

Evaluation of physical egg quality characteristics of free range indigenous Malawian normal feathered and frizzled chicken

Abstract

The study was conducted at the Lilongwe University of Agriculture and Natural Resources, Bunda campus, Animal Science farm. The study used 12 hens on free range system which were supplemented with maize bran in the morning before releasing them. IC hens of two different phenotypes (normal feathered and frizzled) of first to sixth parity were randomly selected and weighed. Four eggs were randomly collected per clutch and weighed. Hen weight and egg weight were collected using digital scale; egg volume using gradual beaker, egg length and egg width using vernier caliper. The egg shells were washed then air dried for three days after which the dry shells were weighed using a scale and the shell thickness using vernier caliper. Data was analysed using Analysis of Covariance (ANCOVA) where hen weight was taken as a covariate. Results showed that there were no significant differences ($P>0.05$) between eggs from normal feathered and frizzled feathered IC in most of physical characteristics such as; egg weight, egg volume, egg length, egg width, shell weight, shell thickness, egg texture and egg colour which had means of 44.70g frizzled and 45.89g normal, 36.57cm³ Frizzled and 39.48cm³ normal, 55.67mm frizzled and 53.46mm normal, 39.03mm frizzled and 39.96mm respectively. It was also noted that eggs (81.82%) from both phenotype were cream white in colour with smooth texture, except egg index which was significantly different ($P<0.05$) between frizzled (71.37%) and normal (75.27%) IC.

Keywords: selective transfer, superficial layer, structural analysis, intensity x-rays, width of diffraction lines, crystalline network constant

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Introduction

Indigenous chickens (IC) are mainly raised by resource poor rural households in developing countries.¹ Although they are of low genetic potential compared to the commercial breeds, IC play a vital role in livelihoods of farmers and contribute significantly to food security and income.¹ IC dominates in most smallholder farms in Malawi and they are deemed less productive but appear to be adapted to local harsh free-ranging rearing environment.² Indigenous chickens contribute significantly to food security for poor households in most African countries.³ Despite these important attributes, productivity of indigenous chicken in Malawi is generally low with hens producing an average of three clutches of twelve eggs per year.⁴ In order to improve egg production there is need to look on the physical characteristics of eggs such as egg weight, egg shell, egg strength, and albumen and yolk quality.

Most of the studies that have been conducted were concerned with increasing poultry meat and egg number without considering quality aspects. For instance,² aimed at increasing flock sizes and flock integration among rural households by improving productivity through selection and evaluation, reducing mortality and improved nutrition. On the other hand, Smallholder Poultry Improvement Programme (SPIP) introduced by Malawi government in the early 1950's, aimed at increasing egg and meat production of indigenous chicken through crossbreeding with the Black Australorp (BA). However, there are no studies that have been carried out to evaluate egg quality attributes for indigenous Malawian chicken. This makes it difficult to come up with

quality standards and grading for free range indigenous egg market. Therefore, this study aimed at generating information which will act as the benchmark upon which future projects in IC will base.

Materials and methods

Site of study

The study was conducted at Lilongwe University of Agriculture and Natural Resources, Bunda College campus, Animal Science Department farm. The study used hens on free range system which were supplemented with maize bran in the morning before releasing them. IC hens of two different phenotypes (normal and frizzled feathered) with parities between first and six were randomly selected. 4 eggs were randomly collected per clutch and weighed. Weights of hen and egg were collected using digital scale; egg colour and texture were collected by observation and palpation, respectively. Egg volume was done by using gradual beaker, egg length and egg width using vernier caliper. The egg shells were washed then air dried for three days after which the dry shells were weighed using a digital scale and shell thickness was measured using vernier caliper. Egg shape index was determined by using the formula egg width divided by egg length multiplied by 100.

Data analysis

Data was analysed using Analysis of Covariance (ANCOVA) where weight of hen was taken as a covariate.

Statistic model

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + x_1x_2 + e$$

Y = Parameters to be found

b_0 = Y intercept

x_1 = Weight of the hen

x_2 = Phenotype

x_3 = Parity

x_4 = Feed

x_5 = Age

x_1x_2 = Interaction between hen weight and phenotype

b_1 to b_5 = Regression parameters

e = Random error

Results

The study revealed that Normal and Frizzled feathered hen produced eggs with smooth shell, eggs with volume of 39.48cm³ for Normal feathered hens and 36.57cm³ for frizzled IC (Table 1). On the other hand, the current study also shown that there is no significant difference (P<0.05) between normal and frizzled feathered chicken eggs on egg colour, egg texture, egg weight, egg length, egg width, egg volume, shell thickness, shell weight except egg index (Table 1).

Table 1 Egg characteristics of Frizzled and Normal IC (Mean±SE)

Parameter	Normal	Frizzled	P-value
Egg Colour	81.82% cream white and 18.18% light brown	81.82% cream white and 18.18% light brown	
Egg Texture	100% smooth	100% Smooth	
Egg Weight(G)	45.89±0.713g	44.71±0.81	0.317
Egg Volume(Cm ³)	39.48±1.01	36.57±1.11	0.086
Egg Length(Mm)	53.46±1.05	55.67±1.15	0.167
Egg Width Mm)	39.96±0.59	39.03±0.64	0.296
Shell Weight(G)	4.413±0.78	4.089±0.86	0.012
Shell Thickness (Mm)	0.331±0.009	0.325±0.01	0.313
Egg Shell Index	75.27±1.53	70.27±1.68	0.05

Discussion

The current results have shown that the egg weight was lower than the one reported by Isidahomen⁵ which was 52.33g for normal and 52.9g for frizzled chicken, this may be due to different production systems, since⁵ studied chickens under intensive management where by hens do not lose more energy for walking long distance in search of feed as a result they gain weight and there was also no competition of feed nutrient between a hen (used for its metabolic processes) and egg (egg formation), resulting in producing eggs with high egg weight. The egg weight was closer to 44.72g for normal chicken and 41.91g for frizzled reported by Udoh.⁶ This could be due to parity since Udoh⁶ studied chickens which were in the first parity despite that they were under intensive production system. Current results on egg weight were higher than 33.29g for normal and 36.16g for frizzled

IC studied by Egahi⁷ and the difference might be due to phenotypes which means that there may be some traits of other breeds such as Black Australorp due to crossbreeding programmes in Malawi, while reports by Egahi⁷ were based on true genotype (homozygous normal and frizzled). In another study, Kamanga⁸ reported that frizzled and normal indigenous chickens produce small eggs ranging from 35-49g as compared to other phenotypes found in Malawi. Also Kamanga⁸ reported that 69% of hens laid small eggs, 27% medium of rang 49-56g and only 4% managed to give large sized eggs. In the current study it has also been observed that there was no significant difference between frizzled feathered chicken egg weight and normal feathered chicken egg weight (0.237) this could relate to their body weights which were also not significantly different (0.914). Apuno⁹ reported that egg weight was directly proportional to hen body weight. Birds with larger body weights consume more feed to maintain their body size, resulting in larger eggs. Apuno⁹ also reported that selection for pullets with higher weights would yield positive results in egg weight.

In another study, Isidahomen⁵ found that body weights and egg weights of frizzled and normal IC produced eggs which were not significantly different but were significantly different to Dominant blue feathered chicken. Isidahomen⁵ reported that there was no significant difference between normal and frizzled egg weight, however, their results were different from (6:10:11) who found that there were significant differences between normal and frizzled feathered egg weight. On egg length, the current study has shown that there was no significant difference between normal and frizzled feathered IC which was in agreement with Isidahomen⁵ in Nigeria;^{10,11} However, the current findings were different from reports by Egahi⁷ who found that significant difference between normal and Frizzled feathered egg length.

The mean egg width from the current study for normal chicken and frizzled feathered chicken are in line with findings by Bobbo.¹⁰ However, the results are lower than reports by Isidahomen⁵ who found 42.1mm for normal and 41.6mm for frizzled feathered chicken while Peters¹¹ found egg width of 49.1mm and 49mm for normal and frizzled feathered chicken respectively. In another study by Egahi⁷ egg width of 27.28mm for normal and 27.91mm for frizzled feathered chicken, are lower than findings from the current study. The reasons underlining these differences could be that egg weight is positively correlated with egg width and egg length, the ones with high egg weight are expected to have high egg length and egg width. Lack of significant differences on egg width between frizzled feathered and normal feathered IC in the current study was in line with Egahi⁷. Peters¹¹ However, Bobbo¹⁰ reported significant differences on egg width between normal and frizzled feathered chicken. Egg shell weights found in the current study (Table 1) were lower than findings by Egahi⁷. Peters¹¹ The differences might be due to environmental factors such as feed, that have low phosphorous content as a result of low phosphorous soil. Maida¹² reported that Malawian soil have low phosphorous which result in low phosphorous plant and phosphorous is one of the major components of egg shell. On shell weight, the current result shows that there was no significant difference between normal feathered shell weight and frizzled feathered shell weight. This is in line with Isidahomen.⁵ However, the findings are in contrast with findings by Bobbo,¹⁰ who found significant differences between frizzled and normal feathered chicken, frizzled produced high shell weight than normal.

The mean values of shell thickness found in this study (Table 1) were lower than findings by Udoh⁶ who found 0.37mm for normal chicken and 0.35mm: Bobbo¹⁰ reported 0.45mm for normal and

frizzled feathered chicken: Isidahomen⁵ reported 0.36mm for normal and 0.49mm for frizzled chicken and 0.36mm for normal feathered chicken reported by Egahi⁷ this was due to lack of phosphorous in their feed. However, Egahi⁷ reported 0.32mm which was in line with the current findings. On shell thickness, the current research has shown that normal feathered shell thickness was not significantly different from frizzled feathered which was similar to findings by Isidahomen⁵ in Nigeria: Udoh,⁶ Bobbo¹⁰ but different from findings by Egahi⁷ who reported significant differences between frizzled and normal feathered shell thickness. The difference might be that Egahi⁷ used chickens based on genotype for normal and frizzled while this study and by Isidahomen⁵ in Nigeria, Udoh,⁶ Bobbo¹⁰ were based on phenotype. The mean egg shape index found in this study (Table 1) was closer to findings by Egahi⁷ who reported 76.99 for normal and 71.18 for frizzled. In another study, Bobbo¹⁰ also reported similar egg shape index of 75.9 for normal but higher shape egg index for frizzled of 77.16 while Peters¹¹ reported high shape egg index of 79 for normal and 78 for frizzled.

There was significant difference on egg shape index between normal feathered and frizzled feathered chickens in the current study which is in line with Egahi.⁷ However, Bobbo,¹⁰ Peters¹¹ found no significant differences between frizzled and normal feathered chickens on egg shape index. This might be due to different ecological zones. In some zones, they have high temperatures which cause stress that makes the cells on the shell grand (where egg shell is formed) to become acidic and deposit more calcium which may result in misshaped eggs. On the other hand, the current study has shown that normal feathered chickens have higher egg shape index than frizzled feathered chickens. Normal feathered chickens produced eggs which were roundish in shape (good egg shape index). Good egg shape index (high egg shape index) enhance marketing and profitability, in the sense that, high egg index provide the best appearance and low egg index are much likely to be broken during packaging and transportation.

Conclusion

In conclusion, the study has shown that Malawian indigenous frizzled and normal feathered chicken have better egg quality characteristics except shell weight and shell thickness despite having small eggs since they are within the range of some frizzled and normal feathered chicken in Africa. However, the study has revealed that the egg shell weights and shell thickness of frizzled and normal feathered chickens were the least if compared to other studies in Africa. Therefore, there is need to improve since egg shell is the most important external part of the chicken egg. The current results have also shown that normal and frizzled feathered chickens produce eggs which are similar in most of physical quality characteristics except egg shape index. Normal feathered chicken produce eggs with high egg shape index than frizzled.

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None.

Conflict of interest

The author declares no conflict of interest.

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