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# INFLUENCE OF COLD STORAGE DURATION ON THE NUTRITIONAL QUALITY OF TABLE EGG

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**Abstract**
*This study was carried out to explore the influence on cold storage length and time on the various quality traits of egg in 2024. For this reason, study eggs were obtained from the female of Playmouth Rock chicken. The eggs collected were randomly allocated to three different groups. The 1st group of birds was raised under (18-200C) with about (48 – 52 percent) relative humidity till 6 week of period, the 2nd group was second one maintained at temperature of 4-5 ℃ and relative humidity of 58-62%, finally, the quality egg characteristics were assigned to eleven weeks. Direct populations are then determined to get the first results on where three egg samples were taken from Group 1 and Group 2 every week in order to analysis the influence of the storage condition and time on the quality of egg for this purpose different egg quality parameters were recorded in this study. The results of present study revealed that the egg quality was significantly influenced by length and condition of storage. Whereas after comparing the results of our study with Pakistani standard, the results showed that egg were kept in room temperature storage were in A grade with two weeks & group B was for 5 weeks of duration. According to the bases of results it was concluded that, grade A eggs can be stored in the cold storage or in refrigerator for 11 weeks.*

**Keywords:** *Autosex layer, Cold storage, Egg, Room condition*

## INTRODUCTION

The best eggs are freshly laid. Some of the benefits of eggs disappear as we grow older. The loss is controlled by the age of eggs, temperature humidity and processing (1). In freshly separated egg, the thick and thin layers of albumen are clearly visible, eggs can stand well and are highly concentrated and absorbed by the egg white. The first change in an aging egg is size- decrease (2). In addition to the poor effect of egg protein, the quality of negative protein also decreased, and the size of diffusion area was expanded; the difference in negative protein and positive protein on outer surface was not distinct enough because eggs became flatter and enlarged (3). Water moves from the egg white to the egg, and lipids move from the egg yolk to the egg white during egg shell storage, so that there is a decrease in solids and lipid content in the yolk. As the egg grows older, the vitelline membrane weakens. Finally the vitelline membrane breaks, and egg yolk and albumin combine (4). After prolonged and careless storage, bacteria are bound to prevail. The greatest challenge in the egg industry is shifting demand. It is known to all that the price depends on supply and demand of the commodity. So, as chickens are laying eggs all the time, production is a continuous

process; whereas demand varies widely. Shell egg refrigerators are used all over the world. As technology, equipment and consumer needs change in the egg industry are also evolving (5, 6). Fluctuating egg prices occur annually due to problems, such as seasonal changes in the demand for eggs sold in Turkey, export crises and a few mistakes in production planning. But there are not enough egg infrastructures; there is insufficient data about the processing of eggs, as well as no facilities for producing eggs (7-10). This research study aims to assess the viability of storing eggs in different environments and analyze variations on the quality affected by storage time

# MATERIALS AND METHODS

This study was carried out to explore the influence on cold storage length and time on the various quality traits of egg in 2024. In this study eggs were selected from the 250 hens aged at 30–32 weeks and collected daily between 11 a.m. to 2 p.m from commercially raised hen's population. In order to avoid age and time of ovulation the first step was to initially checked for their cleaning and standard weight criteria 50-56 gram. Those collected eggs having less weight were excluded from this experiment weight of all the collected eggs, which were then classified into three groups. as shown below.

The data was analyzed through one-way Anova. In order to find best fit data and their significant and no significant relationship the quadratic statistical technique were used with the help of Minitab 7 computer program. Please mention the software used and p value.

On the bases of temperature eggs were classified into three groups.

**Group 1**: The first group referred to as the room is kept for six weeks at a temperature between 18-20 C and 48-52% RH.

**Group 2**: The second group (cold) was maintained at 4-5C and 58-62% relative humidity for eleven weeks.

**Group 3**: The first 45 eggs that had not been defeated in egg scaring were group, it has the name FRESH.

Thirty eggs were chosen from room group and cold group were observed on weekly bases till 6 to 11th week during storage time. The egg mass, egg mass loss (%),egg albumin index, egg albumin height, egg albumin length, egg albumin width, egg yolk height, egg yolk width, index of egg yolk and Haugh unit were recorded with the following formula as suggested by (11).

The egg weight loss % = (starting weight – last weight)/ 100/ starting weight egg albumin height, egg albumin length and egg albumin width, egg yolk height = egg index = egg yolk height 100/ egg yolk diameter.

32. $2(30\ W\ 0.37 - 100)$ Haugh = $100\ 1og \frac{(\text{Egg albumin height} \text{-----} 100)}{100}$

# RESULTS

The findings of this study revealed that the mean values for egg quality attributes in both under experiment groups were observed during initial and end of experiment time. To clarify the comparison between rooms, Table 1 presents the data of cold group at week 6 as storage period for this group is up to 11 weeks. group and cold group. The quality of the egg differs significantly by location and storage time.

The initial alteration that occurs in stored eggs is a loss of weight primarily due to the vaporization of water. It was found that 4% and 1.7% of eggs were stored for six weeks in the rooms and cold groups correspondingly (Table I). Linear increase in egg weight loss is observed with storage time. In the event that storage time is increased by a week, changes in egg loss are 0.67% and 0.28% for the rooms and cold groups (Tables 1, 2 and 3). Egg loss, yolk diameter, protein length and width are increased in long-term storage whereas there is high yolk, the yolk index high protein and low protein index. The result for height, width and length and of egg albumin was recorded (6.5, 88.8 and 67.1 mm in cold stored groups. Nevertheless, we observed that the diffusing region of the albumen grew larger in aged eggs, and as height of the thick albumen diminished.

**Table I.** Average mean values for SD quality traits of fresh and stored eggs in two separate storage types with different duration of time

| Character/ Storage time | Groups | | | | | |
|---|---|---|---|---|---|---|
| | Fresh egg | Room storage | | Cold storage | | |
| | 1st day | 1st week | 6th week | 1st week | 6th week | 11th week |
| Egg mass | 58.73<br>2.98 | 58.74<br>3.75 | 56.9<br>3.26 | 60.1<br>3.97 | 60.9<br>2.15 | 60.2<br>4.49 |
| Egg mass loss (%) | -<br>- | 0.3<br>1.39 | 3.98<br>0.57 | 0.4<br>0.15 | 1.5<br>0.37 | 2.99<br>2.91 |
| Egg albumin index | 7.3<br>1.21 | 5.1<br>1.19 | 2.3<br>0.55 | 6.9<br>1.31 | 3.9<br>0.85 | 4.5<br>0.99 |
| Egg albumin height | 5.9<br>0.83 | 4.1<br>0.84 | 1.7<br>0.47 | 5.3<br>0.87 | 3.97<br>0.59 | 3.97<br>0.67 |
| Egg albumin length | 86.5<br>6.17 | 98.7<br>13.71 | 118.3<br>10.91 | 91.5<br>4.71 | 103.3<br>5.97 | 99.1<br>9.31 |
| Egg albumin width | 65.3<br>3.97 | 69.5<br>11.5 | 93.5<br>11.67 | 66.3<br>3.97 | 76.3<br>4.91 | 77.5<br>7.42 |
| Egg yolk height | 17.1<br>0.75 | 16.2<br>0.83 | 13.5<br>0.69 | 16.7<br>0.67 | 16.5<br>0.77 | 16.3<br>0.78 |
| Egg yolk width | 39.7<br>1.34 | 40.5<br>1.17 | 43.5<br>1.25 | 39.7<br>1.45 | 41.0<br>1.37 | 42.1<br>1.23 |
| Index of egg yolk | 43.3<br>1.97 | 40.3<br>2.11 | 31.3<br>1.99 | 38.7<br>2.35 | 36.5<br>2.29 | 35.1<br>2.43 |
| Haugh | 77.5<br>5.78 | 69.3<br>6.51 | 17.3<br>11.21 | 71.1<br>7.07 | 57.3<br>6.5 | 55.8<br>8.15 |

The result for Haugh values was observed 77.5 during the initial phase of experiment. Whereas the after six week of storage Haugh result was reduced 17.3 and 57.3 under room and cold groups, respectively (Table I, II & III). The results showed that average values per week improved for egg albumin width and length 5.31 and 3.95 mm room and 1.87 and 2.76 mm in cold groups (Table I, II and II).

**Table II.** The results of the room condition group regression estimates of egg quality traits under the length duration of storage time X using simple Y= a+bX or quadratic regression estimates Y =a +Bx +Cx2 in quadratic is considered significant

| Character | $\alpha \pm SE$ | b ± SE | c ± SE | $R^2$ |
|---|---|---|---|---|
| Egg mass loss % | -0.8±0.11 | 0.65±0.03 | Non significant | 65.7 |
| Egg albumin index | 6.5±0.39 | -1.79±0.23 | 0.15±0.05 | 59.3 |
| Egg albumin height | 5.03±0.21 | -1.03±0.19 | 0.05±001 | 63.7 |
| Egg albumin length | 93.1±2.47 | 3.95±0.77 | Non significant | 17.5 |
| Egg albumin width | 63.1±1.91 | 5.31±0.75 | Non significant | 27.5 |
| Egg yolk height | 15.01±0.11 | -0.47±0.003 | Non significant | 51.1 |
| Egg yolk width | 39.1±0.17 | 0.47±0.007 | Non significant | 19.7 |
| Index of egg yolk | 41.3±0.34 | -1.53±0.11 | Non significant | 53.3 |
| Haugh | 73.5±2.87 | -7.57±0.21 | Non significant | 63.3 |

Whereas after week it was increased in the length of storage time, the egg albumin height, egg albumin index and Haugh values were reduced in room condition groups (Table II). It was observed that egg yolk height was reduced and diameter was increased so the egg index was reduced. It was observed that in long storage time of one week of time the egg yolk width, height and index were reduced in both groups.

**Table III.** The cold condition group regression estimates of egg quality traits under the length duration of storage time X utilizing simple Y = a+bX or quadratic regression estimates Y=a+Bx +Cx2 in quadratic is significant

| Character | $\alpha \pm SE$ | b ± SE | c ± SE | $R^2$ |
|---|---|---|---|---|
| Egg weight (loss %) | 0.9±0.21 | 0.27±0.01 | Non Significant | 17.1 |
| Egg albumin index | 6.9±0.21 | -0.53±0.07 | 0.04±0.000 | 30.6 |
| Egg albumin height | 5.7±0.13 | -0.29±0.04 | 0.02±0.003 | 31.5 |
| Egg albumin length | 88.3±1.97 | 2.76±0.67 | -0.15±0.05 | 8.9 |
| Egg albumin width | 65.3±1.34 | 1.87±0.45 | -0.13±0.03 | 11.1 |
| Egg yolk height | 16.5±0.07 | -0.05±0.03 | Non significant | 5.9 |
| Egg yolk width | 39.3±0.23 | -0.45±0.07 | -0.01±0.02 | 21.03 |
| Index of egg yolk | 41.7±0.39 | -0.87±0.11 | 0.05±0.01 | 21.7 |
| Haugh | 69.7±0.79 | -1.35±0.11 | Non significant | 29.7 |

The correlation estimates for egg quality traits exhibited significant difference ($P<0.05$). The correlation estimates among egg quality traits and storage time were found to be higher in room group than for egg kept under cold environment group details given in Table IV.

**Table IV**. The result for correlation estimates among egg quality traits time and storage of length under room temperature and cold environment

| Characters | Storage types | |
|---|---|---|
| | Room storage | Cold storage |
| Egg weight (loss %) | 0.737 | 0.345 |
| Egg albumin index | -0.681 | -0.476 |
| Egg albumin height | -797 | 0.631 |
| Egg albumin length | 0.397 | 0.197 |
| Egg albumin width | 0.599 | 0.299 |
| Egg yolk height | -679 | -0.275 |
| Egg yolk width | 0.431 | 0.473 |
| Index of egg yolk | -659 | -0.451 |
| Haugh | -0.731 | -0.473 |

# DISCUSSION

Our findings revealed that time and storage conditions have significantly affected all egg quality parameters. In this regard, Bell and Weaver, 2012 reported that the storage of egg albumin increased its height, width and length when increasing the storage temperature and time (2). On the other hand, egg yolk weight, percentage, Haugh unit values and egg albumin significantly reduced with storage time. The results of our study contrast with the findings revealed by (12) who noted that a storage time of 9 to 30 days causes an increase in internal protein structure which leads to the breakdown of vitelline membrane and

albumin. Samli *et al.,* 2005 found that albumin mass decreased with storage time. Yolk mass was positively correlated with storage time and temperature (13). When this was expressed as a percentage, the egg albumin mass diminished. Yolk mass was positively correlated with temperature and storage time. The study conducted by Jones (2006), Kaleri *et al.,* 2023a & Kaleri *et al.,* 2023b reported that the use of whole egg proportions to measure components removed all differences and longer storage periods yielded a higher shell percentage and a lower albumen percentage (14-16). Akyurek and Okur (2009) reported that albumen mass and yolk mass were constant for 10 days at all the temperatures (1). According to Carranco-*Jáuregui et al.,* 2006, for storage time, color did not decrease at 4°C while at 20°C the average decrease was of 9.91 to 8.33 over a period of thirty days storage (12). This is due to the dilution of egg yolk. An experiment was performed by (18), who noted that as the egg internal temperature rises, the protein structure of thick albumen and vitelline membranes rapidly disintegrates. Such storage effects are anticipated since some albumen constituents permeate the yolk membrane and leak from the shell (19, 20). This could partially account for the negative relationship between storage and time on yolk color (21). While the membrane decomposes during storage, water gets into the yolk resulting in pigment dilution; with prolonged storage time albumen proteins may enter the yolk and consequently its color decreases. There is no recent data available for the relationship between yolk color and storage temperature or time. The primary factors that contribute to the quality of eggs are genetic and environmental (2, 16) while nutritional factors (22), have a lesser impact. Based on the commercially acceptable techniques, egg white quality is relatively insensitive to hen nutrition (9). But, the quality of egg white can be affected by protein sources ingested by feeder hens (13). It has been reported that increased laying hens production is connected with improved eggshell quality and better egg white. So, in the most efficient group of laying hens, the shells are usually thinner, lighter in color with a higher Howe and Albumen unit as well as dry matter ratio and compressive strength changes depending on storage period (2).

# CONCLUSION

The results of present study showed that egg internal quality traits significantly altered with storage time and conditions. It is conclude that quality traits of eggs in cold group percentage of egg weight loss, egg albumin, and Haugh units were highly affected by storage time, temperature as compared with room group eggs.

## Conflict of Interest:

Authors have no conflict of interest.

## References:


1. Akyurek H, Okur AA. Effect of storage time, temperature and hen age on egg quality in free-range layer hens. Journal of Animal and Veterinary Advances. 2009;8(10):1953-8.
2. Bell DD, Weaver WD, editors. Commercial chicken meat and egg production. Springer Science & Business Media; 2012 Dec 6.
3. González-Redondo P. Effect of long-term storage on the hatchability of red-legged partridge (Alectoris rufa) eggs. Poultry Science. 2010;89(2):379-83.
4. Siyar SH, Aliarabi H, Ahamdi H, Anshori H. Effect of different storage conditions and hen egg on egg quality parameters. InAust Poult Sci Symp. 2007; 19:106-109.
5. Alsobayel AA, Albadry MA. 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. 2011;10(1):41-5.
6. Kaleri R, Jamali Z, Laghari SA, Ishaq S, Khusk FA, Ahmed I, Khoso ZA, Janyaro H, Mangrio ZA, Moryani AA, Kaleri HA. Influence of different housing system on the quality characteristics of table egg produced by Playmouth Rock chicken. Pakistan Journal of Biotechnology. 2024;21(1):57-60.
7. Kaleri RR, Kaleri HA, Khoso ZA, Mangi RA, Solangi GM, Ahmed I, Memon MA, Soomro MA, Khushk FA, Anwar A, Kumar L. Egg Characteristics of Aseel Chickens in 3 Different Taluka's of Tando Allahyar, Sindh Pakistan. Journal of Agriculture and Veterinary Science. 2024;3(1):13-9.

8. Kaleri RR, Kaleri HA, Kalhoro NH, Mangi RA, Solangi GM, Bhuptani DK, Khosa SM, Solangi AW, Lashari AA, Dari S. Phenotypic characterization of indigenous backyard poultry birds in Tando Allahayar, Pakistan. 2023;4:135-141.
9. Akyurek H, Okur AA. Effect of storage time, temperature and hen age on egg quality in free-range layer hens. Journal of Animal and Veterinary Advances. 2009;8(10):1953-8.
10. Kaleri RR, Khoso ZA, Mangi RA, Solangi GM, Ahmed I, Memon MA, Soomro MA, Khushk FA, Anwar A, Kumar L. Economic Importance of Backyard Poultry in Taluka Jhando Mari, District Tando Allahyar, Sindh: Importance of Backyard Poultry in Taluka Jhando Mari. MARKHOR (The Journal of Zoology). 2023;1:74-9.
11. Haugh RR. The Haugh unit for measuring egg quality. 1922:552-573.
12. Carranco-Jáuregui ME, Sanginés-García L, Morales-Barrera E, Carrillo-Domínguez S, Ávila-González E, Ramírez-Poblano M, Pérez-Gil Romo F. Shrimp head meal in laying hen rations and its effects on fresh and stored egg quality. Interciencia. 2006;(11):822-7.
13. Samli HE, Agma A, Senkoylu N. Effects of storage time and temperature on egg quality in old laying hens. Journal of Applied Poultry Research. 2005;14(3):548-53.
14. Jones DR. Conserving and monitoring shell egg quality. 2006:157-165.
15. Kaleri RR, Kaleri HA, Usama M, Janyaro H, Mangrio ZA, Bhuptani DK, Moaryani AA, Solangi AW, Pahanwar SN, Khusk FA, Lanjar Z. Study on Morphological Characteristics of Various Breeds of Aseel Chicken Inhabiting Taluka Chambar of District Tando Allahyar, Sindh. Jammu Kashmir Journal of Agriculture. 2023;3(3):235-9.
16. Kaleri RR, Mangi RA, Solangi GM, Janyaro H, Lanjar Z, Memon MA, Jabbar A, Ahmed I, Khushk FA, Saleem T, Cheema IA. Quantitative traits analysis and kinship relationship of indigenous chicken of Sindh, Pakistan. Pure and Applied Biology. 2024;14(2):266-271.
17. Kaleri RR, Kaleri HA, Hassan MF, Mangi RA, Solangi GM, Memon MA, Lanjar Z, Bozdar ZH, Solangi AW, Memon MA, Ahmed I. Study on the Correlation Estimates Between Various Internal and External Egg Quality Traits of Backyard Chicken. Jammu Kashmir Journal of Agriculture. 2023;3(3):265-70.
18. Kaleri RR, Kaleri HA, Mangi RA, Solangi GM, Khoso ZA, Channa AA, Soomro MA, Memon MA, Bakhash S, Solangi IH. Phenotypic diversity of aseel chicken in district Tando Allahyar, Sindh, Pakistan. Pure and Applied Biology (PAB). 2023;12(4):1541-7.
19. Momoh OM, Ani AO, Ugwuowo LC. Part-period egg production and egg quality characteristics of two ecotypes of Nigerian local chickens and their F1 crosses. Int. J. Poult. Sci. 2010;9(8):744-8.
20. Narushin VG, Van Kempen TA, Wineland MJ, Christensen VL. Comparing infrared spectroscopy and egg size measurements for predicting eggshell quality. Biosystems Engineering. 2004;87(3):367-73.
21. Scott TA, Silversides FG. The effect of storage and strain of hen on egg quality. Poultry science. 2000;79(12):1725-9.
22. Rajkumar U, Sharma RP, Rajaravindra KS, Niranjan M, Reddy BL, Bhattacharya TK, Chatterjee RN. Effect of genotype and age on egg quality traits in naked neck chicken under tropical climate from India. International Journal of Poultry Science. 2009;8(12):1151-5.