SOME QUALITY PARAMETERS OF LOCAL AND EXOTIC CHICKEN EGGS UNDER DIFFERENT STORAGE CONDITIONS

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ABSTRACT

A study was conducted to investigate different storage conditions viz: refrigeration, oiling, washing eggs and storing in black polythene bags, and a control which comprised eggs not treated and stored in transparent polythene bags for 20 days on local and exotic chicken eggs to determine the best storage conditions. Eggs stored in the refrigerator maintained desirable internal quality followed by eggs intensely oiled and eggs stored in black polythene bags. Eggs kept as control had the least desirable internal quality. For short storage eggs up to 10 days, refrigeration, oiling and washing of eggs and storing in black polythene bags could be used while refrigeration is necesary for eggs storage beyond 10 days. Where refrigeration is not possible, oiling seems to be the best alternative for storage.

Key words: Haugh unit, shape index, yolk index.

INTRODUCTION

The poultry industry is an important segment of the food industry providing eggs and meat to a large populace of the country. Eggs provide a means through which the animal protein needs of the society can easily be met. It is one of the most nutritious and complete foods known to man. Chicken egg protein has a biological value of 1.0 and so shares with human protein the distinction of being a perfect protein. In addition, egg is rich in fats, thiamin, riboflavin, vitamins A and D and is a good dietary source of iron (Ihekoronye and Ngoddy, 1985).

Although egg production rate is the primary trait of interest in the poultry industry, egg quality is also important from the stand-point of consumers, acceptability, market value and hatchability of eggs. Eggs deteriorate in internal quality with time depending on the shell and internal contents of the egg (Orji *et al*, 1981). This quality deterioration causes reduction in nutritional value and hatchability. It is necessary therefore, that more attention should be focussed on storage and marketing of eggs (Olomu, 1975). Although much information is available on the quality of exotic chicken eggs under different storage conditions, little comparative studies have been carried out between the quality of exotic and local chicken eggs under different storage conditions.

This study investigates the best storage conditions for local and exotic chicken eggs as determined by external and internal egg quality parameters.

MATERIALS AND METHODS

A total of 200 chicken eggs (100 local and 100 exotic) were used in this study. The eggs of local chickens were obtained from Bayara, Birshin Fulani, Yelwa, Gwallameji and Wunti markets, all within Bauchi town, while the eggs of exotic chicken were obtained from the Abubakar Tafawa Balewa University Farm, Bauchi. It was ensured that the eggs were made available within 24 hours of lay.

Fifty chicken eggs (25 local and 25 exotic) were randomly selected in each case, treated and stored for 20 days as follows:-

i. Arranged in egg trays and stored in a refrigerator at 18^0C.
ii. Immersed in vegetable oil, allowed to drain for a few seconds and stored at room temperature on a flat surface.
iii. Immersed in lukewarm water (40^0C) washed gently to remove dirts from the shell, placed in black polythene bags (eggs shaded) and stored at room temperature.
iv. Untreated eggs-eggs were placed in transparent polythene bags (not shaded and to maintain constant humidity) and stored at room temperature.

External quality parameters

The following external quality parameters were measured or determined once only at the commencement of the experiment for all the eggs used.

i. Egg (measured at 0,4,8,12,16, and 20 days) and shell weights were measured using a mettler PC 2000 electric weighing machine.
ii. Egg length and diameter were measured using a vernier caliper.
iii. Shell thickness was measured by the use of a micrometer screw gauge.
iv. Shape index was calculated from the ratio EL/ED where EL = egg length and ED = egg diameter.
v. Shell surface area (SA) was determined from the expression SA = 3.9782 x $SW^{0.7062}$.
vi. Shell density (SD) was determined from the expression, SD - SW/(SA x ST) where ST = shell thickness, SA = shell surface area and SW = shell weight.

Internal Measurements

The following egg internal measurements were determined at 0,4,8,12,16 and 20 days for all the 50 eggs in each treatment (25 local and 25 exotic)

i. Yolk height/diameter and albumen height were measured using a vernier caliper.
ii. Yolk index was calculated from the ratio YH/YD where YH = yolk height and YD = Yolk diameter.
iii Haugh unit (HU) was calculated from the albumen height (H) and egg weight (EW) according to the expression $HU = 100 \log (H - 1.7EW^{0.37} + 7.6)$ (Carter, 1975.
iv. Egg weight loss was determined as the different between successive weights of egg at the different weighing days.

Data were subjected to analyses of variance within chicken type with treatment and duration as the two main effects; and between chicken types. Means were subsequently separated using LSD.

RESULTS

Internal egg quality parameters

Average yolk index obtained are in Table 1. Significant differences ($P < 0.05$) exist between treatments, storage durations and interaction between treatment and duration for both local and exotic chicken eggs. The average yolk index values for the local and exotic chicken eggs on the 20th day of storage were between 0.193 and 0.338 between 0.193 and 0.338 for the eggs stored in the control and refrigerator treatments respectively.

Oiled eggs were next to refrigerated ones. No significant difference was found between eggs washed and stored in black polythene bags and control for the first 12 days of storage. Generally, exotic chicken eggs maintained higher yolk index than local ones. Haugh unit indices are presented in Table 2. Significant differences were obtained between treatments and between storage durations for both local and exotic chicken eggs.

For exotic chicken eggs, haugh index progressively decreased with increase in number of days of storage with the decrease being significant in most cases. Although local chicken eggs also showed progressive decrease in haugh index with increase in number of days of storage, most of the decrease were not significant. Generally, there was a more rapid decline of haugh index in exotic than local chicken eggs. The two types of eggs washed and stored in black polythene bags were not different from the control throughout the storage duration. Between refrigerated and oiled eggs however significant difference existed in haugh index of exotic chicken eggs on the 8th day of storage. For local chicken eggs on the other hand significant difference existed between the refrigerated and oiled eggs on the 4th, 8th and 16th days of storage.

In general treatment differences were more pronounced during the 4th and 8th days of storage than for other days. Table 3 shows eggs weight losses under the different storage conditions. There were progressive increases in weight losses with time. Weight losses were most rapid during the first four days but

TABLE1: AVERAGE YOLK INDEX OF CHICKEN EGGS UNDER DIFFERENT STORAGE CONDITIONS

Storage Condition	Duration of Storage (days) 0	4	8	12	16	20	SEM
Refrigerator							
Exotic eggs	0.463	0.437	0.412	0.391	0.360	0.338	0.088
Local eggs	0.401	0.382	0.346	0.325	0.295	0.263	0.093
Intensely oiled							
Exotic eggs	0.473	0.413	0.380	0.359	0.313	0.302	0.096
Local eggs	0.396	0.356	0.327	0.280	0.252	0.236	0.107
Eggs stored in black polythene							
Exotic eggs	0.481	0.404	0.336	0.336	0.294	0.292	0.097
Local eggs	0.400	0.338	0.317	0.268	0.219	0.213	0.107
Control							
Exotic eggs	0.467	0.398	0.360	0.330	0.288	0.264	0.096
Local eggs	0.334	0.317	0.262	0.201	0.193	0.193	0.113
SEM Exotic	0.017	0.055	0.055	0.072	0.072	0.080	
SEM Local	0.024	0.080	0.060	0.072	0.091	0.080	
LSD 0.05 (Exotic/Local) = 0.0125							

TABLE 2: AVERAGE HAUGH UNIT OF CHICKEN EGGS UNDER DIFFERENT STORAGE CONDITIONS

Storage Condition	Duration of Storage (days) 0	4	8	12	16	20	SEM
Refrigeration							
Exotic eggs	56.11	48.11	43.55	41.43	39.97	39.97	0.78
Local eggs	61.07	58.10	55.01	52.06	50.88	41.06	1.13
Intensely Oiled							
Exotic eggs	54.32	47.55	45.53	42.97	39.84	36.56	0.92
Local eggs	59.97	46.46	51.97	51.08	46.91	40.69	1.09
Eggs stored in black polythene							
Exotic eggs	54.39	45.55	42.44	39.61	38.06	32.62	0.92
Local eggs	58.73	55.48	47.92	48.95	45.36	44.75	0.92
Control							
Exotic eggs	56.76	45.35	42.00	39.85	37.57	34.54	0.91
Local Eggs	61.03	55.22	45.80	47.75	44.17	40.12	1.06
SEM Exotic	0.54	0.54	0.50	0.51	0.60	0.79	
SEM Local	0.51	0.51	0.91	0.63	0.76	0.65	
LSD 0.5 (Exotic = 1.22)	(Local = 3.75)						

slowed down thereafter. Highest weight losses were observed for eggs used as control while intensely oiled eggs had lowest weight losses. There was no significant difference ($P < 0.05$) between eggs oiled and all the other storage methods on the 4th day of storage. Exotic chicken eggs in general lost weight faster than local chicken eggs.

External quality parameters

Exotic eggs were significantly ($P < 0.05$) heavier (62.17) Vs (41.96g) than local eggs had higher shape index (0.74 Vs 0.69). Exotic eggs were longer and had wider diameters than the local eggs. There was no appreciable difference between shell thickness 0.373 Vs 0.361mm, for local and exotic eggs respectively. Exotic chicken eggs, however, were heavier ($P < 0.05$) (62.17 41.96g) and had higher shape index than local eggs (0.74 Vs 0.69). Exotic chicken eggs however were ($P < 0.05$) heavier shell weight and shell surface area. In addition shell density was higher in exotic than local eggs.

DISCUSSION

Yolk index and haugh unit are indicators of internal quality of eggs. The higher the yolk index (Ayorinde, 1987) and haugh unit (Carew *et at.* 1983) the more desirable the egg quality.

TABLE 3: AVERAGE WEIGHT LOSS (g) OF CHICKEN EGGS UNDER DIFFERENT STORAGE CONDITIONS

Storage Condition	Duration of storage (days) 4	8	12	16	20	SEM
Refrigeration						
Exotic eggs	0.79	1.26	1.51	1.83	2.06	0.40
Local eggs	0.60	0.87	1.20	1.51	1.71	0.36
Intensely oiled						
Exotic eggs	0.53	0.93	1.52	1.81	2.02	0.50
Local eggs	0.48	0.77	1.13	1.45	1.66	0.34
Eggs stored in black Polythene						
Exotic eggs	0.84	1.35	1.80	2.19	2.54	0.54
Local eggs	0.60	0.94	1.26	1.55	1.86	0.40
Control						
Exotic eggs	0.96	1.36	1.96	2.23	2.64	0.54
Local eggs	0.75	1.36	1.36	1.75	1.97	0.37
SEM Exotic	0.15	0.16	0.18	0.18	0.26	
SEM Local	0.09	0.21	0.08	0.08	0.11	
LSD 0.5 (Exotic = 0.16) (Local = 0.10)						

The highest haugh unit 56.7 for exotic chicken eggs obtained in this study is lower than those obtained by other workers (Butswat, 1983 Westman and Hapner, 1986). According to the classification by Kohlmeyer and shaffner (1944), eggs with haugh unit above 70 are termed A grade, 50 to 69, B grade and below 50, C grade.

The high yolk indices and haugh units for eggs stored in the refrigerator and the relatively lower indices and haugh units for eggs intensely oiled and eggs washed and stored in polythene bags may be attributed to the importance of temperature on embryo metabolism as outlined by Landaver (1961). He pointed out that it is important that the environmental temperature of viable eggs below "physiological zero" to maintian dormancy of the embryo. Orr and fletcher (1973) recommended temperatures of between 10 and 15^{0}C for good egg storage. Panigrahi *et al.* (1989) on the other hand showed that storage of eggs at warm temperatures for one month resulted in yolk mottling while storage of eggs at low temperatures for three months resulted in yolk and albumen discolouration. All storage temperatures in this study were above 18^{0}C thus metabolic activities were taking place under all storage conditions resulting in the quality reduction observed under all the storage conditions. However, temperature under refrigeration was lowest resulting in the higher indices.

As observed in yolk index in this study, similar decrease in thick white and albumen index due to storage brought about by the breakdown of fibrous glycoprotein ovomucin which is accentuated by high pH which in turn increases with storage have been observed (Ihekoronye and Ngoddy, 1985). They also indicated that egg yolk size increases with storage time due to movement of water from the albumen to the yolk as a result of osmotic pressure differences. Increase in yolk size results in reduction in yolk index as was observed in this study.

The decline in egg weight with time as measured by increase in weight losses could be due to water, carbon dioxide, ammonia, nitrogen and hydrogen suphide losses from the eggs (Ihekoronye and Ngoddy, 1985). The declines, however, were not the same for all treatments. Eggs refrigerated and those intensely oiled did not lose as much solvent as those in black polythene bags and the control, therefore, reduction in the quality measurements were not as high in the former as in the latter conditions. This observation is similar to those of Olomu (1975) and Butswat (1983).

The higher haugh units obtained for local eggs may be due to their relatively smaller size.

This suggests that smaller sized eggs within a breed may have some advantages over larger ones as has also been suggested by Iposu *et al.* (1994). Highest weight loss for both the exotic and local eggs were observed in the control while lowest weight loss was observed in eggs intensely oiled. The low weight loss for oiled eggs may be because thin films of oil on the shell blocked pores on eggs surfaces thus preventing the escape of any water or gas.

In Conclusion, the best storage condition for the local and exotic chicken eggs is refrigeration. It would seem reasonable that where refrigeration is not available, oiling will be the next best alternative Eggs may stored in black polythene bags as an alternative to oiling provided the storage duration does not exceed 10 days if desirable internal quality is to be maintained. Exotic chicken eggs maintained higher yolk index with storage than local chicken eggs, while local eggs maintained higher haugh unit and looses weight slower than exotic eggs.

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