility and hatchability

Genotype	No set	Fertility (%)	Hatchability (%)
Normal feather	3286	31.14 ± 22.39^b	59.45 ± 21.07^a
Naked neck	2928	68.04 ± 8.01^a	57.31 ± 13.61^a
Frizzle feather	796	63.26 ± 18.93^a	17.73 ± 12.81^b
Marshal	1518	62.91 ± 20.38^a	27.58 ± 21.32^b

abc=Means with different superscripts within the same column differ significantly ($P<0.05$).

Table 2: Mean ± SD of the effect of season on fertility and hatchability

Season	No set	Fertility (%)	Hatchability (%)
Early wet	505	53.73 ± 1.51^b	82.79 ± 3.31^a
Late wet	2576	64.96 ± 28.24^a	66.69 ± 24.88^b
Early dry	2837	53.30 ± 20.07^b	66.80 ± 24.05^b
Late dry	2610	48.51 ± 19.89^c	63.84 ± 24.57^b

abc=Means with the same superscripts within the same column are not significantly different ($P<0.05$).

The least squares means of the effect of season on fertility and hatchability revealed significant ($P<0.05$) differences for the parameters measured as shown in Table 2. Early wet had the highest hatchability (82.79 ± 3.31%), followed by late wet (66.69 ± 24.05%) and late dry (63.84 ± 24.57%), in fertility late wet had the highest mean value of (64.96 ± 28.24%), followed by early wet (53.73 ± 1.51%) and early dry (53.30 ± 20.07%), the least fertility mean value was recorded in late dry (48.51 ± 19.89%). This implies that the significant interactive effect of genotype and season on fertility suggests that the differences are not strictly genetic. It was also observed that among the local chicken genotypes, Normal feathered had the least percentage fertility and had high fertility percentage.

Table 3: Mean ± SD of the interaction effect of genotype and season on fertility and hatchability

Season	Genotype	No set	Fertility (%)	Hatchability (%)
Early wet	Normal feather	273	76.97	75.19
	Naked neck	210	76.09 ± 2.49^{b}	77.64 ± 6.93^{b}
	Frizzle feather	22	72.50 ± 3.54^{b}	81.75 ± 5.61^{a}
Late wet	Normal feather	770	46.96 ± 40.64^{c}	70.96 ± 15.59^{b}
	Naked neck	1235	74.80 ± 6.67^{b}	68.00 ± 9.55^{b}
	Frizzle feather	134	78.96 ± 24.54^{b}	64.49 ± 30.26^{b}
	Marshal	437	58.44 ± 41.13^{c}	65.09 ± 44.11^{b}
Early dry	Normal feather	944	12.26 ± 24.40^{c}	37.91 ± 34.68^{c}
	Naked neck	815	72.66 ± 9.32^{b}	62.19 ± 20.69^{b}
	Frizzle feather	407	77.05 ± 17.15^{a}	86.55 ± 10.58^{a}
	Marshal	671	67.72 ± 29.40^{b}	78.09 ±30.26^{a}
Late dry	Normal feather	1299	39.74 ± 24.52^{b}	62.54 ± 34.01^{b}
	Naked neck	668	61.74 ± 13.56^{b}	64.27 ± 17.28^{b}
	Frizzle feather	233	31.44 ± 30.48^{c}	49.12 ± 36.79^{c}
	Marshal	410	68.96 ± 10.98^{b}	84.19 ± 10.22^{a}

abc=Means with different superscripts within the same column differ significantly ($P<0.05$).
The results in Table 3 reveals that interaction effect of genotype and season in various seasons in the year was significant ($P<0.05$). In early wet frizzle feathered genotype had (72.5%)

In early wet, Naked neck genotypes had fertility 76.09% and hatchability of 77.64% and they were significant ($P<0.05$) in both fertility and hatchability but their hatchability had higher percentage than the fertility. Followed by frizzle feathered genotype this had fertility (72.50%) and hatchability of (81.75%) both in early wet. In late wet, Naked neck genotype had fertility (74.80%) and hatchability (68.00%) followed by frizzle feather fertility (78.96%) and hatchability (64.49%) were significant ($P<0.05$) but their hatchability had higher percentage than the fertility. In early dry, frizzle feather genotype had fertility (77.05%) and hatchability (86.55%) followed by marshal (67.72%) in fertility and hatchability of (78.09%) and the least recorded was in normal feather fertility (12.26%) and hatchability (37.91%). This is not in agreement with the findings of (5) who reported that tropical regions are characterized by high levels of solar radiation and environmental temperature which may adversely affect animal production but it is in agreement with where the best performance was observed in the early wet and late wet and the least performance was recorded in early dry and late dry. It is also an indication that the local chickens could have accumulated genes for better adaptation at the expense of genes for better growth performance.

In late dry, Marshal genotype had the highest in fertility (68.96%) and hatchability (95.5%) followed by the Naked neck fertility (61.74%) and hatchability (64.27%) and the least is frizzle feather fertility (31.44%) and hatchability (49.12%).

Conclusion and Applications

1. The study concluded that Nigerian indigenous chickens, the Naked-neck genotype is more desirable in improving fertility and hatchability in the production of day-old chicks and they exhibited better adaptability to humid tropical environment than

exotic chickens.

2. The genotypic differences on fertility and hatchability parameters signifies that Frizzle-feather performed best in both fertility and hatchability followed by the Naked neck genotype percentage while Normal-feather and Marshal performed differently and had lower percentage of fertility and hatchability.
3. Frizzle feather is recommended as the best in the production of day old chickens followed by the Normal feathered genotype.

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