IJAIR

International Journal of Agriculture Innovations and Research
Volume 5, Issue 5, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received: 31/03/2017 | Accepted on : 06/04/2017 | Published : 18/04/2017

Effects of Preincubation Storage Length and Egg Quality of Baladi Hatching Eggs on Hatchability Parameters

A.A. Alsobayel*, B.Y. Alganad and A.A. AlAbdullatif
Department of Animal Production, College of Food & Agricultural Sciences, King Saud University, P.O Box 2460, Riyadh, Saudi Arabia.
*Corresponding author email id: asobayel@yahoo.com

***Abstract* – A total of 800 Baladi hatching eggs were obtained from the baladi population which has been randomly bred for several years in the Poultry and Livestock Experimental Station of the Animal Production Department, College of Food &Agricultural Sciences, King Saud University. Hatching eggs were randomly divided into 4 experimental groups (200 eggs in each). Each experimental group was divided into three weight groups (<52, 52-56 and >56g) and were stored for 0, 5, 10 and15 days under 80% relative humidity and 15±1 ºC. Fresh eggs were individually weighed before and after storage and incubated following usual hatchery practices. Fifty eggs of each experimental groups were broken out at the end of storage period to determine the effect of storage length and egg group weight on some external (specific gravity and air cell depth) and internal (Haugh units, albumen and yolk pH) egg quality traits. Storage period had a significant (p≤ 0.05) negative effect upon fertile and total egg hatchability, early and total embryonic mortality and all studied egg quality characteristics, whereas egg weight group and EWxST had no significant effect upon all studied traits. From the results of the study we conclude that prolonged storage period of hatching eggs for 10 days or more had a pronounced adverse effect on egg quality and hatchability parameters. whereas egg weight group had statistically no adverse effect upon all studied traits.**

***Keywords* – Egg Quality, Hatching Eggs, Hatchability Parameters, Preincubation Storage.**

I. Introduction

Storage of hatching eggs is an indispensable part of hatchery operation, even though storage length and conditions may influence embryonic viability. Several investigators reported decreased apparent fertility (1, 2, 3, 4, 5, 6, 7) fertile hatchability and total hatchability (1, 4, 5, 6) and increased embryonic mortality (1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 4, 13) the longer the duration of the pre-incubation storage of hatching eggs. Some other investigators reported that prolonged hatching eggs storage lead to increased egg weight loss (2, 5, 6, 13, 14, 15, 16), yolk and albumen pH (9, 12, 17) and air cell depth (12, 17) and decreased Haugh unit values (6, 9, 12, 14, 17, 18) and specific gravity (17, 18). Malik et al. (2015) reported that small eggs Cobb broiler breeder (65-69 g) had significantly better apparent fertility and total egg hatchability than large eggs large (75-80g). Similarly was reported by Edibol and Brake (2008) with respect to fertile hatchability and embryonic mortality. Other investigators recommended eggs of average weight to attain good hatchability (20, 21, 22, 23, 24, 25, 26). However, Brake et al., (1997) reported that the effect of hatching egg storage on embryonic viability depends on storage time duration, environmental conditions, hen age and strain of breeders. Therefore the study was conducted to assess the effect of prolonged hatching eggs storage and egg quality of Baladi chickens on hatchability parameters.

II. Material and Methods

A total of 800 Baladi hatching eggs were obtained from the Baladi population which has been bred for several years in the Poultry and Livestock Experimental Station of the Animal Production Department, College of Food & Agricultural Sciences, King Saud University. Hatching eggs were divided into 4 experimental groups (200 eggs in each) and were stored for 0, 5, 10 and 15 days under 80% relative humidity and 15±1 ºC. Fresh eggs of each experimental group were individually weighed, divided into three weight groups (<52, 52-56 and >56g) and reweighted after storage to determine weight loss. Fifty eggs of each experimental groups were broken out at the end of storage period to determine the effect of storage length and egg group weight on some external (specific gravity and air cell depth), internal (Haugh units and albumen and yolk pH), egg quality traits. Albumen and yolk pH were measured using H12212 pH Meter (HANA instruments.). Following usual hatchery practices, eggs were incubated in moving air incubators (Maino Enrico, Co, Italy) under 37.5±0.2 ºC and 65 % relative humidity and were turned automatically 6 times a day, once every 4 hours from the first day up to the 18th day of the incubation period. On the 18th day of incubation, the eggs were transferred to the hatcher where the temperature and relative humidity were 37 ºC and 65 %, respectively. The trays were designed to separate hatching chicks and do not allow them to move from their places and mix. The eggs were candled at the end of first week and 18th day of incubation period to determine percentages of fertility and early and late embryonic mortality. Data obtained were subjected to statistical analysis using the General Linear Models procedures (28) using the following statistical model:

$Y_{ijk} = \mu + ST_i + EW_j + ST_i * EGj + e_{ijk}$ Where:

Y_{ijk} is the 1^{th} observation of the i^{th} storage period (ST), j^{th} egg weight group (EW).

μ is the general mean.

ST_i is effect of storage period.

EW_j is effect of egg weight group.

$ST_i * EW_j$ is the interaction.

e_{ijk} is the random error associated with Y_{ijk} observation.

III. Results

Apparent fertility (AF): The result in Table (1) indicates that there was no significant storage period (ST), egg weight (EW) and ST x EW effect on AF tended to decrease with increased storage period and tended to be higher for the small egg weight group (Table 1).

Hatchability of total eggs (HT): The result in Table (1) indicates that that there was a highly significant (p≤ 0.01) storage period (ST) effect on total hatchability but egg weight (EW) and ST x EW effects were not significant. HT decreased in general with increased storage period but the decrease significant (p≤ 0.05) after 5 days of storage period. The same Table also shows that HT of stored hatching eggs for ten and fifteen days did not differ significantly and HT tended to decrease with increased egg weight.

Hatchability of fertile eggs (HF): The result in Table (1) indicates that there was a highly significant (p≤ 0.01) storage period (ST) effect on HF but egg weight (EW) and STxEW effects were not significant. HF decrease in general with increased storage period but the decrease was only significant (p≤ 0.05) after 5 days of storage period. The same Table also shows that HF of stored hatching eggs for ten and fifteen days did not differ significantly and HF tended to decrease with increased egg weight.

Total embryonic mortality (TEM): The result in Table (1) indicates that indicates that there was highly significant (p≤ 0.01) storage period (ST) effect on TEM but egg weight (EW) and ST x EW effects were not significant. TEM increased general with increased storage period but the increased significant (p≤ 0.05) after 5 days of storage period. The same Table also shows that TEM of stored hatching eggs for ten and fifteen days did not differ significantly and TEM tended to be higher for the eggs with the smallest and largest weight Early embryonic mortality (EEM): The result in Table (1) indicates that there was highly significant (p≤ 0.01) storage period (ST) effect on EEM but egg weight (EW) and ST x EW effects were not significant. Early mortality increased with increased storage period but the increase was only significant (p≤ 0.05) after 5 days of storage period. The same Table also shows that EEM of stored hatching eggs for ten and fifteen days did not differ significantly and early mortality tended to increase with increased egg weight.

Table 1: Effect of storage period (ST) and egg weight group (EW) on apparent fertility (AF), hatchability of Total Eggs (HT), Hatchability of fertile eggs (HF) and total (TEM), early (EEM) and late (LEM) embryonic mortality.

	AF (%)	HT (%)	HF (%)	TEM (%)	EEM (%)	LEM (%)
ST(days)	NS	**	**	**	**	NS
0	91.33	78.52^{a}	86.86^{a}	13.13^{b}	2.20 b	10.95
5	85.02	71.74^{a}	83.60^{a}	16.40^{b}	3.13 b	13.28
10	83.33	57.32^{b}	69.60^{b}	30.40^{a}	17.6 a	12.80
15	82.67	54.23^{b}	65.32^{b}	33.87^{a}	14.52 a	19.35
EW (g)	NS	NS	NS	NS	NS	NS
<52	88.06	68.42	77.42	22.58	7.74	14.84
52-56	84.94	66.32	78.89	20.64	7.79	12.84
>56	84.50	61.60	72.34	27.66	12.81	14.94
ST*EW	NS	NS	NS	NS	NS	NS
SEM	±1.40	±1.903	±1.834	±1.832	±1.261	±1.537

*significant (p≤ 0.05) ** Highly significant (p≤ 0.001) ^{NS}Non- significant Means the same column with different superscripts differ significantly (p≤ 0.05).

Late embryonic mortality (LEM): The result in Table (1) indicates that there was no significant storage period (ST), egg weight (EW) and STxEW effect on late mortality. **LEM** tended to increased with increased storage period and tended to be higher for the eggs with the smallest and largest weights.

Egg weight loss (EWL): The result in Table (2) indicates that there was highly significant (p≤ 0.01) storage period (ST) effect on egg weight loss but egg weight (EW) and STxEW effects were not significant. EWL significantly (p≤ 0.05) increased with increased storage period reaching its highest value after 15 days of egg storage and tended to be the lowest for large sized egg group.

Yolk pH (YpH): The result in Table (2) indicates there was a highly significant (p≤ 0.01) storage period (ST) effect on YpH but egg weight (EW) and STxEW effects were not significant. **YpH** significantly (p≤ 0.05) increased with increased storage period reaching its highest value after 15 days of egg storage and tended to be the highest for large sized egg group.

Albumen pH (ALpH): The result in Table (2) indicates that there was a highly significant (p≤ 0.01) storage period (ST) effect on albumen pH but egg weight (EW) and STxEW effects were not significant. ALpH significantly (p≤ 0.05) increased with increased storage period reaching its highest after 15 days of storage and tended to be the lowest for large sized egg group.

Haugh units (HU): The result in Table (2) indicates that there was a highly significant (p≤ 0.01) storage period (ST) effect on HU but egg weight (EW) and STxEW effects were not significant. HU values significantly (p≤ 0.05) decreased with increased storage period reaching its lowest value after 15 days of storage and tended to be the lowest for small sized egg group.

Specific gravity (SG): The result in Table (2) indicates that indicates that there was a highly significant (p≤ 0.01) storage period (ST) effect on SG but egg weight (EW) and STxEW effects were not significant. SG significantly (p≤ 0.05) decreased with increased storage period reaching its lowest value after 15 days of storage and was the same for the different egg groups.

Table 2: Effect of storage period (ST) and egg weight group (EW) on Egg weight loss (EWL), yolk pH (YpH) and albumen pH (ALpH), Haugh units (HU), specific gravity (SG) and air cell depth (AC)

	EWL (g)	YpH	ALpH	HU	SG	AC (mm)
ST(days)	**	**	**	**	**	**
0	0.002^c	6.10^c	8.41^d	90.79^a	1.10^a	1.77^d
5	0.40^b	6.25^b	9.00^c	87.04^b	1.09^b	2.84^c
10	0.54^b	6.28^b	9.12^b	82.45^c	1.08^c	4.30^b
15	0.99^a	6.36^a	9.23^a	74.80^d	1.04^d	5.90^a
EW (g)	NS	NS	NS	NS	NS	NS
<52	0.68	6.25	8.92	83.66	1.08	3.73
52-56	0.68	6.23	8.92	84.01	1.08	3.65
>56	0.58	6.28	8.89	83.70	1.08	3.69
ST*EW	NS	NS	NS	NS	NS	NS
SEM	±0.059	±0.009	±0.016	±0.173	±0.001	±0.038

*significant (p≤ 0.05) ** Highly significant (p≤ 0.001) Ns Non- significant Means the same column with different superscripts differ significantly (p≤ 0.05).

IV. Discussion

The results indicated a significant (p≤ 0.01) storage period effect upon most studied traits but no significant effect of egg weight group and ST x EW was observed on any of the studied traits.. Ten days storage period led to a significant (p≤ 0.05) decrease in total and fertile hatchability and increase in early and total embryonic mortality. However 10 and 15 days storage periods had statistically similar adverse effect up on all studied traits. Several investigators reported similar storage period effect with respect to total and fertile hatchability (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 24, 29, 30, 31, 34) and embryonic mortality (1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13). In contrast to our results some investigators reported significant decrease in apparent fertility (1, 2, 3, 4, 5, 6, 7) and increase in late embryonic mortality (1, 3, 4, 5, 6, 8, 9, 10) the longer the duration of the pre-incubation storage of hatching eggs. These differences might be due to different strains, length and conditions of storage period used by different investigators. In our study, egg weight had no significant effect on hatchability parameters. Similar results were reported by Ulmer-Franco et al. (2010) with respect to apparent fertility and fertile hatchability. Contrary to our results, Malik et al. (2015) reported a significant egg weight effect on apparent fertility and total hatchability and found that the increase of egg weight of cobb broiler breeder above 65-69 g led to decrease in apparent fertility and total egg hatchabilty. Similarly was also reported by Edibol and Brake (2008) with respect to fertile hatchability and embryonic mortality and by 35Ulmer-Franco et al. (2010) with regard to late embryonic mortality and egg specific gravity. Sharokhina (1975) found that hatchability of eggs weighing 46-50 and 66-74 g was 8-10.5% lower than that of 50-56 g. On the other hand several investigators recommended eggs of average weight to attain good hatchability (22, 23, 24, 25, 26, 27,). The results also indicated a significant (p≤ 0.01) storage period effect upon all studied traits. Egg weight loss, yolk and albumen pH and air cell depth significantly ($p \leq 0.05$) increased and Haugh units and specific gravity decreased with increased storage period of hatching eggs. Several investigators reported similar results with regard to egg weight loss (2, 4, 5, 6, 13, 14, 15, 16), yolk and albumen pH (9, 12, 15) and air cell depth (12, 15, 18) and decreased Haugh units (5, 6, 9, 12, 14, 15, 18,) and specific gravity (15, 18). It has been suggested that that the decrease in embryo viability may be caused by changes in certain physical aspects of the egg, namely albumen pH (33) and albumen quality (9, 34, 35). Prolonged preincubaqtion egg storage leads to morphological changes in the blastoderm and malformation in the embryo (36, 37) with increased cell necrosis (36). These results lead us to conclude that egg quality deterioration due to prolonged storage of hatching eggs has an adverse effect on hatchability parameters.

V. Conclusion

From the results of the study we conclude that prolonged storage period of Baladi hatching eggs for 10 days or more had a pronounced adverse effect on all studied egg quality traits and hatchability parameters, whereas egg weight group had statistically no adverse effect upon all studied traits.

Acknowledgment

The authors extend their appreciation to the Deanship of Scientific Research and Agricultural Research Centre, College of Food and Agriculture Sciences, King Saud University for funding this study.

References

[1] Elibol, O., S. Peak, and Brake J., 2002. Effect of flock age, length of egg storage, and frequency of turning during storage on hatchability of broiler hatching eggs. Poultry science 81 (7):945-950.
[2] Mousa-Balabel, T. M. and Saleem, E. K. Y., 2004. Effect of selection and duration of storage of broiler hatching eggs on hatchability percent and chick weight. Kafr El-Sheikh Vet. Med. J. 2 (2): 197-208.
[3] Alsobayel, A. A., Almarshade, M.A. and El-Badry, M.A., 2012. Effect of breed, age and storage period on fertility and hatchability of hatching eggs of commercial broilers breeders raised under local conditions in Saudi Arabia. Arab Gulf Journal of Scientific Research 30 (1): 1-6
[4] Reijrink, D., Berghmans, R., Meijrof, B., Kemp, B. AND Brand, H., 2010. Influence of egg storage time and preincubation warming profile on embryonic development, hatchability, and chick quality. Poultry science 89 (6): 1225-1238.
[5] Khan, M. J., S. H. Khan, A. Bukhsh, M. I. Abbass, and Javed, M., 2013. Effect of different storage period on egg weight, internal egg quality and hatchability characteristics of Fayumi eggs. Italian Journal of Animal Science 12 (2):211-216.
[6] Khan, M. J., S. H. Khan, A. Bukhsh, and Amin, M., 2014. The effect of storage time on egg quality and hatchability characteristics of Rhode Island Red (RIR) hens. Veterinarski arhiv 84 (3):291-303.
[7] Othman, R. A., Amin, M. R. and Rahman, S., 2014. Effect of egg size, age of hen and storage period on fertility, hatchability, embryo mortality and chick malformations in eggs of japanese quail (Coturnix coturnix japonica). Journal of Agriculture and V--eterinary Science 7 (1):101-106.
[8] Whitehead, C., M. Maxwell, R. A. Pearson, and Herron, K. M., 1985. Influence of egg storage on hatchability, embryonic development and vitamin status in hatching broiler chicks. British Poultry Science 26 (2):221-22 8
[9] Lapao, C., L. Gama, T., and Soares, M. C., 1999. Effects of broiler breeder age and length of egg storage on albumen characteristics and hatchability. Poultry science 78 (5):640-645.
[10] Fasenko, G. M., 2007. Egg storage and the embryo. " Poultry science 86(5): 1020-1024.
[11] Demirel, S., and Kırıkçı, K., 2009. Effect of different egg storage times on some egg quality characteristics and hatchability of pheasants (Phasianus colchicus). Poultry science 88 (2):440-444.
[12] Younis D. T., Abdulbaqi, T. M. and Alsaigh, A. S., 2009. Effect of storage period and ultraviolet light treatment in egg quality and percentage of hatchability in broiler breeders hens. Iraqi Journal of Veterinary Sciences. 23 (Suppl.1, pp.): 251-255.
[13] Hamidu, J., Z. Uddin, M. Li, G. Fasenko, L. Guan, and Barreda, D., 2011. Broiler egg storage induces cell death and influences embryo quality. Poultry science 90 (8):1749-1757.
[14] Monira, K. N., Salahuddin, M. and Miah, G. (2003). Effect of breed and holding period on egg quality characteristics of chicken. Int. J. Poult. Sci, 2(4): 261-263.
[15] Samli, H. E., Agma, A. & Senkoylu, N., 2005. Effects of storage time and temperature on egg quality in old laying hens. The Journal of Applied Poultry Research 14(3): 548-553.Roque, L., and Soares, M., 1994. Effects of eggshell quality and broiler breeder age on hatchability. Poultry science 73 (12):1838-1845.
[16] Alsobayel, A. A., Almarshade, M. A. and Albadry, M. A., 2013. Effect of breed, age and storage period on egg weight, egg weight loss and chick weight of commercial broiler breeders raised in Saudi Arabia. Journal of the Saudi Society of Agricultural Sciences 12(1): 53-57.
[17] Alsobayel, A. A. and Albadry, M. A., 2011. Effect of storage period and strain of layer on internal and external quality characteristics of eggs marketed in Riyadh area. Journal of the Saudi Society of Agricultural Sciences 10 (1): 41-5.4
[18] Malik, E.E M. Sakin, I.Y.A., Elagib, A.A.H., Dousa, M. B. and Elamin, K. M., 2014. Effect of Egg Weight and egg Shell Thickness on Hatchability and Embryonic Mortality of Cobb Broiler Breeder Eggs. Global Journal of Animal Scientific Research 3(1): 186-190.
[19] Elibol, O. and Brake, J., 2008. Effect of Egg Weight and Position Relative to Incubator an on Broiler Hatchability and Chick Quality. Poultry science 87:1913-1918.
[20] Shatokhina, S.T. 1975. Relationship of morphological traits of eggs with embryonic and post-embryonic development of different lines of laying hens. Thesis of Candidate of Agricultural Sciences, Kuban Agricultural University, Krasnodar, Russia.
[21] Wilson, H. R. "Interrelationships of egg size, chick size, post-hatching growth and hatchability." World's Poultry Science Journal 47.01 (1991): 5-20.
[22] Brah, G. S., Chaudary, M. L. and Sandhu, J. S. Research Articles-Analysis of relation of egg weight with embryonic mortality, hatching time, chick weight and embryonic efficiency in chickens. Indian Journal of Poultry Science, 1999, 34.3: 308-312.
[23] Gonzalez, A., Satterlee, D.G., Moharer, F. and Cadd, G. G., 1999. Factors affecting ostrich egg hatchability. Poultry science, 78(9): 1257-1262.
[24] Abiola, S. S., Meshioye, O.O., Oyerinde, B. O. and Bamgbose, M.A., 2008. Effect of egg size on hatchability of broiler chicks. Arch. Zootec, 57 (217): 83-86
[25] Alabi, O.J., Ng`ambi, J.W. and Norris, D., 2012. Effect of Egg Weight on Physical Egg Parameters and Hatchability of Indigenous Venda Chickens. Asian Journal of Animal and Veterinary Advances, 7:166-172
[26] Mwesigwa, M., Semakula, J., Lusembo, P., Ssenyonjo, J., Isabirye, R., Lumu, R and Namirimu, T., 2015. Effect of pre-incubation and incubation conditions on hatchability and chick quality of Kuroiler chickens. Uganda Journal of Agricultural Sciences 16 (1) :115-127.
[27] Brake, J., T. Walsh, C.E. Benton, J.N. Pette Jr., Meijerhof, R. and Penalva, G., 1997. Egg handeling and storage. Poult.Sci.76:144-152.

[28] SAS Institute.(2000) SAS User, s Guide, NC.Cary, USA.

[29] Fasenko, G., Christensen, V., Wineland, M. and Petitte, J., 2001. Examining the effects of prestorage incubation of turkey breeder eggs on embryonic development and hatchability of eggs stored for four or fourteen days. Poultry science 80 (2):132-138.

[30] Kuurman, W., Bailey, B., Koops W. and Grossman, M., 2002. Influence of storage days on the distribution for time of embryonic mortality during incubation. Poultry science 81 (1):1-8.

[9] Hassan, S.M., Siam, S. A., Mady, M. A. and Cartwright, A.L., 2005. Egg storage period and weight effects on hatchability of ostrich (Struthio camelus) eggs. Poultry science 84(12): 1908-1912.

[32] Ulmer-Franco, A. M., Fasenko, G. M. and O'Dea Christopher, E. E., 2010. Hatching egg characteristics, chick quality, and broiler performance at 2 breeder flock ages and from 3 egg weights 1. Poultry science 89:2735-2742

[33] Meijerhof, R., 1994. Theoretical and empirical studies on temperature and moisture loss of hatching eggs during the pre-incubation period: Praktijkonderzoek Pluimveehouderij www.iosrjournals.org www.iosrjournals.org 101 | Page

[34] Hurnik, G. I., Reinhart, B. S., and Hurnik, J. F., 1978. Relationship between albumen quality and hatchability in fresh and stored eggs. Poultry Sci. 57:854–857.

[35] Tona, K., Bamelis, F., De Ketelaere, K. B., Bruggeman, V., and Decuypere, E., 2002. Effect of induced molting on albumen quality, hatchability, and chick body weight from broiler breeders. Poultry science 81(3), 327-332.

[36] Arora, K. L., and Kosin, I. L., 1966b. Developmental responses of early turkey and chicken embryos to preincubation holding of eggs: inter- and intra-species differences. Poultry Sci. 45:958–970. Al-Yousef, Y. M., 2007. A survey study on the distribution of Saudi baladi chickens and their characteristics. International Journal of Poultry Science 6 (4):289-292

[37] Mather, C. M., and Laughlin, K. F., 1979. Storage of hatching eggs: the interaction between parental age and early embryonic development. Br. Poult. Sci. 20:595–604