GROWTH PERFORMANCE OF NORMAL, FRIZZLE AND NAKED-NECK CHICKENS IN A TROPICAL ENVIRONMENT

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ABSTRACT

Growth performance of normal-feathered, frizzle and naked neck indigenous chickens of Nigeria during an 18-week growing period was studied. Differences in body weights among the three genotypes (sexes combined) were not significantly different at all ages, although those with normal feathering showed general superiority over the other two genotypes. Male normal-feathered individuals had significantly higher body weights than the females from week 6, whereas differences between male and female naked necks were significantly from the females at all ages. No significant differences were observed among the genotypes and between the sexes in both absolute and relative growth rates in the 18-week growing period.

It therefore seems that any advantage the two major genes investigated may have as a consequence of their direct effects on efficiency of thermoregulation of chickens in hot environments would probably be manifested after the growing period. This justifies the exploitation of these genes for egg production in the tropics.

Keywords: **Indigenous chickens, frizzled feather, naked neck, major genes, growth performance.**

INTRODUCTION

Certain major genes have been found relevant to the tropical production environment which is characterized by stress factors, notable among which is high temperature. Among these major genes are the feather distribution gene, naked neck (Na) and the feather structure gene, frizzle (F).

For example, Horst (1988) and Mathur and Horst (1990) have reported superiorities of individuals with frizzle and naked neck genes both singly and in combination over individuals with normal feathering for egg number, egg mass/weight and 40-week body weight in tropical environments. This superiority has been attributed to the greater efficiency of thermoregulation that is associated with these genes.

Whereas Ibe (1992) has shown that frizzle and naked neck individuals in a tropical environment matured earlier than individual with normal feathering, Nwosu *et al*(1984) reported that normal local chickens of Nigeria reached their point of inflection earlier than the exotic counterparts. It is therefore possible that these major genes are also associated with earlier sexual maturity, a characteristic which influences total egg production in the laying house. The body size of an individual at sexual maturity is determined by its rate of growth.

Indigenous chickens of Nigeria have been reported to have relatively small body size and egg size (Nwosu and Asuquo 1985; Nwosu and Omeje, 1985; Oluyemi, 1979; Hill, 1954). Improvement in the egg size of indigenous chickens can be achieved as a correlated response through improvement of their body size of selection. Knowledge of growth curve parameters of these chickens may aid in the selection process.

The objective of the present study is to examine the absolute and relative growth rates of three different genotypes of indigenous Nigerian chickens, with a view to determining the influence of frizzle and naked neck genes on growth.

MATERIAL AND METHODS

Normal, frizzle and naked neck individuals in this study were derived from a random-mating population of these types maintained in our experimental station. This population consists of indigenous chickens of Nigeria. All day-old chicks were brooded on deep-litter pens under standard management. The brooding phase lasted six weeks, although heating was discontinued after 3-4 weeks. Vaccination against Newcastle disease was given at day five.

Chicks were transferred to open-sided houses for rearing from 6 weeks until the pullets were housed for laying at 18 weeks of age. During this period, birds were fed commercial growers' ration and vaccinated for Newcastle disease, Gumboro and fowl pox. A coccidiostat was routinely provided in drinking water. All experimental birds were weighed weekly throughout the 18-week brooding/growing period.

Body weight data for each week were analysed using Harvey's Least-Squared and Maximum Likelihood Programme (Harvey, 1987). The following fixed effects model was used:

$$Y_{ijk} = u + G_i + S_j + (GS)_{ij} + e_{ijk} \text{ ....(1)}$$

In (1), Y_{ijk} is a single body weight measurement, u is the overall mean, G_i is the main effect of genetic group, S_j is the main effect of sex, $(GS)_{ij}$ is the interaction between genetic group and sex, and e_{ijk} is the random error. Errors were assumed to be independently and identically normally distributed with zero mean and homogenous variance. Also, data were analysed separately for the sexes within each genetic group.

A simple linear regression model (2) was used to determine the absolute growth rate for each genotype-sex combination for the entire 18-week period.

$$W_i = a + b(Age)_i + e_{ij} \text{ ....(2)}$$

where W_i is t. sion constant, and e_{ij} is the r (1945) two-paran also fitted to the each of the geno determine relative gı

$$W_t = Ae^{kt} \text{ ......}$$

where W_t is the body weight at time t, A is a constant and k is the required instantaneous relative growth rate. Both growth function were determined using the SPSS/PC+ programme (SPSS, 1988). Parameters of function (3) were estimated by linear estimation procedures, following a logarithmic transformation (4).

$$\ln W_t = \ln A + kt \text{ ....(4)}$$

Comparisons of growth rates were done using the method described in Zar (1974).

RESULTS AND DISCUSSION

Table 1 gives the mean body weights of the three genotypes at different ages. There were no significant differences in body weights among all genotypes (sexes combined) at all ages. However, individuals with normal feathering were generally superior in body weight to both naked-necks and frizzles at all ages, and whereas naked-necks showed superiority over frizzles from week 1 to week 10, the reserve was the case from week 11 to week 18.

Body weights obtained in this study for all genotypes fall within the range reported for normal indigenous chickens in previous studies (Nwosu and Asuquo, 1985; Oluyemi, 1979), thus supporting the general observation that indigenous chickens are small in size, relative to improved exotic chickens. However, the advantage of body size reduction, from point of view of lowered maintenance requirement

Table 1: LEAST-SQUARES MEAN BODY WEIGHT (G) OF THE DIFFERENT GENOTYPES (COMBINED SEXES) AT DIFFERENT AGES

	Genotype[a]		
Age (weeks)	Normal	Naked-neck	Frizzle
2	53.2 (2.82)	47.3 (7.03)	45.1 (6.44)
4	135.1 (6.00)	118.3 (14.96)	112.0 (13.71)
6	216.7 (8.05)	199.2 (20.06)	193.5 (18.41)
8	314.0 (12.56)	290.8 (31.34)	282.0 (28.72)
10	393.5 (10.21)	380.8 (24.46)	372.5 (23.33)
12	511.3 (13.33)	496.7 (33.250	499.0 (30.48)
14	668.2 (14.33)	640.8 (35.74)	660.5 (32.76)
16	784.1 (15..98)	745.8 (39.85)	776.0 (36.53)
18	862.5 (14.20)	822.5 (35.42)	871.00 (32.46)

[a] Standard errors in parentheses

and greater efficiency of thermoregulation, is well known and has informed the use of the sex-linked dwarf gene (dw) which causes 20 - 30% reduction in body size. Since body weights of individuals in the three groups did not differ significantly during the growing phase, they all could be involved in a breeding programme designed to develop the indigenous chicken as a potential light egg-laying breed or strain. Frizzle and naked individuals may however have an advantage over individuals with normal feathering in a tropical environment because of the greater efficiency of thermoregulation associated with the frizzle and naked neck genes.

Mean body weight of the sexes within genotypes at different ages are presented in Table 2. Differences between normal-feathered male

TABLE 2: LEAST-SQUARES MEAN BODY WEIGHT (G) OF THE SEXES WITHIN GENOTYPES AT DIFFERENT AGES.

Age (wks)	Genotype - Sex[1,2,3]					
	NOM	NOF	NNM	NNF	FRM	FRF
2	54.6 (4.20)	51.8 (3.80)	52.0 (6.40)	42.5 (2.50)	42.6 (7.20)	47.0 (12.50)
4	143.0 (8.10)	127.1 (8.20)	126.7 (12.00)	110.0 (10.00)	104.0 (17.80)	120.0 (40.00)
6	236.3^a (12.61)	197.1^b (9.63)	223.3 (24.14)	175.0 (15.00)	192.0 (20.35)	195.0 (35.00)
8	338.8^a (19.60)	289.3^b (12.69)	326.7 (34.80)	255.0 (5.00)	284.0 (37.50)	280.0 (80.00)
10	420.6^a (15.69)	366.4^b (11.51)	386.7 (24.04)	375.0 (15.00)	410.0 (33.47)	335.0 (35.00)
12	551.3^a (17.84)	471.4^b (13.21)	523.3 (17.64)	470.0 (0.00)	548.0 (59.96)	450.0 (90.00)
14	735.6^a (18.71)	600.8^b (15.02)	698.7 (29.63)	585.0 (5.00)	726.0 (61.61)	595.0 (85.00)
16	878.1^a (19.13)	690.0^b (16.84)	856.7^a (44.85)	635.0^b (15.00)	862.0 (69.89)	690.0 (110.00)
18	965.0^a (21.83)	760.0^b (17.26)	930.0^a (11.55)	715.0^b (5.00)	962.0 (43.29)	780.0 (70.00)

NOM - Normal male; NOF - Normal female; NNM - Naked-necked male;
NNF - Naked-necked female; FRM - Frizzle male; FRF - Frizzle female
Standard error in parentheses
Means in same row for each genotype with different superscripts are significantly different ($P < .05$)

and female individuals became significant from week 6, in favor of males. Significant body weight differences between male and female naked necked chickens were observed from week 15. Male frizzles did not differ significantly in body weight from the females at all ages. However, female frizzles were superior to males from week 1 to week 7, whereas the reverse was the case from week 8 to week 18 for the same group.

Males are known to generally have higher body weights than females, although Oluyemi and Ogunmodede (1979) have observed more conspicuous sexual dimorphism for body weight in exotic than in Nigerian local chickens. The much later age of manifesting sexual dimorphism for body weight among naked neck individuals and lack of significant sexual dimorphism for frizzles could be due to physiological mechanisms influences by these genes.

Table 3 gives the absolute growth rate equations for the entire 18-week period. There were no significant differences ($P > .05$) in absolute growth rate, measured by regression of body weight on age, for males and females of all genotypes. However, the superiority of males over females for this parameter is 21%, 19.6% and 23.7% for normal, naked neck and frizzle individuals, respectively. The instantaneous percentage growth rates (Table 4) did not also differ significantly among the genotypes and between the sexes within genotype. The average values were 19% and 17% for males and females, respectively, irrespective of genotype. The relative accuracy of regression of weight on time and instantaneous percentage growth rate as estimators of absolute and relative growth rates, respectively compared with average daily gain and average relative growth rates have been observed (Liu *et al.*, 1991).

Table 5, which gives the absolute growth rates of males and females of the different genotypes in two different segments of the growth curve, shows that growth was slower from week 1 to week 11 than from week 12 to week 18. There was no significant difference in growth rate in the first eleven weeks between males and female of all genotypes. However, between 12 and 18 weeks, there was divergence, with males of all genotypes having significantly higher rates of absolute growth than the females.

Rate of growth is an important characteristic of growing animals. In cockerels and pullets, the age at sexual maturity corresponds with the point of inflection of the growth curve. Data presented indicate that individuals with normal feathering and those with the frizzle and naked necked genes did not differ significantly both in body weight and in both absolute and relative growth rates during the growing period. Any advantage that the two major genes may have as a consequence of their direct effects on efficiency of thermoregulation of chickens in hot environments would probably be manifested after the growing period. Evidence for this has come from the observation that individuals carrying the frizzle and naked necked genes were superior to normal-feathering individuals in egg number, egg mass and 40-week body weight (Horst, 1988; Mathur and Horst, 1990). In this regard, these genes could be exploited in the tropics. It is apparent that the depressive effect of heat stress is more pronounced during the laying period than during the growing period. Depression in feed intake of growing pullets as a result of heat stress may be beneficial, since it is an accepted management practice to intentionally restrict feed intake of this class of chickens to enable them mature slowly.

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TABLE 3: ABSOLUTE GROWTH RATE EQUATIONS, ENTIRE PERIOD (1-18 WEEKS)

Genotype	Sex	Equation[a,b]	R^2 (%)	S.E.
Normal	M	$W = -93.04 + 57.50A$	94.6	71.90
Normal	F	$W = -57.17 + 45.43A$	95.7	50.29
Naked-necked	M	$W = -97.28 + 55.59A$	96.4	56.45
Naked-necked	F	$W = -56.94 + 43.46A$	98.9	24.68
Frizzle	M	$W = -129.97 + 59.12A$	91.0	97.26
Frizzle	F	$W = -68.38 + 45.66A$	90.9	77.03

[a] All regressions are significant ($P < .001$)
[b] W = body weight A = Age

TABLE 4: INSTANTANEOUS RELATIVE GROWTH EQUATIONS

Genotype	Sex	Equation[a]	R^2(%)	S.E.
Normal	M	$W = 57.83e^{.18t}$	87.4	.354
Normal	F	$W = 53.73e^{.17t}$	87.7	.332
Naked-necked	M	$W = 55\ 20e^{.18t}$	90.5	.306
Naked-necked	F	$W = 49.94e^{.17t}$	89.4	.316
Frizzle	M	$W = 42.20e^{.20t}$	88.8	.370
Frizzle	F	$W = 50.21e^{.17t}$	86.6	.361

[a] All regressions are significant ($P<.001$)
W = body weight t = age (weeks)

TABLE 5: ABSOLUTE GROWTH RATES (g/wk) IN DIFFERENT SEGMENTS OF THE GROWTH CURVE

		Segment	
Genotype	Sex	1-11 weeks	12-18 weeks
Normal	M	47	69
	F	41	48
Naked-neck	M	42	67
	F	41	41
Frizzle	M	47	69
	F	38	55

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