EGG QUALITY OF *Gallus domesticus* UNDER DOMESTIC STORAGE IN NIGERIA

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ABSTRACT

Empirical relationships between egg quality parameters and storage length were determined using the total of 174 fresh chicken eggs stored for 14 consecutive days under three different conditions. These conditions mimicked the current methods of handling eggs domestically and in retail business. Differences in percentage weight loss and interior quality characteristics were significantly affected by type of storage, even after only 5 days of storage ($P < 0.05$). Generally quality depreciation was lowest in eggs placed in an open bowl and stored in a refrigerator (REF eggs), followed by eggs stored in a closed polythene bag and kept under room temperature (PBR eggs), and highest amongst eggs placed in an open bowl and kept under room temperature (OBR eggs). Correlations between egg parameters and length of storage were in most cases very highly significant ($P < 0.001$), and in all measured parameters, OBR eggs recorded the highest correlation coefficients (r), followed by PBR eggs, and finally REF eggs. Amongst REF eggs, correlation between Haugh unit values and days of storage was not significant ($P > 0.05$), whereas correlation with percentage weight loss or yolk index was very highly significant ($P < 0.001$). It was concluded that eggs placed in polythene bags and kept under room temperature suffer less depreciation in quality compared with eggs kept in open bowls. Where facilities are available, it was suggested that eggs should first be packaged in polythene bags before refrigeration.

Keywords: Correlation, Egg quality, Storage length, *Gallus domesticus*, Nigeria

INTRODUCTION

Post-harvest losses of agricultural products due to deterioration are still a major threat to food security in Nigeria. Factors responsible for this include lack of effective systems for conveying products from myriads of subsistence farmers in the hinterland to the consuming dwellers in urban areas, and the non-performing preservation and conservation facilities occasioned by irregular and defective electric power supply. Deterioration or depreciation in quality commences immediately after harvest in animal products, and its extent is dependent mainly on length and temperature of storage (Fry and Newell, 1957; Hinton, 1968). Most modern preservation facilities employ refrigeration, and the efficiency of this system in maintaining the interior quality of eggs has been the object of numerous investigations (Olomu, 1975; Onwudiike and Sonaiya, 1983; Okoli and Udedibie, 2000; Oguike and Onyekweodiri, 2000). In Nigeria egg storage is in most cases under ambient condition. Whilst the retailer usually displays eggs for sale on open paper or plastic egg trays, the housewife often stores them in the same polythene bag used by the retailer in packaging the eggs. Some housewives have refrigerators, but the irregular electric power supply hinders their operation. The objectives of this study were to measure the quality of eggs stored under conditions similar to the prevailing general practice, and derive regression models relating egg quality indices to length of storage.

MATERIALS AND METHODS

The fresh chicken eggs used in this study were obtained directly from a commercial farm in Owerri. The total of 174 eggs were divided into three equal groups, and each group of 58 eggs was allotted to one of three storage conditions. The first was storage in an open plastic bowl kept inside a refrigerator (REF eggs); the second was storage in an open plastic bowl under normal room temperature (OBR eggs); and the third, was storage inside black polythene bag under normal room temperature (PBR eggs). In each storage condition, 30 eggs were used for weight loss determination whilst the remaining 28 eggs were reserved for interior quality assessment. Eggs for weight loss determination were subdivided into 3 replicates and each replicate contained 10 eggs. The weight of each replicate was determined daily, and for 14 consecutive days.

Similarly, the eggs for interior quality measurements were separated into two replicates of

Table 1: Mean scores for various egg quality parameters as affected by temperature and length of storage

Parameter	Storage period (d)	Refrigerator (open bowls)	Not Refrigerated (closed bags)	Not Refrigerated (open bowls)	SEM
Weight (%)	5	0.64[a]	1.13[b]	1.75[c]	0.104
	9	0.93[a]	1.58[b]	2.33[c]	0.096
	14	1.35[a]	2.02[b]	2.99[c]	0.098
Haugh Unit	5	68.35[a]	60.86[a]	49.70[c]	3.726
	9	68.78[a]	53.73[b]	41.91[c]	3.956
	14	66.50[a]	44.95[b]	32.08[a]	3.297
Yolk Index	5	0.47[a]	0.40[b]	0.37[b]	0.030
	9	0.46[a]	0.34[b]	0.31[c]	0.024
	14	0.45[a]	0.30[b]	0.26[c]	0.017

Table 2: Regression equation relating egg quality to duration of storage (days)

Parameter	Correlation coefficient	Significance
Weight loss (%)		
$Y_1 = 0.0537 + 0.1605X$	0.928	***
$Y_2 = 05953 + 0.1864X$	0.986	***
$Y_3 = 0.09635 + 0.989X$	0.989	***
Haugh Unit		
$Y_1 = 72.3167 - 0.7082X$	0.442	NS
$Y_2 = 72.2028 - 3.7712X$	0.896	**
$Y_3 = 62.6242 - 3.8580X$	0.932	***
Yolk Index		
$Y_1 = 0.4850 - 0.0052X$	-0.808	***
$Y_2 = 0.4413 - 0.0209X$	-0.743	***
$Y_3 = 0.4250 - 0.0209X$	-0849	***

14 eggs each. For the 14 days, one egg was removed each day from each replicate, weighed, broken on a Petri dish and the thick albumen height was measured using a spherometer. A Konraws manual weighing balance was used, and weights were obtained to the nearest 0.1 gram. The yolk dimensions were assessed using a Venier caliper. The Haugh unit was calculated as: HU = 100 log (H + 7.57 – $1.7W^{0.37}$), where H = albumen height (mm) and W is egg weight (g). The yolk index was derived by dividing the height of yolk by the width.

Statistical Analyses: The means obtained from the replicates in each storage condition were tested for significant differences at the 5th, 9th and 14th days of storage. Analysis of variance and F – LSD were employed to separate treatment means for their significance. Correlation and linear regression analyses relating egg parameters to number of days of storage were carried out. All statistical computations were executed by the SPSS software (SPSS, 1990).

RESULTS AND DISCUSSION

Differences in percentage weight loss were significantly different ($P < 0.05$) across the three storage conditions on the 5th, 9th and 14th days of storage (Table 1). Consequently the refrigerated eggs suffered the least weight loss, followed by eggs placed in polythene bags. Eggs placed in open bowls and kept under room temperature recorded the greatest weight loss. These results demonstrate the practical advantage of egg storage in closed polythene bags over storage in open bowls or egg trays. Essien *et al.* (1996) made similar observations. Differences in Haugh units and yolk indices amongst the various treatment groups generally followed the trend established by differences in weight loss. It is known that a polythene packaging material provides a barrier to evaporation and other gaseous losses. Therefore, packaging eggs in polythene bags may be somewhat similar to oil coating of eggs in its preserving effect since the latter is known to preserve the interior quality of eggs by minimizing gaseous losses (Knight *et al.*, 1972; Ihekereonye and Ngoddy, 1985; Ikeme and Enelamah, 1985; Okeudo *et al.*, 2003). Nonetheless, storing eggs in the polythene bag in which they were purchased should present less handling problems than oil coating of eggs. Details of correlations between egg quality indices and periods of storage are presented in Table 2. Correlation coefficients (r) were very high, and generally similar to figures reported by Essien *et al.* (1996). Correlation coefficients were highest for eggs placed in bowls and kept under room temperature, and lowest in refrigerated eggs. The implication is that egg quality deterioration was more responsive to days of storage in the former, than in the later, and demonstrates once again the greater tendency for eggs to decay under ambient conditions. Amongst the refrigerated eggs, the relationship between Haugh unit and days of storage was not significant ($P > 0.05$), whereas the relationship between percentage weight loss or yolk index and days of storage was very highly significant ($P < 0.001$). This indicated that refrigeration cannot completely preserve the quality of eggs during the storage period. Certainly this underpins the necessity of packaging eggs in gas proof materials (such as polythene) before

refrigeration. Bell (1996) noted that domestically, eggs are kept in the refrigerator, usually in cartons in which they were retailed. The very high correlation coefficients recorded in this study underscore the usefulness of these regression equations in predicting egg quality changes, even on daily basis.

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