

THE EFFECT OF STORAGE TIME AND STORAGE METHODS ON SOME INTERNAL QUALITY TRAITS OF NIGERIAN LOCAL CHICKEN EGGS

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Abstract

This study aimed at evaluating the effect of storage time and methods on some internal quality traits of Nigerian local chicken eggs. A total of 160 eggs obtained from a population of Nigerian heavy local chicken ecotype (NHLHC) hens aged 50 weeks were used. Sixteen eggs were randomly allotted to one control group (0/fresh), three storage periods (7, 14 and 21 days) and three storage methods (untreated, oiling, and white polythene). The control group comprised of eggs sampled fresh on the day of collection. The traits measured were: egg weight, albumen and yolk weight, albumen and yolk height, albumen and yolk width, albumen and yolk pH and Haugh unit. The result obtained indicated that storage time significantly ($p < 0.01$) influenced the internal quality traits studied. Egg weight, albumen and yolk weight, albumen and yolk height and Haugh unit significantly ($p < 0.01$) decreased with increased storage time. The albumen and yolk width and pH increased with prolonged storage time. Fresh eggs were of better quality ($p < 0.01$) than stored eggs. Untreated eggs deteriorated faster ($p < 0.05$) than eggs stored using other methods. Oiling improved ($p < 0.05$) the storage quality of the eggs. To maintain desired internal quality when stored at room temperature it is recommended that eggs should not be stored for more than 14 days and preferably should be treated by oiling.

Keywords: egg quality, Nigerian local chicken, storage method, storage time

Introduction

Poultry egg is one of the cheapest, most affordable and acceptable animal product. Eggs possess two characteristics that make them valuable as foodstuffs, namely, they are highly nutritious and serve important roles in many food products because of their functional properties (Scott and Silversides, 2001). Thus, they are an excellent means through which the animal protein of the populace can be met. Kul and Seker (2004) noted that the quality of an egg is determined by various standards that are imposed on the exterior (quality of the egg shell) and interior components of the egg (quality of the albumen and yolk). Though eggs are known to possess excellent keeping quality, like all food, they have limited shelf life. Deterioration of eggs starts soon after lay. Albumen and yolk quality are not only important indication of egg freshness but are also important for the egg breaking industry because albumen and yolk have different markets (Samli *et al.*, 2005). In most part of Nigeria, eggs are usually stored at room temperature until they are sold or consumed. To maintain the consumers' acceptability, it is critical that proper storage is done. Several studies have been done on effect of storage period and/or methods on egg quality characteristics of different breeds/strains of poultry birds (Monira *et al.*, 2003; Lengkey *et al.*,

2012; Tilki and Saatci, 2004). There is dearth of information in respect to the egg preservation in Nigerian local chicken. The objective of this study was, therefore, to investigate how different storage times and methods influence the internal quality traits of the Nigerian local chicken eggs.

Materials And Methods

The study was done in the Department of Animal Science, Faculty of Agriculture and Natural Resources, Ebonyi State University, Abakaliki. Abakaliki lies between latitude 06° 4'N and longitude 08° 65'E in the derived savanna ecological zone of Nigeria with a humid dry climate. The annual mean rainfall ranges between 1500-2250mm with daily temperature of 29-32°C and relative humidity of 85% (Nwakpu, 2005). A total of 160 eggs obtained from a population of Nigerian heavy local chicken ecotype (NHLHC) hens aged 50 weeks old established and maintained in the Department of Animal Science Farm, University of Nigeria, Nsukka, were used for this study. All eggs for the study were collected on the same day and carefully transported to the experimental site. Freshly laid eggs were weighed within 5hrs of collection. Sixteen eggs were randomly allotted to one control group, three storage periods (7, 14 and 21 days) and three storage methods. The storage methods were as

follows:

1. Untreated: fresh eggs were put in cardboard egg crates and kept on the laboratory table at room temperature (30.5°C).
2. Oiling: eggs were treated individually by spraying vegetable oil (refined palm oil) lightly round the eggs. The oil was allowed to drain. Later, the eggs were put in cardboard egg crates and left on the laboratory table at room temperature (30.5°C).
3. White polythene: untreated eggs were put and tied in white polythene bags of 0.2mm thickness and then left on the laboratory table at room temperature

(30.5°C).

The control group comprised of eggs sampled fresh eggs on the day of collection. These were same as eggs for storage time day 0.

On each sampling day, eggs were weighed and broken on a white tile with flat surface. The height and width of the albumen and yolk were measured using an electronic vernier caliper. The yolk was carefully separated from the albumen and both components weighed individually. All weights were obtained using a sensitive scale balance (Mettler P 1210). The Haugh unit which was estimated with the formula: $HU = 100 \log (H - 1.7 W^{0.37} + 7.57)$; where HU = Haugh unit, H = observed height of the albumen (mm) and W = weight of egg (g) (Haugh, 1937). The albumen and yolk pH were obtained using a pH meter.

Table 1. Effect of storage time on internal egg quality traits

Variable	Storage Time (day)				SEM	P-value
	0	7	14	21		
Initial Egg weight (g)	46.12 ^a	46.21 ^a	46.28 ^a	45.48 ^a	1.02	0.345
Final Egg weight (g)	46.12 ^a	44.30 ^{ab}	43.25 ^b	41.88 ^c	0.92	0.000
Egg weight loss (%)	0.00 ^d	4.09 ^c	6.67 ^b	7.90 ^a	0.32	0.000
Albumen weight (g)	22.58 ^a	21.38 ^{ab}	20.55 ^b	19.88 ^b	0.85	0.016
Albumen height (cm)	0.58 ^a	0.46 ^b	0.39 ^c	0.33 ^d	0.02	0.000
Albumen width (cm)	6.94 ^c	8.44 ^c	9.22 ^b	9.91 ^a	0.20	0.000
Albumen pH	8.36 ^c	8.80 ^b	8.93 ^b	9.16 ^a	0.08	0.000
Yolk weight (g)	17.11 ^a	16.34 ^b	16.09 ^{bc}	15.76 ^c	0.24	0.000
Yolk height (cm)	1.73 ^a	1.36 ^b	1.31 ^b	1.15 ^c	0.04	0.000
Yolk width (cm)	3.66 ^c	4.33 ^b	4.50 ^a	4.64 ^a	0.08	0.000
Yolk pH	6.34 ^c	7.17 ^b	7.52 ^b	7.98 ^a	0.22	0.000
Haugh unit	81.08 ^a	71.72 ^b	66.50 ^c	59.40 ^d	1.83	0.000

^{abcd}Means in the same row not sharing a common superscript letter are significantly different ($p < 0.05$).

SEM: standard error of mean.

Table 2. Main effects of storage method on internal egg quality traits

Variable	Storage Method				SEM	P-value
	Control (fresh egg)	Untreated	Oiling	White polythene		
Initial Egg weight (g)	46.12 ^a	46.32 ^a	46.18 ^a	46.06 ^a	0.97	0.632
Final Egg weight (g)	46.12 ^a	42.86 ^b	43.22 ^b	43.36 ^b	0.80	0.019
Egg weight loss (%)	0.00 ^c	7.48 ^a	6.38 ^b	5.93 ^b	0.51	0.000
Albumen weight (g)	22.58 ^a	20.23 ^b	20.58 ^{ab}	20.32 ^b	0.63	0.035
Albumen height (cm)	0.58 ^a	0.39 ^b	0.41 ^b	0.34 ^c	0.01	0.000
Albumen width (cm)	6.94 ^c	9.33 ^a	8.79 ^b	9.46 ^a	0.20	0.000
Albumen pH	8.36 ^c	9.09 ^a	8.83 ^b	8.96 ^{ab}	0.07	0.000
Yolk weight (g)	17.11 ^a	15.83 ^b	16.18 ^b	17.01 ^a	0.31	0.000
Yolk height (cm)	1.73 ^a	1.23 ^c	1.38 ^b	1.20 ^c	0.05	0.000
Yolk width (cm)	3.66 ^c	4.62 ^a	4.36 ^b	4.50 ^a	0.06	0.000
Yolk pH	6.34 ^c	7.85 ^a	7.23 ^b	7.49 ^b	0.19	0.000
Haugh unit	81.08 ^a	65.42 ^c	68.07 ^b	61.33 ^d	1.79	0.000

^{abcd}Means in the same row not sharing a common superscript letter are significantly different ($p < 0.05$).

SEM: standard error of mean.

All data obtained were subjected to ANOVA using multivariate procedure of the General Linear Model (SPSS, 2010). Significant means were compared by Duncan's test of the software.

Results And Discussion

Result of the effect of storage time on the internal egg quality traits of the NHLC eggs is presented in Table 1. This table reveals that there was a negative ($p < 0.01$) effect of storage time on all parameters studied. Egg weight, albumen weight, yolk weight, albumen height, yolk height and Haugh unit significantly ($p < 0.05$) decreased with increased storage time. Similar findings were obtained by Walsh *et al.* (1995) and Tabidi (2011). Egg weight loss was significantly increased ($p < 0.05$) as storage time increased. This finding corroborates the findings of other authors (Demirel and Kırıkçı, 2009; Khan *et al.*, 2013). The albumen and yolk width and pH increased significantly ($p < 0.01$) with storage time. Lengkey *et al.* (2012) obtained a similar result from a study carried out on duck eggs. This affirms the reports of Silversides and Scott (2001) and Tilki and Inal (2004) that egg quality are at maximum when eggs are laid and their values decrease with increasing storage time). The deterioration can be attributed to the loss of water from the egg due to evaporation, through the shell pores, and also as a result of escape of carbon dioxide from the egg leading to a rapid increase in the alkalinity of the albumen and yolk. Akyurek and Okur (2009) noted that as storage time increases, the vitelline membrane decreases, allowing nutrients in the yolk to become available to any micro organism present in the albumen, thereby enhancing the degradation process.

There were variations ($p < 0.05$) in all the internal egg quality traits evaluated with respect to the storage method (Table 2). Fresh eggs, as expected, had better quality in terms of HU, albumen and yolk weights, heights, and pH. Untreated eggs seemed to deteriorate faster than those treated with oil. Dudusola (2009) and Heath (1977) observed decreases in albumen pH in oiled eggs. Formm (1969) and Obanu and Mpieri (1984) indicated a progressive weakening of the vitelline membranes and liquefaction of the yolk caused mainly by diffusion of water from the yolk height and noted that such chemical degradation in the can be inhibited by oiling.

Conclusion

The internal egg quality traits are important properties for quality determination of table eggs. Results of the present study indicate that rapid deterioration of eggs occurred as storage time

increased and varied with the method of storage. It is recommended, therefore, that table eggs from the local chicken should not be stored for more than 14 days, under room temperature, and preferably should be treated by oiling to reduce evaporation of water and CO_2 from the pores in the shell in order to maintain the acid-base balance.

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