Effect of Storage Method and Storage Duration on Chicken Egg Quality

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Abstract— *Poultry production is a fast growing industry and has become a dependable source of obtaining income for many farmers. There is therefore a growing need for technologies to preserve poultry products, in this case eggs, to prevent or reduce post-harvest losses. The aim of this present study is to evaluate the effect of storage method and duration on internal and external egg quality traits of eggs stored under three different storage conditions. A total of 190 eggs (from Isa brown breed hens aged 51 weeks) were used for the analysis. The storage methods to which the eggs were subjected included; 1) Cold Storage (M1), 2) Saw dust (M2) and 3) Control (M3) at a temperature range of 26°C- 32°C.The eggs were stored for 15 days, while the readings were taken at three day intervals. Albumen height, haugh unit, yolk index and egg weight have been found to be important parameters influenced by storage method and storage duration. Cold storage had the highest value for albumen height, haugh unit, yolk index and egg weight, while eggs stored under sawdust had no significant difference from those under control. Duration however had a deteriorating effect on important egg quality traits form D3 to D15 as could be observed in Albumen weight (41.14 to 36.37), Haugh unit (73.0 to 55.1), Yolk Index (36.99 to 26.61) and Egg weight (61.85 to 56.76). Thus, lower egg quality was recorded as storage time increased. Results from the first microbial analysis (freshly laid eggs) showed that no organism was isolated. Coliform bacteria, mold and yeast were isolated from eggs stored using cold storage and control conditions respectively. This study showed that eggs stored under cold storage retained both internal and external quality traits for longer time than those stored under sawdust and control, after the eggs had been stored for 15 days.*

Keywords— Egg, Egg quality, Storage method, Storage duration.

I. INTRODUCTION

The effect of storage methods and time on the external and internal egg quality traits of laying hens in different climate is going to examined. The parameters were: egg weight, albumen and yolk height, albumen and yolk width, albumen and yolk indices, Haugh unit, egg width, egg length and shape index.

II. MATERIAL AND METHOD

Eggs used in this study were collected from Department of Animal Science and Technology Teaching and Research Farm, and analyzed at the Departmental Laboratory, Nnamdi Azikiwe University, Awka, Anambra state, Nigeria. Awka, the capital of Anambra state is located on Latitude: 6° 12' 45.68" N, Longitude: 7° 04' 19.16" E.

The eggs were collected from 51 weeks old Isa brown layers in less than 24 hours of lay. The first storage method (M1) is the cold storage (7°C), the second storage method (M2) is storage on saw dust at room temperature at the range of 26°C- 32°C, while the third storage method (M3) is the Control (Stored without any form of treatment). Standard methods were used to determine the internal and external egg quality trait.

III. RESULT AND DISCUSSION

3.1 Effect of storage method on internal egg quality

While albumen height, albumen index, albumen length, albumen weight, albumen width, yolk diameter, yolk height, yolk index, yolk ratio, yolk weight and Haugh unit were significantly different ($P<0.05$), Albumen ratio was not significantly ($P>0.05$) affected by method of storage. The Yolk height and Haugh unit were highest for eggs stored using cold storage and lowest for eggs stored using control.

This result agrees with that of Tabidi (2011) who found that albumen height was higher in eggs stored in refrigerator compared to that obtained from eggs which were subjected to storage at room temperature. Albumen index of eggs preserved using cold storage was higher, followed by those stored under sawdust, then those under control condition. The reduction in albumen index in sawdust and control could be attributed to the high room temperature compared to conditions in cold storage. Albumen length and Albumen width were lowest for eggs stored under cold storage. The highest Albumen length was recorded for eggs stored under control (9.62), while eggs stored under sawdust had the highest width (7.87). This result aligned with that of Scott and Silversides (2000) and Raji *et al*. (2009). The increase in length and width of the albumen could be as a result of high loss of CO_2 which occurs at room temperature, leading to rapid deterioration in albumen quality. Albumen weight had the highest value for eggs stored under cold storage, while control group gave the lowest value. This finding agreed with that of Jin *et al.*(2011) who attributed changes in egg quality to loss of moisture by evaporation through the egg shell pores and the escape of CO_2 from albumen.

3.2 Effect of storage duration on internal egg quality

Except for Yolk ratio, other internal egg quality traits were affected ($P<0.05$) by storage duration. Albumen height, Albumen index, Albumen ratio, Albumen weight, yolk height, yolk index and Haugh unit decreased with an increase in storage duration, while as duration increased, Albumen length, Albumen width, and yolk diameter tend to increase with time.

Yolk diameter increased with storage time. This result agrees with that of Okonkwo (2009), Raji *et al*. (2009) and Scott and Silverside (2000). The yolk of fresh eggs is round and firm. As the yolk ages it losses quality by absorbing water and increasing in size. According to literature, yolk wholeness is dependent on the strength of the vitelline membrane which is inversely related to the duration of storage (Jones and Musgrove, 2005; Li-Chan *et al.,* 2017). Kirunda and McKee (2000) also reported the decrease in the strength of the Vitelline membrane during storage making the yolk more susceptible to breaking. Yolk weight increased from 3.96 to 4.46 with an increase in time of storage, this result agrees with findings of Jin *et al*. (2011). The increase in weight could be as a result of the absorption of water by the yolk from thin albumin. Yolk index decreased with duration from 36.99-26.6. This present study agrees with Caner and Cansiz (2007), Fasenko *et al*. (1995), Monira *et al*. (2003), and Miles and Henry (2004) in their findings observed a decrease in yolk index with storage time. Yolk height decreased from 1.46 to 1.16 with time, this aligns with findings of Okoli *et al*. (2000) and Seidler (2003), who observed that as the egg ages due to prolonged storage, the vitelline membrane degenerates and water from the albumen moves into the yolk causing the yolk to have a flattened shape.

3.3 Effect of storage method on external egg quality

As observed from the Table 3, only the Average shell thickness and egg weight were significantly ($P< 0.05$) affected by storage method. The Average shell thickness of eggs stored using cold storage and Control were not significantly different from each other. Egg length, Egg width, Shape index and shell weight of the three storage methods were not significantly different ($P>0.05$).

Also the shell thickness was affected by both storage method and duration. For control it decreased from 0.80 at day 3 to 0.70 at day 15, in sawdust from 0.90 to 0.81, and cold storage from 0.80 to 0.70. This result disagrees with the result obtained by Tabidi (2011) who observed no difference in the egg shell thickness between the eggs stored at room temperature and those stored using a refrigerator. This could be as a result of the rate of loss of CO_2 form eggs in the three storage method due to season.

3.4 Effect of storage duration on external egg quality

Results on the effect of storage duration on external egg traits is presented in table 4.The effect of storage duration was significant ($P<0.05$) for Average shell thickness, Egg length, Egg weight, Shape index and Shell weight. There was no

significant difference (P>0.05) for Egg width and Shell ratio. For the Average shell thickness, the durations (D3-D12) slightly differ from each other, and the highest shell thickness was recorded in D15.

Results from the study shows that Average shell thickness and Egg weight were affected by the method of storage. All other external parameters were unaffected by the method of storage. Cold storage had the highest egg weight (61.30) while eggs under control had the lowest egg weight (58.18). The highest weight loss was recorded in control while the least weight loss was recorded in cold storage. This result agrees with the findings of Dudusola (2009) who found that weight losses differ with the different storage methods, where the eggs preserved by refrigeration had lower moisture loss compared to those in groups stored at room temperature (control). This reduction in weight could be due to high rate of moisture losses through the egg shell from the albumen due to high room temperature compared to temperature of cold storage.

Average shell thickness was affected by duration. According to Jibir *et al.* (2012), shell thickness or strength is the most commonly used parameter for measuring external egg quality. Storage duration also had an impact on Shell weight, this present finding agrees with that of Samli *et al*. (2005) and Jin *et al.,* (2011) who observed and reported significant changes in shell weight with storage time and temperature. Egg weight tends to decrease with duration, this report is in accordance with that of Samli *et al.* (2005), Akyurek *et al.* (2009), Walsh *et al.* (1995) and Siyar *et al.* (2007), who observed a decrease in egg weight with duration of storage.

IV. CONCLUSION

This study has shown the effect of using cold storage, saw dust and control at room temperature to store eggs over a time frame in order to determine the most suitable means of preserving it. Cold storage happens to be better than the other two methods, since it has values higher than the other two storage methods in terms of Albumen height, Haugh unit, yolk index, shell thickness and egg weight which are considered to be important parameters in the determination of egg quality. Storage on Saw dust still maintained external quality of the egg, even after internal deterioration had set off. Sawdust can be used to store eggs that would be consumed within very few days of storage. The qualities of egg, especially the internal quality deteriorated greatly with time. The yolk began to stick to the shells and the thick albumen became completely watery and immeasurable. Therefore, eggs should be consumed as soon as possible otherwise it should be preserved using cold storage.

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