COMPARISON OF PROXIMATE COMPOSITION, INTERNAL AND EXTERNAL QUALITIES OF EGGS FROM FOUR SPECIES OF POULTRY MARKETED IN SAMARU ZARIA, NIGERIA

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ABSTRACT
The objective of this study was to compare the proximate composition, internal and external qualities of eggs from four species of poultry (exotic chicken: ISA brown, local chicken: normal feathered, guinea fowl and quail), marketed in Samaru Zaria, Nigeria. A total of 240 eggs (60 for each specie) was purchased within the Samaru environment in Zaria, Nigeria. Data collected was subjected to one way analysis of variance procedure of SAS. Results showed that for most of the internal egg quality traits studied, exotic chicken had the highest value followed by guinea fowl and local chicken. The albumen pH ranged from 7.84 (for quail egg) to 8.35 (for guinea fowl egg), which is within normal pH range of 7.5 to 8.5 reported in literature. For external egg quality traits, the results showed that, there was significant difference ($P<0.05$) for most of the tested parameters. The exotic chicken egg is significantly (P0.05) heavier (56.116g) than others. This translates to other related traits as egg length and egg diameter, which were significantly higher in eggs from the exotic chicken as compared to eggs from other poultry species. However, eggs from guinea fowl had the highest value for egg shell thickness (0.414mm) and egg shell weight (7.116g) compared to eggs from other poultry species. This means guinea fowl eggs may have advantage over eggs from other poultry species to withstand cracks and breakages during handling and transportation.

INTRODUCTION
Poultry egg is a rich source of high quality protein and provides a unique source of nutrient for humans (Okoh, *et al.,* 1989). In Nigeria, different poultry species contribute significantly to the annual animal protein supply to the populace (Ikeobi *et al.,* 1999). Poultry eggs are good sources of income and are of particular significance in scientific research, such as vaccine production (Adebambo, 2005). The egg is a complex structure distinguished by having four different parts: the egg shell, shell membrane, albumen and yolk. When eggs are for human consumption, it is important that they are suitable for this purpose (Kabir *et al.,* 2014). This will be determined by both the internal and external quality of the egg (Smith, ,1990). Quality has been defined by Kramer (1951) as the properties of any given food that has influence on the acceptance or rejection of this food by the consumer. Egg quality is composed of those characteristics that affect its acceptability to consumers such as cleanliness, freshness, egg weight, shell quality; yolk index, albumen index, Haugh unit and chemical composition (Stadelman, 1977; Song *et al.,* 2000). Egg quality is a general term which refers to several standards which define both internal and external quality. External quality is focused on egg shell cleanliness and thickness, egg weight, height, width and shape whereas internal quality refers to albumen cleanliness and viscosity, yolk quality and absence of blood spots (Jacob *et al.,* 2000; Kabir *et al.,* 2014). Unlike external (shell) quality, internal quality of the egg begins to decline as soon as the egg is laid. It was reported by Kabir and Muhammad (2011) that, although factors associated with the management and nutrition of the hen do play a role in internal egg quality, egg handling and storage practices do have a significant impact on the quality of the egg reaching the consumer. The objective of this study is to determine the proximate composition of eggs from different poultry species and compare their internal and external qualities for the benefit of the consumer in and around Samaru, Zaria.

MATERIALS AND METHODS
The experiment was conducted at the biochemistry laboratory of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Samaru, Zaria, Kaduna state. Description of the study area was earlier given by Kabir and Olufemi (2013). Two hundred and forty eggs (60 from each of the 4 species) produced by local chicken (normal feathered), exotic chicken (ISA brown), guinea fowl and Japanese quail, were used. The eggs were purchased fresh from Samaru, Zaria. The parameters for external egg quality traits

include egg weight (EWt), egg length (EL), egg diameter (ED), egg shell weight (ESWt) and egg shell thickness (EST). The internal egg quality traits include albumen weight (AlbWt), albumen height (AlbHt), albumen diameter (AlbD), albumen pH (AlbpH), yolk weight (YlkWt), yolk height (YlkHt), yolk diameter (YlkD), yolk pH (YlkpH). The parameters used for proximate analysis include dry matter (DM), crude protein (CP), oil, ash and nitrogen free extract (NFE). All weight measurements were taken in grams while length measurements were in millimeters and centimeters. Proximate analysis of the egg was also carried out. Data collected was subjected to one way analysis of variance procedure of SAS (2003). Significant means were separated using Duncan Multiple Range Test, (Duncan, 1955).

The following statistical model was employed:

$$Y_{ij} = \mu + B_i + e_{ij}$$

Where: Y_{ij}= Individual observation, μ= Overall mean, B_i= Effect of the i^{th} poultry species (i= 1, 2, 3, 4) and e_{ij}= Random error.

RESULTS AND DISCUSSION

Proximate Analysis: The proximate composition of eggs from four species of poultry was shown in Table 1. The dry matter, crude protein and oil contents of ISA Brown eggs were significantly different (P<0.05) from the others. The oil content of quail egg obtained in the present study was lower than that of Japanese quail reported by Song *et al.*, (2000). This could be due to differences in strains of quails used, seasonal factor, feed and age of birds (Nagarian *et al.*, 1991; Tanabe and Ogawa, 1975; Izat *et al.*, 1986). Quail eggs had the highest ash and nitrogen free extract content.

External Qualities: Table 2 shows the external quality traits based on various poultry species. The eggs from exotic chicken had the highest egg weight, egg length and egg diameter. Guinea fowl eggs had significantly (P<0.05) higher shell thickness and shell weight, which could be the reason for the better shell strength known for guinea fowl eggs. This observation confirmed the earlier findings of Okezie, (2006), who attributed this as advantage over other eggs to withstand cracks and breakages during handling and transportation.

Internal Qualities: Table 3 shows the internal quality traits for eggs from various poultry species. The exotic chicken had the highest albumen weight, albumen height and albumen diameter. No significant difference (P>0.05) was observed for the albumen diameter of guinea fowl eggs and that of local chicken eggs. Similarly, there was no significant difference (P>0.05) between the yolk weight of eggs from exotic chicken and those from guinea fowl. The yolk weight of eggs from guinea fowl and local chicken were at par. The albumen height and yolk height of exotic chicken and local chicken eggs were significant (P<0.05) different. The yolk diameter and yolk pH of guinea fowl eggs and local chicken eggs were not significantly different (P>0.05). The albumen pH obtained from eggs of various poultry species studied herein ranged from 7.84 (for quail egg) to 8.35 (for guinea fowl egg), which is within normal pH range of 7.5 to 8.5 indicated by Silversides and Scott, (2001). In a newly laid egg the albumen pH lies between 7.6 and 8.5. During storage, the albumen pH increases at a temperature dependent rate to a maximum value of about 9.7 (Heath, 1977). After 3 days of storage at 33°C, Sharp and Powell (1931) found an albumen pH of 9.18. After 21 days of storage, the albumen had a pH of 9.4 regardless of storage temperature between 33 and 35°C (Li-Chan *et al.*, 1995). Heath (1977) observed that when carbon dioxide (CO_2) loss was prevented by the oiling of the shell, the albumen pH of 8.3 did not change over a 7-day period of storage at 22°C. In oiled eggs stored at 7°C, albumen pH dropped from 8.3 to 8.1 in seven days (Li-Chan *et al.*, 1995). Increases in albumen pH are due to CO_2 loss through the shell pores, and depend on dissolved CO_2, bicarbonate ions, carbonate ions and protein equilibrium.

Conclusion: Based on the findings of this study, exotic chicken and quail eggs had the best egg quality. This may be attributed to the diverse use of exotic chicken's eggs and the medicinal attributes of quail eggs. On the other hand, guinea fowl eggs are strong with thick egg shell, which are more resistant to handling and transportation breakages.

REFERENCES

Adebambo, O.A. (2005). Indigenous poultry breeds genetic improvement for meat and egg. *Proceedings 1st Nigerian International Poultry Summit : 1-8.*

Ikeobi, C.O.M., Hyginus, C.M., Adenowo, J.A and Adebambo, O.A. (1999). Egg quality characteristics of four poultry species in Nigeria, *Tropical Journal of Animal Science* 1 (1): 37-42.

Jacob, J.E., Miles, R.D. and Mather, F.B. (2000). Egg quality. US Department of Agriculture, cooperative extension services, University of Florida, IFAS.

Kabir, M., Sulaiman, R.O., Idris, R.K., Abdu, S.B., Daudu, O.M., Yashim, S.M., Hassan, M.R., Adamu, H.Y., Eche, N.M., Olugbemi, T.S. and Adedibu, I.I. (2014). Effects of strain, age and the interrelationships between external and internal qualities of eggs in two strains of layer chickens in northern Guinea savannah zone of Nigeria, *Iranian Journal of Applied Animal Science,* 4 (1): 179-184. http://ijas.ir/main/uploads/userfiles/files/Kabir%20%2813-154%29.pdf

Kabir, M. and Olufemi, O. (2013). Prediction of body weight from linear body measurements at eight weeks of age in two broiler breeds in northern Nigeria, *Proceedings 4th Nigerian International Poultry Summit,* UNAAB Abeokuta, Pp 85-90,

Kabir, M. and Muhammad, S.M. (2011). Comparative study of fertility and hatchability in Shika-brown commercial and parent stock egg-type chickens in Zaria-Nigeria. *Nigerian Poultry Science Journal,* 8:37-41.

Kramer, A. (1951). What is quality and how it can be measured: from a food technology point of view. In market demand and product quality market resource Workshop department. Michigan state college.

Okoh, P.N., Olomu , J.M., Dim, N.I. and Aduku, A.O. (1989). A comparative study of the physical and chemical characteristics of guinea fowl and domestic chicken egg, *Nigerian Journal of Animal Production,* 1(6): 64-68.

Smith A.J. (1990). Poultry. Macmillian press limited. page 128-133.

Song, K.T., Choi, S.H. and Oh, H.R. (2000). A comparison of egg quality of Pheasant, Chykar, Quail and Guinea fowl. *Asian-Australia Animal Science* 13(7): 18-22.

Stadelman, W.J. (1977). Quality preservation of shell eggs in egg science and technology (2nd edition) (Ed. W.J. Stadelman and O.J. Cotterill) AVI Publishing Company Inc. Westport, Connecticut, pp41-47.

Table 1. Proximate composition of eggs from various poultry species

Poultry species	DM	CP	Oil	Ash	NFE
Local chicken	25.586^{d}	18.891^{d}	10.887^{c}	1.197^{c}	68.988^{b}
Exotic chicken	38.525^{a}	19.646^{a}	11.077^{a}	1.543^{b}	67.662^{d}
Guinea fowl	32.907^{b}	19.175^{c}	11.036^{b}	1.190^{c}	68.527^{c}
Quail	30.671^{c}	19.280^{b}	0.187^{d}	1.576^{a}	78.982^{a}
SEM	0.008	0.005	0.004	0.004	0.008

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

DM: dry matter, CP: crude protein, NFE: nitrogen free extract, SEM: standard error of mean.

Table 2. External egg quality traits in various poultry species

Poultry species	EWt (g)	EL (cm)	ED (cm)	ESWt (g)	EST (mm)
Local chicken	36.966^{c}	3.662^{b}	2.338^{c}	3.233^{c}	0.109^{c}
Exotic chicken	56.116^{a}	4.227^{a}	2.930^{a}	5.516^{b}	0.340^{b}
Guinea fowl	42.416^{b}	3.461^{c}	2.539^{b}	7.116^{a}	0.414^{a}
Quail	8.183^{d}	1.519^{d}	0.915^{d}	2.125^{d}	0.063^{d}
SEM	0.008	0.005	0.004	0.004	0.008

^{abcd}: Means in the same column not sharing a common superscript letter are significantly different ($P<0.05$). EWt: egg weight, EL: egg length, ED: egg diameter, ESWt: egg shell weight, EST: egg shell thickness, SEM: standard error of mean.

Table 3. Internal egg quality traits in various poultry species

Poultry species	Albwt (g)	AlbHt (cm)	AlbD (cm)	AlbpH	YlkWt (g)	YlkHt (cm)	YlkD (cm)	YlkpH
Local chicken	20.133^{b}	6.010^{c}	4.937^{b}	8.346^{a}	12.400^{b}	12.200^{c}	2.240^{b}	6.570^{b}
Exotic chicken	35.916^{a}	6.74^{a}	5.974^{a}	8.030^{b}	13.050^{a}	15.600^{a}	2.460^{a}	7.500^{a}
Guinea fowl	20.750^{b}	6.24^{b}	4.764^{b}	8.355^{a}	12.783^{ab}	12.400^{b}	2.275^{b}	6.580^{b}
Quail	4.033^{c}	3.500^{d}	2.015^{c}	7.840^{c}	2.766^{c}	3.900^{d}	0.650^{c}	5.051^{c}
SEM	0.034	0.017	0.008	0.0002	0.023	0.003	0.002	0.002

^{abcd}: Means in the same column not sharing a common superscript letter are significantly different (P<0.05). Albwt: albumen weight, AlbHt: albumen height, AlbD: albumen diameter, AlbpH: albumen pH, YlkWt: yolk weight, YlkHt: yolk height, YlkD: yolk diameter, YlkpH: yolk pH, SEM: standard error of mean.