EGG QUALITY PARAMETERS OF FRIZZLE AND NAKED-NECK FRIZZLE CHICKEN GENOTYPES UNDER DIFFERENT DIVERSIFICATION SYSTEMS

E. Subalini[1], S. Thanuejah[2], and S. Elango

Faculty of Agriculture, Eastern University, Sri Lanka

[3]*Department of Animal Science, Faculty of Agriculture, Eastern University, Sri Lanka*

INTRODUCTION

The poultry industry in Sri Lanka is mainly oriented towards exotic germplasm. However, the productive performance of the exotic chicken is highly affected by various environmental factors, mainly temperature. Therefore, it is difficult to exploit the productive potential of exotic birds in high temperature regions at a low cost production system. Various management aspects can be introduced to reduce heat stress and to improve the productive level of exotic chickens. Introducing heat tolerance genes to the exotic germplasm is the permanent solution to resolve the constraint.

The heterozygous naked neck gene (*Nana*) causes a 20-30% reduction of feather coverage. This reduction in feather coverage facilitates better heat dissipation and improves thermoregulation, resulting in better relative heat tolerance in hot climates (Mahrous et al. 2008). In frizzle chickens, the rachises of all feathers are extremely re-curved, with barbs also being extremely curled. This causes a reduction in tropical heat stress by improving the birds' ability for convection, resulting in improved feed conversion and better performance (Merat 1990). Benedict *et al*. (1932) found a considerable increase in energy metabolism for frizzled birds, implying that they will respond differently, from normal feathered birds, to high temperatures.

In this context, a study was planned to analyze the egg quality traits of frizzle and naked-neck frizzle under different diversification systems. The results of the study will shed light on the type of diversification system that should be used to obtain good quality eggs from the frizzle and naked-neck frizzle genetic groups of chicken.

METHODOLOGY

The study was conducted in different locations in Batticaloa, Ampara and Trincomalee districts of Sri Lanka during the period from January 2013 to March 2014. A total of 150 poultry farms rearing both chicken types together were selected for this study. Equal numbers of crop-based, livestock-based and monoculture farms were considered in gathering data. For a crop-based farming system, the farms with biennial and annual crops were considered, and for livestock-based farming systems, farms with ruminant animals such as cattle, buffalo and goat were considered. From each farming system, a total of 100 eggs were randomly selected to gather information. Semi-intensively operated farms were selected for the study. The production parameters measured were egg weight, egg shape index, specific gravity, fertility, hatchability, albumen weight, yolk weight, yolk: albumen ratio, shell weight and shell thickness. Data of the three diversification systems of each chicken genetic group were subjected to an analysis of variance (ANOVA) using the General Linear Models (GLM) Procedure of the Statistical Analysis System (SAS 2004). Where significant differences were observed, treatment means were compared with the Duncan's Multiple Range Test. All statements of statistical differences were based on $p<0.05$.

---

[1] Correspondence should be addressed to Ms.Subalini Elango, Department of Animal Science Faculty of Agriculture, Eastern University, Sri Lanka, Chenkalady (e-mail : subalini23@yahoo.com)

RESULTS AND DISCUSSION

External quality traits of eggs

Significant differences were observed (P>0.05) in all the external quality traits of both genetic groups of chicken in all the diversification systems.

Table 1: External quality traits of the egg of frizzle and naked-neck frizzle chicken under different diversification systems (± Standard Error)

Traits	Frizzle			Naked-neck frizzle		
	Crop-based (n=200)	Livestock-based (n= 200)	Monoculture (n= 200)	Crop-based (n= 200)	Livestock-based (n= 200)	Monoculture (n= 200)
Mean egg weight (g)	47.33 ± 1.64^{c}	44.23 ± 1.27^{b}	41.39 ± 1.45^{a}	52.64 ± 2.01^{r}	47.01 ± 1.32^{q}	43.62 ± 1.11^{p}
Egg shape index (%)	73.44 ± 1.27^{c}	71.12 ± 1.02^{b}	69.98 ± 1.72^{a}	75.21 ± 1.21^{r}	73.04 ± 1.73^{q}	70.96 ± 1.25^{p}
Specific gravity	1.13 ± 0.01^{c}	1.09 ± 0.02^{b}	1.04 ± 0.02^{a}	1.15 ± 0.01^{r}	1.10 ± 0.02^{q}	1.04 ± 0.03^{p}
Fertility (%)	73.07 ± 1.56^{b}	76.32 ± 1.43^{c}	69.64 ± 1.56^{a}	72.64 ± 1.27^{p}	79.21 ± 1.75^{r}	75.23 ± 1.66^{q}
Hatchability (%)	80.46 ± 1.34^{b}	75.64 ± 1.04^{a}	82.55 ± 3.78^{c}	90.62 ± 4.01^{r}	79.38 ± 3.76^{p}	86.34 ± 2.72^{q}

*Means with the same letters across the rows for each chicken genetic group are not significantly different

a) Egg weight

The mean egg weight was significantly higher (P<0.05) in a crop-based diversification system while it is significantly lower (P<0.05) in a monoculture system for both genetic groups of chicken (Table 1). Under the crop-based farming system, the availability of diverse feed materials such as grains, seeds, green leaves, crop residues and insect pest are comparatively higher than in other farming systems. Therefore, the energy gain is high. Further, under the crop-based farming system, the energy loss is reduced as the shade is high.

b) Egg shape index

The egg shape index was significantly higher (P<0.05) in both genetic groups of chicken in the crop-based diversification system, while it was significantly lower (P<0.05) under the monoculture system for both genotypes (Table 1). Under the crop-based diversification system, exposure of birds to sunlight stimulates reproductive activity and starts egg production on time, and will reflect in egg size. In other diversification systems studied, it was observed that sheds and highly-shaded trees were there.

c) Specific gravity of egg

Specific gravity was significantly higher (P<0.05) in the crop-based farming system for both genetic groups of chicken (Table 1). The gravity was higher as the weight and volume are the determinants of specific gravity. Comparatively, the lowest value was recorded in both genetic groups of chicken in monoculture. The results indicated that specific gravity is directly proportional to egg weight. This was agreed with the reports made by Yeasmin and Howlider (1998), Nahar *et al*. (2007), Onagbesan *et al*. (2007).

d) Egg fertility

Egg fertility was significantly higher (P<0.05) in both genetic groups of chicken under the livestock-based diversification system, while it was lowest in the monoculture system (Table 1). Under the livestock-based diversification system, the availability of protein-based feeds such as feces, feed residues, etc are highly available. This might be the reason for higher fertility in that particular system. Further, under livestock intensification, laying facilities are high as the birds can find specific places for laying. Therefore, the physical forces to damage the egg and embryo will be reduced. However, under the monoculture and crop-based diversification systems, these facilities do not exist.

e) Egg hatchability

Hatchability was significantly differed (P<0.05) among different diversification systems for both genetic groups of chicken in all the diversification systems. The hatchability of eggs for both the chicken genetic groups of chicken was significantly higher (P<0.05) under the crop-based diversification system (Table 1).

Internal quality traits of egg

Significant differences were observed (P<0.05) in all the internal quality traits of both genetic groups of chicken in all the diversification systems.

Table 2: Internal quality traits of the eggs of frizzle and naked-neck frizzle chicken under different diversification systems (± Standard Error)

Traits	Frizzle			Naked-neck frizzle		
	Crop-based (n= 200)	Livestock-based (n= 200)	Monoculture (n= 200)	Crop-based (n= 200)	Livestock-based (n= 200)	Monoculture (n= 200)
Albumen weight (g)	26.34±1.23^{c}	23.11±1.04^{b}	20.25±1.21^{a}	27.55±1.76^{r}	26.38±1.54^{q}	22.62±1.56^{p}
Yolk weight (g)	16.42±0.94^{c}	13.12±1.12^{b}	10.76±1.01^{a}	18.64±1.32^{r}	15.37±1.33^{q}	10.64±1.02^{p}
Yolk:albumen	0.62±0.01^{c}	0.56±0.02^{b}	0.53±0.02^{a}	0.59±0.01^{r}	0.58±0.01^{q}	0.47±0.01^{p}
Egg shell weight (g)	4.57±0.13^{a}	8.00±0.11^{b}	10.38±0.15^{c}	6.45±0.21^{q}	5.26±0.19^{p}	10.36±0.78^{r}
Egg shell thickness (mm)	0.28±0.002^{a}	0.37±0.003^{b}	0.45±0.002^{c}	0.33±0.002^{q}	0.30±0.002^{p}	0.45±0.002^{r}

*Means with the same letters across the rows for each chicken genetic group are not significantly different

a) Albumen weight

In accordance with the results obtained (Table 2), albumen weights differed significantly (P<0.05) between different diversification systems, with the highest values being presented by both genetic groups of chicken under the crop-based diversification system. The correlation between total egg weight (Table 1) and albumen weight was strong and positive (Suk and Park 2001).

b) Yolk weight

The yolk weight of both genetic groups of chicken is significantly higher (P<0.05) in the crop-based diversification system (Table 2). Under the crop-based diversification system, the availability of diverse nutrition is higher than in other systems. In literature, a similar observation was reported by Fikry Amer (1972) and Parmar et al. (2006). The correlation between yolk weight and total egg weight (Table 1) was strong and positive (Offiong et al. 2006; Suk and Park 2001).

c) Yolk: albumen (Y:A) ratio

The calculated Y:A ratio was significantly highest (P<0.05) under the crop-based diversification system. However, in naked-neck frizzle chicken, it was significantly higher in both the crop- and livestock-based diversification systems (Table 2). Here, it is important to line out the great importance of yolk proportion in the egg processing industry as it is linked to higher dry matter content and to a higher content of essential fatty acids (Benabdeljelil and Merat 1995).

d) Egg shell weight and thickness

Egg shell weight and thickness were significantly higher (P<0.05) in the monoculture system for both chicken genetic groups. In most of the surveyed areas, chicken keepers provide calcium as a supplement to their birds under monoculture. This might increase egg shell weight and the thickness of the eggs of the chicken.

CONCLUSION

The frizzle and naked-neck frizzle chicken perform well under the crop-based diversification system in terms of all the external and major internal quality traits. Therefore, the performance of these chicken genetic groups could be further improved under the crop-based diversification system with improved management practices and breeding programs.

REFERENCES

Benabdeljelil, K. and P. Merat. 1995. Comparaison de types génétiques de poules pour une production d'oeufs locale: F1 (Fayoumi×leghorn) et croisement terminal ISA au Maroc. Ann. *Zootech., 44*: 313-318.

Benedict, F.G., Landuer, W. and Fox, E.L. 1932. The physiology of normal and frizzle fowl, with special reference to the basal metabolism. *Storrs Agricultural Experimental Station, Bull.177,* India.

Firky Amer. 1972. Egg Quality of Rhode Island Red, Fayoumi and Dandarawi. *International Journal of Poultry Science* 51: 232-238.

Mahrous, M., Galal, A., Fathi, M.M. and Zein El-Dein, A. 2008. Impact of Naked Neck (Na) and Frizzle (F) Genes on Growth Performance and Immunocompetence in Chickens. *International Journal of Poultry Science* 7 (1): 45 - 54.

Merat P. 1990. Pleiotropic and associated effects of major genes. Crawford R. D., (ed), *Poultry breeding and genetics*, Amsterdam: Elsevier. 442-448.

Nahar, K., Ahmed, S., Monir, M.M. and Rahman, M.S. 2007. Comparative evaluation of egg quality characteristics of broiler parent stock and synthetic broiler. *Bang. Journal of Animal Science 36 (1 & 2)*: 82-87.

Offiong, S.A., O.O. Ojebiyi, E.O. Moeses, B.I. Umoh, and E.E.A. Offiong. 2006. Comparison of the morphometric characteristics of exotic commercial and local chicken eggs in the tropical environment. *Journal of Animal Sciece and Vetirinary Advances 5*: 1046-1049.

Onagbesan, O., Bruggeman, V., Desmit, L., Debonne, M., Witters, A., Tona, K., Everaert, N. and Decuypere, E. 2007. Gas exchange during storage and incubation of Avian eggs: Effects on embryogenesis, hatchability, chick quality and post-hatch growth. *World's Poultry. Science Journal 63*: 557-573.

Parmar, S. N. S., M. S. Thakur, S. S. Tomar, and P. V. A. Pillai. 2006. Evaluation of egg quality traits in indigenous Kadaknath breed of poultry. *Livestock Research for Rural Development. 18(9).*

Suk, Y. O. and Park, C. 2001. Effect of Breed and Age of Hen on the Yolk to Albumin Ratio in Two Different Genetic Stocks. *Poultry Science 80*:855-858.

Yeasmin T. and M.A.R. Howlider. 1998. Comparative physical features egg production and egg quality characteristics of normal and dwarf indigenous (Deshi) hens of Bangladesh. *Journal of Applied Animal Research 13*: 191-196.