

EVALUATION OF SOME ANATOMICAL AND PHYSIOLOGICAL STATUS OF RETAIL CHICKEN SHELL TABLE EGGS WITHIN USMANU DANFODIYO UNIVERSITY, SOKOTO

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ABSTRACT

Anatomical and physiological egg quality characteristics are important parameters that affect egg retail value; characteristics such as shape index affect the risk of cracked eggs, egg weight is one of the primary criteria for grading eggs, albumen pH is an important indicator of egg freshness and physicochemical and interfacial property of yolk is affected by pH. Length of storage, temperature and humidity of storage environment affects egg quality parameters. Cracked eggs are also more vulnerable to be affected by the mentioned factors. Adverse weather condition which is prevalent in the humid tropical countries and lack of infrastructural storage facilities for storage of egg, adversely affects egg preservation in these countries Therefore this study was carried out to determine some egg quality parameters within Usmanu Danfodiyo University, Sokoto. Five eggs were bought from each six randomly selected retailers within Usmanu Danfodiyo University, Sokoto at hostels mini market. One Hundred and Twenty (120) eggs were bought for a period of four weeks between July and August. The design of the experiment was a completely randomized design. The six randomly selected egg retailers formed the treatments. Control treatment was added with average standard values of egg weight, albumen pH, yolk pH and egg shape index as obtained in the literature. The number of weeks (4) formed the replicates and 5 egg numbers as units of each replicate. The weight, width and length of each egg were taken to calculate the shape index. Albumen and yolk pH were also measured. GENSTAT package was used for data analysis. Only the albumen pH was significantly ($P < 0.001$) different between the control (Average standard value for albumen pH) and the six egg retailers sampled, though within the acceptable limit. It was concluded that: eggs sold within the Usmanu Danfodiyo University, Sokoto Main Campus Hostels Area were of good weight and acceptable albumen pH (freshness). Most of the eggs studied, though not significantly different across the treatments, were not of the standard shape index.

Keywords: Egg, shape index, pH, albumen, yolk

INTRODUCTION

Egg quality is determined by its consumer's acceptance with respect to several characteristics including cleanliness, freshness, surface area, mass volume, coefficient of packaging, weight, pH, shell quality, yolk index, albumen index, haugh unit and chemical composition (Narushin, 1997). The size and shape of egg differ among various species of birds, but all eggs have three basic parts which include the yolk, albumen, and shell. Freshness in egg makes major contribution to the quality of egg and egg products. The changes that occur in egg during storage are many and complex and affect the functional properties of the yolk and albumen, these changes include thinning of albumen, increase of pH, weakening and stretching of vitelline membrane and increase in water content of the yolk. Egg shape index is defined as the percentage ratio of width to length of the egg. It is an important criterion in determining egg quality. Shape index has a significant effect on the proportion of crushing strength variation (Anderson *et al.*, 2004). Egg characteristics such as shape index affect the risk of cracked eggs. Egg quality is generally affected by storage conditions example length of storage, temperature and humidity of storage environment. Adverse weather condition which is prevalent in the humid tropical countries and lack of infrastructural storage facilities for storage of egg adversely affects egg preservation in these countries (USDA, 2005). The limitation or lack of facilities for the preservation and storage of eggs makes farmers to quickly sale their eggs on daily basis as they are collected from the birds (Abanikannda and Leigh, 2012). These problems could lead to middle men storing eggs for a lengthy period of time under inappropriate storage conditions especially when demand is low and providing such to the market when demand is high in order to get better profit. This scenario usually

causes insufficient and inappropriate prices of eggs coupled with the poor quality of the eggs. Egg weight is one of the primary criteria used in the grading of eggs and, as a result, this influences an egg's retail value. The weight of an egg varies between 50 and 70g depending mainly on the egg of the hen and, to a lesser extent, on its genotype. Eggs have been classified as pewee or pullet, small, medium, standard, large. Very or extra large, jumbo and king depending on country (GFA, 2021). Different species of poultry and strains within species all have their characteristic egg weight (Rose, 1997). Hens usually lay medium to large size eggs and large size eggs and large size is regarded as the standard egg weight. Albumen quality an important indicator of egg freshness. It is a standard measure of egg quality and it is influenced by environmental factors such as temperature and length of egg storage (Samli *et al.*, 2005). When the egg is laid the pH of the albumen is about 6.7 (PPP, 2021). The pH of the albumen rises in a few days to approximately 9.3 – 9.5. this pH is too high for bacteria to penetrate and it seems to function as an antibacterial defence system. The pH of the yolk in a newly laid egg was reported to be 6.5 (PPP, 2021). Also, Scott and Silversides (2000), reported newly laid eggs to have a yolk pH of close to 6.0, however during storage it gradually increases to reach 6.4 to 6.9. The yolk maintains a steady pH despite rise in albumen pH with time. After albumen rise in pH, the difference between the yolk and the albumen could be up to 3 pH units. This represents a 1000 fold difference in concentration of H⁺ ions as the pH is a log value.

MATERIALS AND METHODS

Experimental location

The experiment was conducted at Usmanu Danfodiyo University, Sokoto main campus hostels mini market. Sokoto State lies between latitude of 12°N and 13.55°N and longitude 40°E and 60°E. Mean annual temperature is 38.34°C with the highest in April reaching 40°C high. The Total annual rainfall is about 700mm (weatherspark, 2019).

Sources of Egg

Eggs were purchased from the Usmanu Danfodiyo University Sokoto main campus hostels mini market randomly from six retailers irrespective of their size, shape weight and freshness. The sellers were maintained throughout the period of egg purchase.

Data collection

Five eggs were bought between July and August from each of the six selected retailers on weekly basis, to form a total of 30 eggs per week to give a total of for a period of four weeks (1 month) to mark a total of 120 eggs. The weight of each of the eggs was taken using an electronic weighing scale of 0.1g sensitivity (Camry electronic weighing scale EHA259). The length and breadth of each of the eggs were individually taken using a divider calipers and a meter rule. Each of the eggs was individually broken and yolk was separated from the albumen. A pH meter of 0.1 sensitivity (Made by Hanna) was used to measure the pH of yolk and the albumen of each of the eggs. The egg shape index was calculated using the formula $\text{Width/Length} \times 100$. The shape index (SI) classification of eggs is: Standard (72 – 76), Sharp (≤ 72) and round (≥ 76) (Duman, *et al.*, 2016)

Experimental Design and Data analyses

The design of the experiment was a completely randomized design format. The six randomly selected egg retailers formed the treatments and a control treatment was added with average standard values of egg weight, albumen pH, yolk pH and egg shape index as obtained in the literature. The number of weeks (4) formed the replicates and 5 egg numbers as units of each replicate. The data was subjected to analyses of variance (ANOVA) using GENSTAT (2017) statistical package.

RESULTS AND DISCUSSION

The results of the egg quality parameters is presented in Table 1. there were no significant differences ($P > 0.05$) across the treatment means for egg weight, yolk pH and shape index. The albumen pH however was significantly ($P \leq 0.001$) different across the treatment means with the control having lower (better) pH compared to that from the six egg retailers. The significantly ($P \leq 0.001$) higher (lesser quality) pH of the albumen from the six egg retailers entails that the eggs from the retailers were not within the first few days of their freshness. Though the albumen pH from the six egg retailers had risen (8.12 – 8.64), the pH was within the lower limit of 8.64 and

lower than the maximum limit of 8.85 for some layer birds between the age of 32 and 64 weeks (Silversides and Budgell, 2002). Also the albumen pH from the six egg retailers falls within the albumen pH range of 7.78 and 9.26 for eggs stored at a room temperature of 21°C within a period of 10 days (Silversides and Budgell, 2002). The reason for the good quality of the albumen from the six egg retailers though not as good from that of the control might be as a result of the fact that this research was conducted between July and August which did not coincide with the months (April and May) that had been attributed to be the hottest in most parts of Nigeria as reported by Dafwang (1987). The weight of the eggs even though not significantly different among the treatment means, that obtained from the six egg retailers was not up to the average standard took for some countries given for large size egg (GFA, 2021), but the eggs weight fell within the standard for large size eggs of USA, Canada and Australia. Though the shape index was not significantly different among the treatment means, the shape of the eggs collected from five of the retailers deviated from the standard egg shape and had sharp disposition (egg shape index of above 76). The reason might be from high temperature, diseases, diet and other management factors of the birds during egg formation and lay as reported by Beyer, (2005).

Table 1: Egg Quality Parameters

Parameters	Control -Egg Status	RET 1 - Egg Status	RET 2 - Egg Status	RET 3 - Egg Status	RET 4 - Egg Status	RET 5 - Egg Status	RET 6 - Egg Status	P-Value	LOS
Weight(g)	63.00	58.28	58.16	55.01	59.14	56.31	59.95	0.08	NS
Albumen pH	6.70 ^b	8.56 ^a	8.12 ^a	8.83 ^a	8.39 ^a	8.54 ^a	8.64 ^a	0.001	***
Yolk pH	6.50	6.32	6.43	6.50	6.53	6.37	6.41	0.85	NS
Shape Index	74.30	80.34	78.84	78.58	75.32	78.14	78.34	0.11	NS

ab means values with different superscripts along the same row are significantly different ($P \leq 0.001$)=*** (extremely significant); NS= No significant difference ($P > 0.05$); RET= Retailer; LOS= Level of significance

CONCLUSION

It was concluded that eggs sold within the Usmanu Danfodiyo University, Sokoto Main Campus Hostels Area were of average weight and increased but acceptable albumen pH (freshness). Most of the eggs were not of the standard shape index.

REFERENCES

- Beyer, R.S (2005). Factors affecting egg quality. Kansas state University. Retrieved November 31, 2011 from <http://www.oznet.ksu.edu/library/lrstk2/ep127.pdf>
- Dafwang, I (1987). Hot weather management tips for poultry farmers. Nigerian livestock journal, 7: 14- 18.
- GENSTAT (2017). www.vsni.co.uk/software/genstat
- GFA (2021). Gluten Free Alchemist. Egg Size and Weight- An International Guide with Egg Size Comparison Chart. www.glutenfreealchemist.com. Retrieved 30th September, 2021.
- Jacob, J.P., miles, R.D and Mather, F.B (2000). Egg quality. University of Florida. Retrieved January 12, 2012 from <http://www.edis.ifas.ufl.edu/pd/files/ps/ps02000PDF>
- Nurushin, (1997). The avian egg: Geometrical description and calculation of parameters. *Journal of Agricultural Engineering Research*; 68: 201-205.
- PPP (2021). Poultry Performance Plus. pH of eggs. <https://www.poultryperformanceplus.com>
- Rose, S.P (1997). Principle of poultry science. CAB International publishing New York pg 1-87
- Samli, H.E., Agma, A and Senkeglu, N (2005). Effect of Storage time and temperature on egg quality in old laying hens. *Journal of applied poultry research*; 14: 548-553
- Silversides , F.G and Budgell, K (2004). The relationship Among measures of Egg Albumen Height, pH and whipping Volume. *Poultry Science.*, 83: 1619-1623
- Singh, D.P., Chauhary, M.L., Brah, G.S and Sandhu, J.S (1992). Evaluation of two white leghorn strains and their reciprocal crosses for part year production. *Indian Journal of Poultry Science*; 27(3): 131-143
- USDA, (2005) Egg grading manual, Agric. Hand book No. 75. Agriculture marketing service.
- Weatherspark (2019). <https://weatherspark.com>