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FREQUENCY AND EFFECTS OF FRIZZLE GENES ON BODY WEIGHT OF THE FRIZZLE FEATHERED BIRD ON FREE RANGE IN SELECTED POPULATIONS OF NIGERIAN LOCAL CHICKENS

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ABSTRACT

The objectives of this study were to provide information on frequency and effect of the frizzle feather genes on body weight of the frizzle chickens under the free range production system
The study was conducted at Katsina-Ala Local Government Area in four districts, town ship, Tongov, Ikyura-itiev and Shitile. Data were collected on 1993 birds, comprising of 1673, 188, 48 and 84 normal feathering, naked neck frizzle feathered and the dwarf chickens respectively. Parameters that were measured were frequency of the frizzle gene and body weight of the frizzle genotype. Data were subjected to descriptive statistics to estimate the means, variance and coefficient of variation as well as the frequency of the frizzle gene in the populations. The frequency of the frizzle gene was least 2.16 percent. This may be due to selection by farmers based on interest, crossbreeding with normal feathering birds and the inadequacy of the heterozygous frizzle to breed true inter-se. The frizzle gene had significant effect on body weight as it enhances feed intake, improved sensible heat loss which create relief of insensible respiratory pathways under long and short term heat stress. These leads to efficient thermoregulation and less disturbance in the acid base balance. The frizzle gene appeared to exert influence on feed intake. Incorporating feed intake as selection criteria may lead to genetic gain in body weight of the frizzle birds. The frizzle gene has the potential to be used for the development of either boiler or layer strain for tropical conditions.

Key words: Body weight, feed-intake, frizzle-gene, thermo-regulation

INTRODUCTION

The present challenge to increase food production in developing countries is in efficient exploitation of genetic diversity among and within indigenous and exotic breeds (Johari *et al*., 2006). There are different strains of the local chickens in the tropics. The most productive and adapted animals for each environment must be identified for breeding purposes (Ahuya *et al*., 2004), only then it will be viable to increase food production through genetic improvement without further expansion of animal numbers. Development of a breeding program involving long-term strategies for the indigenous breeds in the tropics is largely been neglected. Productivity, including fitness and adaptive traits can be maximized without adversely affecting the environment and diversity needed for the unknown future .The frizzle gene appeared to be highly adapted to the tropical conditions with high potential to improve performance if incorporated with other indigenous strains for egg and meat production.

At 28^{o}C, (Benedict *et al*., 1932) reported that the heat production of frizzle was greater than in normal feathering fowls. The frizzle genes appears to increase conductivity of the feathers by affecting their structure (Somes, 1990).

At 32^{o}C, in low and high growth rate stock, the frizzle birds increased body weight gain from four to seven weeks of age compared with non-frizzle birds (Yunis and Cahaner, 1999). The body weight at sixteen weeks of age for heterozygous frizzle males was significantly higher than that of non frizzle ones under hot ambient temperature (Galal and Fathi, 2001). Jianxi (2002) found that at high temperature (34^{o}C), male chickens with frizzle feathers increased their daily body weight by 11% compared to normal feathering chickens. The effect of frizzle genes seems to improve adaptability through improving physiological buffering critical temperature (Horst and Mathur, 1994). The plumage reduction leads to higher body surface temperature, improved heat loss and consequently lower body temperature (Smith *et al*., 2005). It had also been reported that the frizzle gene reduced polypnoea as reflected by higher blood levels of carbon dioxide and smaller increases in blood pH and alkalosis. The frizzle gene had also been reported to stabilized acid-base balance, maintain electrolytic homeostasis and contribute to greater resistance to hyperthermia caused by high temperature (Smith *et al*., 2005). The frizzle gene enhanced direct heat dissipation by reduction of body insulation, thereby improving thermoregulatory physiological responses under high ambient temperature (Jianxi, 2002).

Feed intake and efficiency in chickens vary base on ambient temperature. The birds with better ability to manage increased ambient temperature would consume more feed, performed better at constant and increased ambient temperature and be less heat stressed compared to birds with reduced ability to manage body heat. The reduced insulation of the frizzle chickens gave it an edge over the normal feathering birds on body heat regulation. The effect of the frizzle gene on body weight of the frizzle chicken especially under high ambient temperature is an important tool that can be use to improve performance of the frizzle chickens. The objectives of this study were to provide information on frequency and effect of the frizzle feather genes on body weight of the frizzle chickens under the free range production system.

MATERIALS AND METHODS

Location

The study was conducted in four districts, township, Tongov, Kyurav-Itiev and Shitile of Katsina-Ala Local government area of Benue State. Nigeria. Katsina-Ala lies in the guinea savannah zone of Nigeria. Annual rainfall ranges between 159-180mm. The local government lies between latitude 6^{o} and 7^{o} degree North and longitude 9^{o} and 10^{o} degrees South (PKLGA, 2003). There were two seasons, the rainy season which last from April to October, and the dry season (hot season) starting from November to March. The average annual temperature varied from 32^{o}C to 38^{o}C.

Animal management

Local chickens consisting of normal feathering, Naked Neck, Frizzle and Dwarf chickens were used for the study. The birds were reared by the free range traditional production system. The birds scavenge for their feed with occasional supplementation from household and kitchen waste. Thatch huts were provided for housing at night. There was no designed arrangement for medication or health care. Incubation and brooding were all achieved through natural processes.

Data collection

The samplying technique employed was the stratified random samplying. Forty households were selected randomly in each district. The birds in each household were capture and their gene type identified and recorded. Body weight of the chickens was measure using a 1kg weighing balance. A 500 g weighing balance was use to weigh the chicks and growers. Data were collected on gene-types and body weight. The body weights of the chickens were taken according to sex of chicken, physiological status, growers and chicks respectively.

Data analysis

Data were analyzed by descriptive statistics to estimate the mean body weight according to the physiological status of the chicken, phase of growth, variation within the physiological status in body weight and the frequency of the gene type in the studied populations.

RESULTS

Frequency of major genes in the study area

The frequency of major genes in the study area showed that normal feathering gene was most common 84.16 percent. This was followed by the naked neck 9.46 percent. The frizzle and the dwarf genes were 2.16 and 4.22 percent respectively (Table 1).

Table 1: Frequency of the Major Genes

Major gene type	Number	%Frequency
Normal feathering	1,673	84.94
Naked neck	188	9.43
Frizzle feathered	48	2.41
Dwarf	84	4.22
Total	**1,993**	**100**

There was sex effect as the frizzle cocks weigh significantly ($p<0.05$) higher (1.707 ± 0.102) than the frizzle hens (Table 2). The effect of the physiological status of the birds was also apparent. Weight of brooding frizzle hens (1.350 ± 0.121) significantly ($p<0.05$) differed from that of frizzle idle hens. The weight of frizzle glower chickens and that of the chicks were 0.495 ± 0.069 and 0.060 ± 0.24 respectively.

Effect of frizzle genes on body weight

The variation in the body weight of frizzle idle hens was 0.034 with the coefficient of variation of 16.20 percent. Body weight of frizzle cocks also showed low variability between birds (0.063), while the coefficient of variation was 4.69 percent (Table 2). Coefficient of variation of body weight of growers was high.

Table 2: Effect of Frizzle Gene Type on body weight of the flock components

Flock components	Mean	± SEM	Var.	Coev.
weight idle hens	1.129	0.051	0.034	16.20
Weight of brooding hens	1.350	0.021	0.046	12.12
Weight of cocks	1.707	0.102	0.063	14.69
Weight of eggs	-	-	-	-
Weight of growers	0.495	0.069	0.075	55.33
Weight of chicks	0.060	0.240	-	-

SEM = standard error of mean. Var= variance. Coev = coefficient of variation.

DISCUSSION

Frequency of major genes in the study area

The lowest frequency of the frizzle gene in the population may be due to conscious selection by the rural farmers due to declining interest. Crossbreeding with normal feathering birds is another factor that may be implicated in accounting for the low frequency of the frizzle genes in the population.

The frizzle bird genotype is heterozygous and mating of frizzle birds inter se do not breed true (Fredrick and Hut, 1980), but yield three genotypes FF, Ff and ff in the ratio of 1:2:1.The ff genotype exhibiting normal plumage. This inadequacy in breeding true may also be implicated in the low frequency of the frizzle genes recorded in the populations. The population conscious selection and breeding of the homozygous dominant (FF) which the rural farmers assumed to be different from the frizzle (ruffle feathered) and the homozygous recessive (ff) normal feathering will produce the genotype (Ff) that all will be frizzle feathered.

The presences of the frizzle gene among the genetic resources of the rural poultry indicated that breeding program involving long-term strategies for improved productivity, fitness and adaptive traits of the frizzle chickens can be successful due to the scope of farmer participation.

Efficiency of production

This is a key component of sustainability. This broadly includes economically important traits. Poultry being a highly competitive and dynamic industry, there is constant striving for improved performance including greater efficiency of production. The body weight of the frizzle birds observed in this study is appreciable. These were birds that had not gone through conscious selection for genetic improvement, reared under the free range production system without feed supplementation and disease management.

Economically important traits of the frizzle chicken

Feed intake

Birds eat to satisfy their energy requirement. The bird would therefore eat less at high ambient temperature. The covariance between the ambient temperature (environment) and the energy need dictating the quantity of feed consumed (genetic potential) is the adaptation provided by the ruffle genes. This gene reduces body insulation cover leading to higher body surface area , body surface temperature (Jianxi, 2002) , physiological buffering critical temperature (Horst and Mathur, 1994), increased heat lost and consequently lower body temperature (Smith *et al*,.

2005). The frizzle genes also reduce polypnoea as reflected by high blood levels of carbon iv oxide and small increases in blood pH and alkalosis (Smith *et al*., 2005). The frizzle gene had also been reported to stabilize acid –base balance, electrolyte homeostasis, and contributing to greater resistance to hyperthermia caused by high temperature.

The above points are the genetic potentials of frizzle gene that enhanced the frizzle feathered birds the ability to consume more feed and gain weight at constant and varied high temperature compared to normal feathering birds. Thus direct measurement of feed consumption had a real genetic basis (Johari *et al*., 2006), and in frizzled feathered birds, it's a measure of the effect of the frizzle gene on thermoregulation. In the frizzle feathered birds, information on feed consumption should be incorporated in selection and breeding program which could enhance genetic gain in egg or meat production efficiency.

Feed efficiency

Feed efficiency is an important characteristic to be improved to get income over feed cost. Incorporating feed consumption and body weight gain in selection and breeding program of the frizzle feathered birds will lead to genetic improvement in feed efficiency.

Body weight gain

The variance and coefficient of variation in body weight of the various flock components observed in this study indicated that there were variations in the expression of these traits between individual birds. Selecting superior individuals in the population to be parents of the next generation in an appropriate breeding program may lead to genetic improvement of the trait.

The high coefficient of variation observed for the growers was also understandable. The effect of genes on body weight gain had been reported to vary across ages. So also is the environmental effect at different ages. Thus, the genotype, the environment effects, genotype by environmental interaction and the covariance between the genotype and the environment effects on body weight gain would vary widely as observed.

Again the variance and coefficient of variation are pointers to the fact that, the frizzle feather birds were genetically unique with low variability between them. The frizzle bird is heterozygous dominant (Ff), the known genotype makes it easy in designing breeding program to improve the performance of the frizzle chicken.

CONCLUSION

The frequency of the frizzle gene was low in the selected populations. The frizzle gene provided the frizzle birds with physiological mechanisms to reduce their body temperature, while at the same time providing stability to body physiological processes affected by increase in temperature. This gene is seriously threatened and its persistency in rural poultry is endangered. Feed consumption of the frizzle bird had a real genetic basis and information on feed consumption can be included in a selection and suitable breeding programs to enhance genetic gain in egg or meat production. There is need to provide information on genetic parameter estimates, (repeatability, heritability, genetic correlation, environmental and phenotypic correlation on feed intake, feed conversion efficiency and body weight gain) of the frizzle chickens as guides to appropriate selection methods.

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