EFFECT OF STORAGE AND SPECIES ON THE PERCENTAGE YOLK INDEX AND HAUGH UNIT OF VARIOUS POULTRY SPECIES

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ABSTRACT
This study was designed to compare the egg quality of three poultry species (turkey, chicken and guinea fowl) under two storage methods (refrigeration and room temperature) over 28 days storage period. A total of 72 eggs comprising 24 eggs from each species, were assessed for exterior and interior quality at 0, 7, 14, 21 and 28 days of storage as well as the determination of chemical composition at 0 day of age using the 3 x 2 factorial design. Results obtained showed that the average weight of fresh turkey eggs was 69.13 g; chicken eggs, 60.13 g and guinea fowl eggs, 38.50 g .However, there was significant decline in haugh unit due to species and method of storage, but the decline in guinea fowl eggs was relatively faster from 21st day of storage. These are important issues in egg handling, transportation, processing and consumption.
Keywords: Storage; Percentage yolk index; Haugh unit; three species of poultry eggs.

INRODUCTION
All living organisms need protein because it is the basic structural material from which all body tissues are formed such as muscles, skin, nerves, blood cells, hair, hooves, bone, etc. (Esonu, 2006) No other nutrient can replace protein in the ration, because, in addition to its importance as a structural component, all enzymes and many hormones are proteins (Esonu, 2006). Because of the animal's numerous needs for protein and its irreplaceable nature, there is a certain minimum dietary level recommended for each class of animal, depending on physiological age and type of production (Esonu, 2000). Animal products being one of the most important constituents of human diet which aid in proper development of the body are in short or limited supply. The husbandry system coupled with the hot and humid tropical climate adversely affect product quality. Although eggs are less perishable compared with meat and milk, evidence exist nonetheless showing that chicken egg quality depreciates significantly after one week of storage under ambient condition. Presently, there is scare information on the effect of storage on the quality of poultry eggs of various species and storage temperatures. Turkey eggs and more importantly guinea fowl eggs are consumed in large numbers in Nigeria, and interestingly little are known about changes in exterior, interior and chemical quality parameters during handling and storage. Research in this area is justified because of the immense importance of poultry eggs in human diet, and losses that may be incurred during storage.

MATERIAL AND METHOD
A total of 72 eggs comprising 24 eggs each from turkey, chicken and guinea fowl were used in this study. Fresh turkey and chicken eggs were obtained from a commercial farm at Isuofia in Aguata Local Government Area of Anambra State. Fresh guinea fowl eggs were obtained from dealers in Awka, Anambra State because of wild nature of guinea fowl.
The 24 eggs from each species were divided into two groups of 12 eggs and kept in the refrigerator at 4^{o} C while the second 12 eggs were kept under the ambient temperature of 26 ^{0}C - 30 ^{0}C (room temperature) on a plastic egg crate respectively. The 12 eggs from each group were further sub divided into four of three eggs for each sub groups. Three eggs from each group were cracked for interior and exterior quality measurement at seven days intervals. The albumen height and width were measured using venier caliper. The egg was broken out on a flat plate, and readings were taken in millimeters. Then the albumen was separated from the yolk and poured in a petri dish. The albumen weight was taken. The yolk was separated from the albumen using a spoon and the weight measured on the sensitive electronic balance. The yolk height and width were measured with the pin end of venier caliper. The haugh unit was calculated using the formula derived by Haugh (1937):

$$HU = 100Log (H+7.57 – 1.7W^{0.37})$$

Where H = Observed albumen height (mm) and

W = Observed weight of eggs (g)

The ratio of yolk height to average of the width was taken as the yolk index while the ratio of the albumen height to average albumen width was also taken as the albumen index.

Statistical analyses were carried out using the 3 x 2 factorial designs. Factors were 3 poultry species (turkey, chicken and guinea fowl) and 2 storage methods (refrigeration and room storage). Data analysis was executed using the analysis of variance for completely randomized design. Egg quality parameters were regressed on shell thickness / percentage weight loss, and the correlation coefficients tested for significance. Means having significant differences were separated using the least significant difference (LSD) method as describe by Snedecor and Cochram (1983). Statistical analysis was performed using SAS (1999) computer application software.

RESULTS AND DISCUSSION

The effect of species by storage method interaction is shown in table 4.8. Generally and in few exceptions yolk index was highest in guinea fowl eggs throughout the four storage periods in both refrigerated and room temperature stored eggs (P>0.05). After the 7th day of storage, yolk indices of guinea fowl and chicken eggs stored under refrigeration were similar to yolk indices of counterparts stored under room temperature, whereas for turkey eggs room temperature stored eggs were significantly lower in yolk index than those stored under refrigeration (P<0.05). After the 28th day of storage, species related differences in yolk index among eggs stored under refrigeration were not significant (P>0.05) whereas under room temperature storage, guinea fowl and turkey eggs were similar in yolk index, while chicken eggs were significantly lower in yolk index than eggs from the other two species (P<0.05).

These results suggests that based on the yolk index, guinea fowl eggs would have longer shelf life than turkey or chicken eggs. This observation is supported by the lower weight loss suffered by guinea fowl eggs during storage compared with turkey and chicken eggs (Tables 4.2 and 4.3). However, this is contradicted by the higher haugh unit value recorded by turkey eggs during storage compared with guinea fowl eggs (Table 4.4). Although the haugh unit and yolk index are considered to be the best indicators of interior egg quality (Ogunwole *et al.,2017*), the yolk index may be better than the haugh unit when comparisons across different species are undertaken.

The effect of length of storage on haugh unit of turkey, chicken and guinea fowl eggs are presented in Table 4.4. Although, fresh guinea fowl eggs were significantly higher (P<0.05) in haugh unit than turkey and chicken eggs, this was not the case during storage. By the 7th and 28th days of storage, turkey eggs were significantly higher (P<0.05) in haugh unit than chicken and guinea fowl eggs, whereas chicken eggs were higher (P < 0.05) in haugh unit than the eggs from the other two species by the 21st day of storage. Differences in haugh unit between the three poultry species were not significant (P>0.05) by the 14th day of storage. These results indicate that no clear trend could be established in the differences in haugh unit between these species during a storage period of 28 days. However, in all the poultry species and for all the storage periods, eggs stored in the refrigerator were consistently higher in haugh unit (P<0.05) than eggs stored under room temperature. This was in support with Akinola, and Iyomo,(2018). Species by storage interaction effect was not significant (P>0.05) in any of the storage period.

Table 1: Effect of storage and species on the haugh unit of various poultry species

Days	**7**	**14**	**21**	**28**
Species				
Turkey	63.86[a]	50.99	39.7[b]	32.68[a]
Chicken	55.28[b]	49.41	43.17[a]	25.15[c]
Guinea fowl	56.06[b]	48.69	36.04[c]	29.56[b]
SEM	1.18	0.73	0.58	0.36
Storage				
RM	45.53[b]	35.16[b]	26.01[b]	19.06[b]
RG	71.27[a]	64.23[a]	53.29[a]	39.19[a]
SEM	0.964	0.595	0.476	0.292
Interaction				
(Species x Storage)	NS	NS	NS	NS

[a, b, c,] Means in the same column bearing different superscript(s) are significantly different (P< 0.05)
RM = Eggs stored under room temperature
RG = Refrigerated eggs
SEM= Standard error of the mean

Table 2: Effect of storage and species on the yolk index of various poultry species

Days	**7**	**14**	**21**	**28**
Species				
Turkey	0.27[b]	0.31[b]	0.33[ab]	0.29[ab]
Chicken	0.49[a]	0.38[b]	0.32[b]	0.24[b]
Guinea fowl	0.48[a]	0.52[a]	0.40[a]	0.39[a]
SEM	0.029	0.023	0.023	0.35
Storage				
RM	0.40[a]	0.37[a]	0.27[b]	0.19[b]
RG	0.42[a]	0.44[a]	0.42[a]	0.43[a]
SEM	0.029	0.023	0.023	0.35
Interaction				
(Species x Storage)	**	**	**	**

[a, b, c,] Means in the same column bearing different superscript(s) are significantly different (P< 0.05)
RM = Eggs stored under room temperature
RG = Refrigerated eggs
SEM= Standard error of the mean

Table 3: Interaction means on the percentage yolk index between turkey, chicken, and guinea fowl egg stored in room temperature verses refrigeration temperature.

Species	RM	RG 7 days storage
Turkey	0.21^{c}	0.32^{b}
Chicken	0.56^{a}	0.41^{ab}
Guinea fowl	0.42^{ab}	0.54^{a}
SEM		0.054
14 days storage		
Turkey	0.28^{c}	0.34^{bc}
Chicken	0.35^{b}	0.41^{b}
Guinea fowl	0.47^{ab}	0.57^{a}
SEM		0.043
21 days storage		
Turkey	0.30^{bc}	0.35^{bc}
Chicken	0.23^{c}	0.40^{ab}
Guinea fowl	0.27^{c}	0.52^{a}
SEM		0.043
28 days storage		
Turkey	0.24^{b}	0.34^{ab}
Chicken	0.07^{c}	0.41^{a}
Guinea fowl	0.25^{b}	0.53^{a}
SEM		0.065

$^{a, b, c,}$ Means in the same column bearing different superscript(s) are significantly different ($P< 0.05$)
RM = Eggs stored under room temperature
RG = Refrigerated eggs
SEM= Standard error of the mean

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