EFFECT OF DURATION OF STORAGE ON EGG QUALITY

[*]Adeoye, A.A., [**]Udoh, J.E., [***]Oladepo, A.D., & [****]Ojajuni, J.B
[*]Animal Production and Health, Ondo State University of Science and Technology, Okitipupa.
[***]Agricultural Science, Adeyemi College of Education, Ondo
[**]Animal Science Department, University of Uyo, Uyo
[****]Zoology programme, Ondo State University of Science and Technology, Okitipupa
e-mail address:adeomoh@yahoo.com; Phone No. 08138273174

ABSTRACT
One hundred and twenty (120) freshly laid eggs by 36 weeks old Isa brown layers kept at the Poultry Unit, Teaching and Research Farm, Ondo State University of Science and Technology, Okitipupa were randomly collected and stored at room temperature for 21 days. At week 0, week1, week 2 and week 3 of storage, 30 eggs were broken for egg quality analysis. Data collected were subjected to statistical analysis. Duration of storage had significant effect ($p<0.05$) on all the internal and external parameters except shell index and shell thickness. The overall egg weight, egg length, egg width, shell index, shell weight, shell ratio and shell thickness were 56.82, 5.69, 4.43, 78.02, 7.45, 13.11 and 0.28 respectively, while yolk height, albumen height, yolk weight, albumen weight, albumen ratio, yolk ratio and Haugh unit were 13.55, 4.97, 16.32, 33.06, 58.11, 28.82 and 67.50 respectively. Most of the traits declined in values as the storage duration increased except yolk weight and ratio which increased as the egg aged. Duration of storage of egg had effect on the egg quality that determines acceptability by consumers.
Keywords: Eggs; Isa brown; storage duration; shell index; yolk ratio

INTRODUCTION
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 is determined by both the internal and external quality (Smith, 1990). Egg quality is composed of characteristics that affect its acceptability to consumers such as cleanliness, freshness, weight, shell quality, yolk index, albumen index, Haugh unit and chemical composition (Song *et al.*, 2000). Unlike external quality, internal egg quality begins to decline as soon as the egg is laid. Variability in the quality and nutritional values of eggs have significant impact on consumers' health and welfare. Some factors affect egg quality. They include the breed and strain of layers (Kucukyilmaz *et al*., 2012), dietary composition (Goldberg *et al*., 2012), birds' health, environmental conditions and storage, processing and handling and age (Ryu *et al*., 2011 and Kabir *et al.*, 2014). The objective of this study is to determine the effect of duration of storage on the internal and external quality of eggs kept at room temperature.

MATERIALS AND METHODS
One hundred and twenty (120) freshly laid eggs were randomly collected in a batch from 36 weeks old exotic chickens (Isa Brown) kept at the Poultry Unit, Teaching and Research Farm, Ondo State University of Science and Technology, Okitipupa, 30 of the eggs were analysed for internal and external quality within 24 hours of laying. The remaining were stored at room temperature on the laboratory desk and at weekly interval 30 eggs were randomly selected till 21 days and similarly analysed.The external quality parameters included egg weight (EWt), egg length (EL), egg shell weight (ESWt), egg width (EWdt), shell index (SIdx), shell ratio (SRatio) and egg shell thickness (EST). The internal egg quality traits included albumen weight (AlbWt), albumen height (AlbHt), albumen ratio (AlbRatio), yolk weight (YlkWt), yolk height (YlkHt), yolk ratio (YlkRatio), Haugh unit (Hu).Data collected were 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:

$Yij = \mu + Di + eij$

Where: Yij= Individual observation, μ= Overall mean, Di= Effect of the ith duration (i= 1, 2, 3, 4) and eij= Random error.

RESULTS

Table 1 shows the summary statistics of egg quality traits. The external quality traits - egg weight, length, width and shell index, weight, ratio and thickness were 56.82 g, 5.69 mm, 4.43mm, 78.02 %, 7.45 g, 13.11 %, 0.28 mm respectively, for external traits. The internal quality - yolk height, albumen height, yolk weight, albumen weight, albumen ratio, yolk ratio and Haugh unit were 13.55 mm, 4.97 mm, 16.32 g, 33.06 g, 58.11 %, 28.82 % and 67.50 respectively.

Table 1. Summary Statistics for egg quality traits

Variables	Means	N	Minimum	Maximum	CV
Egg weight (g)	56.82 ± 0.40	109	47.3	67.96	7.37
Egg length (mm)	5.69 ± 0.03	109	5.06	6.62	6.39
Egg width (mm)	4.43 ± 0.02	109	4.06	5.28	6.12
Shell index	78.02 ± 0.50	109	64.23	92.63	6.70
Shell weight (g)	7.45 ± 0.07	109	5.60	9.14	9.39
Shell ratio	13.11 ± 0.10	109	10.91	15.52	7.58
Shell thickness (mm)	0.28 ± 0.02	109	0.01	0.49	59.40
Yolk height (mm)	13.55 ± 0.23	85	7.09	16.90	15.84
Albumen height (mm)	4.97 ± 0.15	107	2.36	10.23	30.76
Yolk weight (mm)	16.32 ± 0.19	89	12.50	22.90	10.92
Albumen weight (g)	33.06 ± 0.40	89	24.10	41.87	11.41
Albumen ratio	58.11 ± 0.37	89	46.35	65.20	6.02
Yolk ratio	28.82 ± 0.34	89	21.22	40.00	10.98
Haugh unit	67.50 ± 1.21	107	40.15	100.00	18.58

Table 2 shows the effect of duration of storage on the external traits. Significant difference ($P<0.05$) was observed in all the traits considered except shell index. In egg weight, no significant difference was observed from week 0 to 2. Egg weight reduced with age. Egg lengths across weeks were 5.72, 5.87, 5.63 and 5.49 mm. No significant difference was observed from week 0 to 2. Similar trends were observed in egg width and shell ratio. The values for shell weight were 7.72, 7.38, 7.19 and 7.43 for the weeks respectively. Table 3 shows the effect of storage duration on the internal quality traits. Significant difference ($P<0.05$) was observed in all the traits considered. For yolk height, significant difference was observed from week 0 to 3. Hence, yolk height reduced as the egg age. The values for albumen height were 6.80, 4.32, 4.30 and 3.86. Similar trend was observed for albumen ratio and Haugh unit. Albumen ratio reduced as the egg age, but yolk ratio increased with age.

Table 2: Effect of storage duration on external quality of egg

Variable	0-week	1-week	2-week	3-week	SEM
Egg weight (g)	58.48^{a}	57.38^{a}	56.29^{a}	53.94^{b}	0.40
Egg length (mm)	5.72^{ab}	5.87^{a}	5.63^{bc}	5.49^{c}	0.03
Egg width (mm)	4.48^{ab}	4.54^{a}	4.36^{bc}	4.27^{c}	0.03
Shell index	78.52^{a}	77.61^{a}	78.06^{a}	77.84^{a}	0.50
Shell weight (g)	7.72^{a}	7.38^{ab}	7.19^{b}	7.43^{ab}	0.07
Shell ratio	13.22^{b}	12.87^{b}	12.78^{b}	13.44^{a}	0.10
Shell thickness (mm)	0.24^{a}	0.30^{a}	0.26^{a}	0.33^{a}	0.02

Means with different superscript in a row are significantly different ($p<0.05$)

Table 3: Effect of storage duration on internal quality of egg

Variable	0-week	1-week	2-week	3-week	SEM
Yolk height	15.22[a]	14.37[b]	11.52[c]	10.33[d]	0.23
Albumen height	6.80[a]	4.32[b]	4.30[b]	3.86[b]	0.15
Yolk weight	15.54[b]	16.56[ab]	16.53[ab]	17.09[a]	0.19
Albumen weight	35.09[a]	33.36[ab]	32.61[b]	28.96[c]	0.40
Albumen ratio	60.10[a]	58.15[b]	57.89[b]	54.29[b]	0.37
Yolk ratio	26.71[c]	28.94[b]	29.38[b]	32.04[a]	0.34
Haugh unit	81.48[a]	61.68[b]	63.39[b]	58.98[b]	1.21

Means with different superscript in a row are significantly different ($p<0.05$)

DISCUSSION

The significant effect of duration of storage observed on virtually all egg quality traits observed in this study is in agreement with the works of earlier researchers (Akyurek and Okur, 2009; Silversides and Scott, 2001; Sekeroglu *et al.*, 2008; Sung and Kyung, 2014). The decrease in egg weight observed in this study as egg aged could be attributed to evaporation of water through the shell pores. This is in line with the observation of Sung and Kyung (2014). This could also be responsible for decrease in Haugh unit, albumin weight, yolk height, albumen height with age. However, yolk weight increased as the duration of egg storage increased,Khan *et al*. (2013) postulated the movement of water from albumen to the yolk as the possible explanation of the increased yolk weight with storage duration. This also accounted for decrease in albumen weight.During aging there is carbodioxide and oxygen exchange and water evaporates through the shell increasing the air chamber and reducing albumen height. The Haugh unit of 61.6 at the seventh day of storage is lower to 66.2 reported by Sung and Kyung, 2014 at room temperature. The discrepancies could be attributed to differences in age and breed of the layers used. The non-significant effect of storage duration on shell thickness and shell index is similar to the observation of Sung and Kyung, 2014 while the significant effect observed in shell weight is contrary to the report of the researchers. It could be concluded that storage reduces the acceptability of egg by consumers as quality is grossly affected.

REFERENCES

Akyurek, H. and A.A. Okur, (2009). Effect of storage time, temperature and hen age on egg quality in freerange layer hens. *J. Anim. Vet. Adv*., 8: 1953-195

Goldberg, E.M., Gakhar, N., Ryland, D., Aliani, M., Gibson, R.A., House, J.D., (2012). Fattyacid profile and sensory characteristics of table eggs from laying hens fed hempseed and hempseed oil. *J. Food. Sci.* 77:153-160.

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 ofApplied Animal Science*, 4 (1): 179-184.

Khan, M.J.A., S.H. Khan, A. Bukhsh, M.I. Abbass and M. Javed, (2013). Effect of different storage period on egg weight, internal egg quality and hatchability characteristics of Fayumi eggs. *Ital. J. Anim. Sci.,* 12: 51.

Kucukyilmaz, K., Bozkurt, M., Yamaner, C., Cýnar, M., Catl, A.U., Konak, R., (2012).Effect of an organic and conventional rearing system on the mineral content of hen eggs. *Food Chem*. 132:989-992

Ryu, K.N., No, H.K., Prinyawiwatkul, W., (2011). Internal quality and shelf life of eggs coated with oils from different sources. *J. Food. Sci*. 76:325-329.

Sekeroglu, A., M. Sarica, E. Demir, Z. Ulutas, M. Tilki and M. Saatci, (2008). The effects of housing system and storage length on the quality of eggs produced by two lines of laying hens. *Arch. Geflugelk*, 72: 106- 109.

Silversides, F.G. and T.A. Scott, (2001). Effect of storage and layer age on quality of eggs from two lines of hens. *Poult. Sci*., 80: 1240-1245

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.

Sung Heon Chung and Kyung-Woo Lee, (2014). Effect of Hen Age, Storage Duration and Temperature onEgg Quality in Laying Hens. *International Journal of Poultry Science* 13 (11): 634-636, 2014