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A study on the impact of preservation methods and storage time on internal quality index of Vanaraja fowl eggs

Nutan Ramteke, AK Santra, Nishma Singh and Rupal Pathak

Abstract
The effects of storage method and duration on the quality index of vanaraja fowl eggs were examined. The quality index were EW (egg weight), percent EWL (egg weight loss), AH (albumen height), AI (albumen index), YH (yolk height), YI (yolk index), and HU (Haugh units). In this experiment, we used 90 fresh Vanaraja eggs. Storage period for eggs were 5, 10 and 15 days while the preservation methods were without any preservation method (untreated eggs), thermostabilization, sealing by lime and surface coating (oil coating) at 40 °C. This research found that as eggs were stored longer, their weight, height of the albumen, height of the yolk, the ratio of the albumen to the total egg, the ratio of the yolk to the total egg, and the Haugh units all decreased significantly (p<0.01). Albumen index, a measurement of egg quality, exhibited a substantial decline (p<0.01) from 6.54% to 3.71% between days 5 and 15, respectively. Preserving eggs at 40 °C have significant difference (p<0.01) as compare to others preservation method. At 40 °C (room temperature), oil-coated eggs had higher albumen index (AI), yolk index (YI), and Haugh unit (HU) values than untreated, thermostabilized, and lime-sealed eggs (5.6%, 36.7%, and 74, respectively). The current research demonstrates that the storage method and storage period have the greatest impact on an egg's quality index.

Keywords: Vanaraja, thermostabilization, lime sealed, percent egg weight loss, haugh unit

Introduction
In contrast to the external quality, the internal quality of the egg begins to deteriorate as soon as the hen lays it [1]. This is because water and carbon dioxide are lost through the pores of the eggshell [2]. Backyard egg production techniques in rural areas help small households' economies and produce a steady income. Maintaining egg quality by selecting the most effective storage technique (i.e. method and period of storage) is one of the restrictions. Egg quality can be effectively preserved by refrigeration, although options are scarce in rural locations. An alternative to refrigeration for protecting egg quality is oil coating, which is far less effective. Nevertheless, growers utilize preservatives like lime and oil to prolong the shelf life of eggs in some underdeveloped nations where refrigeration is infrequent. Egg weight, albumen height, and yolk height are a few factors that can be used to gauge the quality of an egg. One of the factors that determine egg quality is the Haugh unit, which assesses egg freshness and albumen quality [3]. A number of studies have implicated a decrease in egg quality with longer storage [4].
The purpose of this study was to determine how long and how the storage method affected the interior characteristics of fowl eggs.

Materials and Methods
At a government poultry farm in Durg, eggs were gathered from a 64-week-old Vanaraja breed that was kept in a deep litter system. 90 fresh eggs in total were gathered and split into two groups: group A (the control group) and group B (three replicates). On day zero, without the use of preservatives, the internal characteristics of a control group A (fresh eggs) consisting of 18 eggs were evaluated. The 72 eggs in Group B were separated once more into its four equal-egg subgroups, B1, B2, B3, and B4. The 18 eggs in Subgroup B1 were preserved naturally without any additional preservatives (untreated eggs), while the eggs in Subgroups B2, B3, and B4 were stored using heat stabilization, lime sealing, and oil coating, respectively. All of the eggs were kept at 40 °C. A total of 24 eggs, six from each treatment, were periodically retrieved at 5-day intervals and held for a total of 15 days. Egg weight, egg weight loss,

albumen height, yolk height, albumen index, yolk index, and Haugh units are some of the markers of egg composition and quality. [Initial whole egg weight (g) at day 0 - whole egg weight (g) after storage]/initial whole egg weight (g) at day 0 was used to compute the total egg percentage (%) of weight loss of the entire egg. [5]. Eggs were indexed and maximum albumen heights in at least three locations were measured with a spherometer. The following formula was used to get the albumen index for each individual egg: Albumen index (%) = thick albumen height (mm) / thick albumen mean diameter (mm) multiplied by 100 [6]. At the yolk's centre, the height of the yolk was measured. Using a spherometer and vernier calliper, the height and diameter of the yolk were measured, and the yolk index was then determined [7]. Using the formula HU = 100 log10 (H-1.7 W0.37 7.56)—where HU stands for Haugh units, H stands for egg white height (mm), and W stands for egg weight (G)—Haugh units were derived from the recorded egg weight and albumen height.

With the aid of the statistical programme SPSS (2007), data from the study were statistically analysed to assess the impact of preservation method and time on egg interior parameters [8]. Using Kramer's (1956) modifications to Duncan's multiple range tests, individual means were evaluated for significance [9].

Results and Discussion

In this study, the internal quality of the eggs—including their weight, weight loss percentage, albumen and yolk heights, albumen and yolk indices, and Haugh units—was analysed. Various storage times resulted in a substantial (p<0.01) drop in egg weight. Mean egg weight loss rates were seen at days 5 (0.05%), 10 days (0.79%), and 15 days (1.99%), according to Table 1 and Fig. 1. These findings were discovered to be comparable to those of Samli *et al.* (2005) [10] and Jin *et al.* (2011) [1] who reported weight loss of 2.08% and 3.11%, respectively, within 5 and 10 days of storage. The loss of water in the egg through evaporative effects is assumed to be the cause of the weight reduction. The overall impact of the preservation technique (Table 2) revealed that the weight loss rate of untreated eggs (2.5%) was higher than that of the other preservation techniques. This loss could be caused by the egg's loss of water, hydrogen sulphide gas, nitrogen, ammonia, carbon dioxide, and other gases. [11, 12]. With prolonged storage times, egg albumen height reduced significantly (p<0.01) (Table 1 and Fig. 2). According to the findings, albumen had an average height of 5.26 mm (5 days), 4.11 mm (10 days), and 3.18 mm (15 days) during various storage times. This result is consistent with Scott and Silversides (2000) [13] They found that after 10 days of storage, preserved eggs' albumen height significantly decreased (p<0.005), going from 9.16 mm to 4.75 mm. We found significant differences (p<0.01) in mean albumen height with different storage methods (Table 2 & Fig. 2). A higher albumen height (4.5 mm) was found for the oil-coated eggs than for the other methods. A notable difference (p<0.01) in the height of the egg yolk was observed when the storage method and storage period were different (Table 1 & Fig. 3). The results showed that oil-coated eggs had a higher yolk height (16.2 mm) than other methods at 40 °C. The findings of Scott and Silversides (2000) [13] and Abanikannda (2007) [14] are supported by the study's observation that albumen and yolk heights drop as temperature rises. Because they can slow the loss of carbon dioxide and the conversion of carbonic acid to carbon dioxide, the various techniques of preserving egg quality differ from one another. This is due to the fact that these losses cause the mucin fibres that give albumen and yolk their gel-like texture to lose their structural integrity, leaving them watery [15, 16].

Table 1: Overall impact of storage time on internal quality of Vanaraja eggs

Storage Time (Day)	EW (g) (Before storage)	EW (g) (After storage)	EWL percent	AH (mm)	YH (mm)	AI (%)	YI (%)	HU
5	58.5±0.49	58.42±0.59^{a}	0.05±0.05^{c}	5.26±0.23^{a}	16.4±0.44^{a}	6.54±0.32^{a}	36.7±1.15^{a}	79.4±1.51^{a}
10	57±0.47	56.5±0.45^{b}	0.79±0.17^{b}	4.11±0.17^{b}	15.5±0.36^{a}	4.97±0.25^{b}	34.5±0.95^{a}	71.9±1.4^{b}
15	57.9±0.6	56.72±0.50^{b}	1.99±0.19^{a}	3.18±0.16^{c}	14.4±0.42^{b}	3.71±0.2^{c}	30.8±1.13^{b}	63.8±1.48^{c}
Sig. level	NS	*	**	**	**	**	**	**

Values with various superscripts in a row have significantly differing (MeanSE) values. *p<0.05, **p<0.01; NS= Non-significant

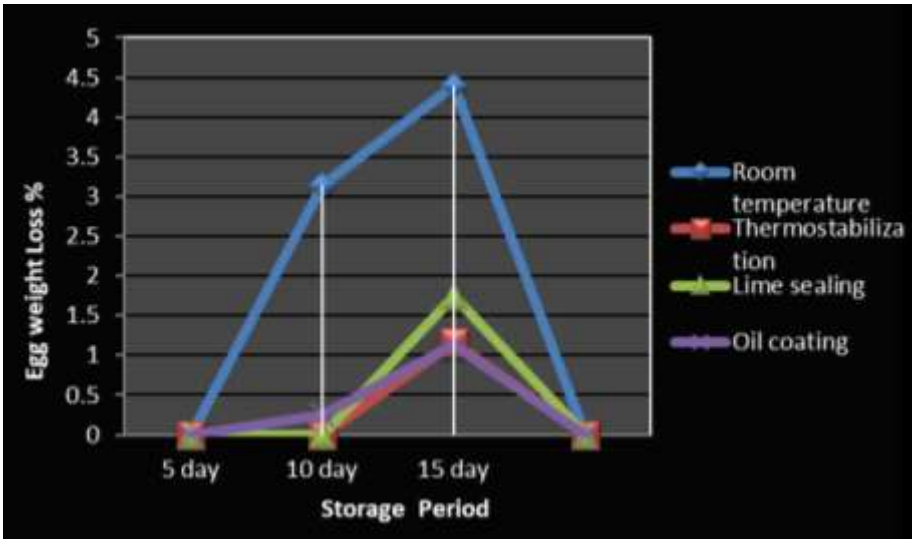

Fig 1: Impact of preservation methods and storage time of on Percent egg weight loss in Vanaraja chicken egg

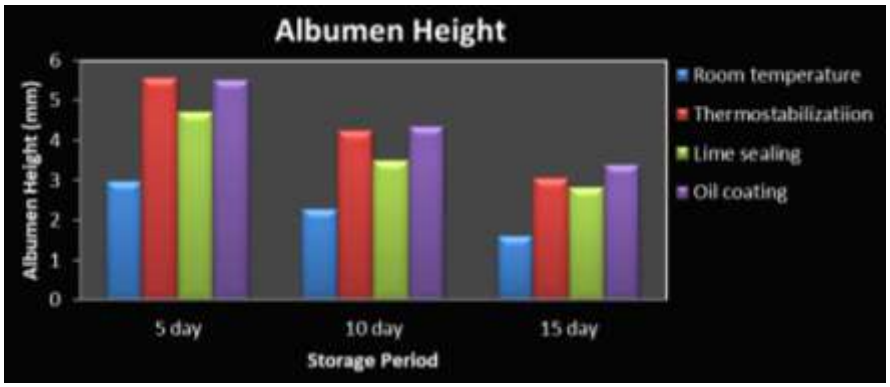

Fig 2: Impact of preservation methods and storage time on albumen height in Vanaraja chicken egg

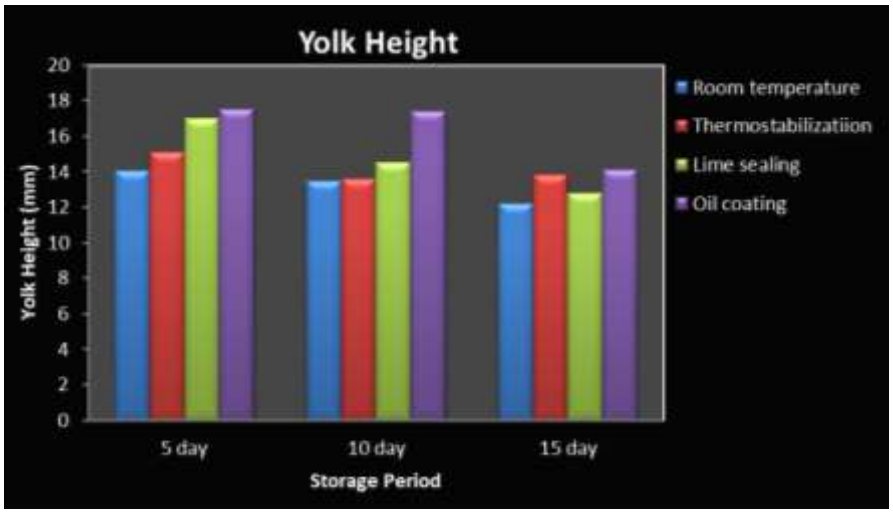

Fig 3: Impact of preservation methods and storage time on yolk height in Vanaraja chicken egg

Albumen index, yolk index, and Haugh units were affected by storage time and manner, as shown in Tables 1 and 2. The findings indicated that storage duration had a significant impact on the albumen index. After 5, 10, and 15 days of storage, the albumin index significantly (p<0.01) dropped, falling from 6.54% to 4.97% and 3.71%, respectively (Fig. 4). These findings concur with those of Tabidi (2011) [17]. Eggs with oil coating had a much higher albumen index (5.6%) than the other treatments. With prolonged storage times, a substantial decline (p<0.01) in yolk index was seen. According to this study, after 15 days of storage, the yolk index significantly (p<0.01) dropped from 36.7% to 30.8% (Table 1). In comparison to other techniques, oil-coated eggs had the highest Yolk Index value (36.7%) (Table 2 & Fig 5). After 5, 10, and 15 days of storage, the mean HU values were 79.4, 71.9, and 63.7, respectively (Table 1 and Fig. 6). At room temperature, oil-coated and untreated eggs had Haugh units of 74.0 and 56.9, respectively (Table 2). These findings are in line with Tona *et al.* (2004) [18] and Jones and Musgrove (2005) [19], who found that storage had a substantial negative impact on Haugh units (p<0.001).

Table 2: Overall impact of preservation methods on internal quality in Vanaraja eggs

Preservation methods	EW (g) (Before storage)	EW (g) (After storage)	EWL percent	AH (mm)	YH (mm)	AI (%)	YI (%)	HU
Untreated	56.5±0.67	55.0±0.65^{b}	2.5±0.33^{a}	2.4±0.16^{c}	12.7±0.4^{d}	2.58±0.4^{c}	27.2±1.0^{d}	56.9±1.6^{c}
Thermostabilized	57.2±0.79	56.9±0.78^{a}	0.48±0.13^{b}	4.2±0.29^{b}	14±0.4^{d}	4.99±0.4^{b}	28.9±1.0^{d}	72.4±2.14^{b}
Lime sealing	57.8±0.6	57.5±0.58^{a}	0.56±0.16^{b}	3.9±0.17^{b}	14.9±0.4^{c}	4.81±0.24^{b}	33.2±1.15^{c}	70.3±1.3^{b}
Oil coated	59.1±0.68	58.8±0.67^{a}	0.51±0.13^{b}	4.5±0.22^{b}	16.2±0.49^{b}	5.6±0.27^{b}	36.7±1.16^{b}	74±1.56^{b}
Sig. level	NS	**	**	**	**	**	**	**

Values with various superscripts in a row have significantly differing (Mean SE) values. *p<0.05, **p<0.01; NS= Non-significant

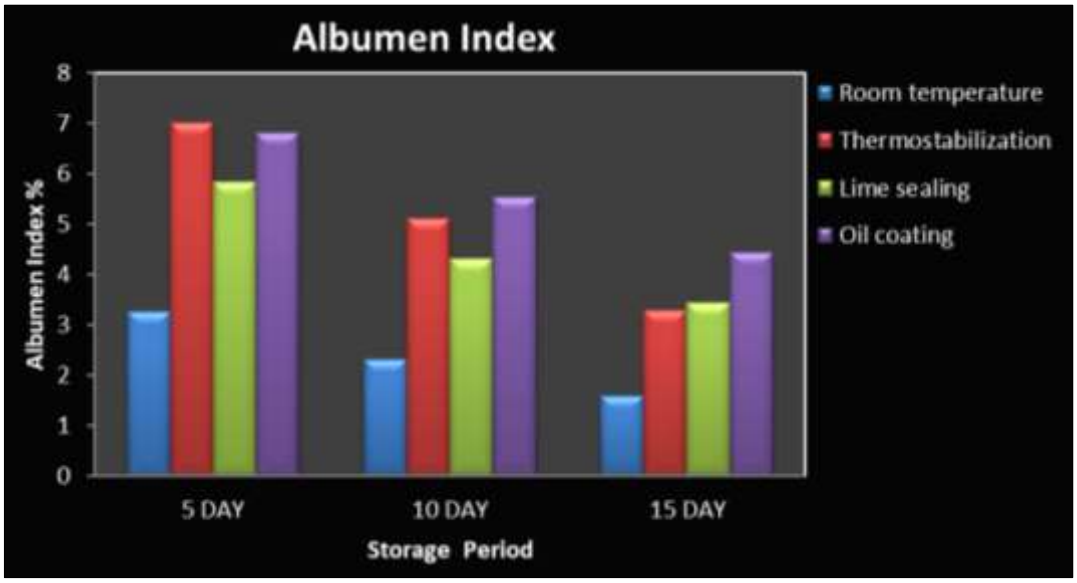

Fig 4: Impact of preservation methods and storage time on yolk index in Vanaraja chicken egg

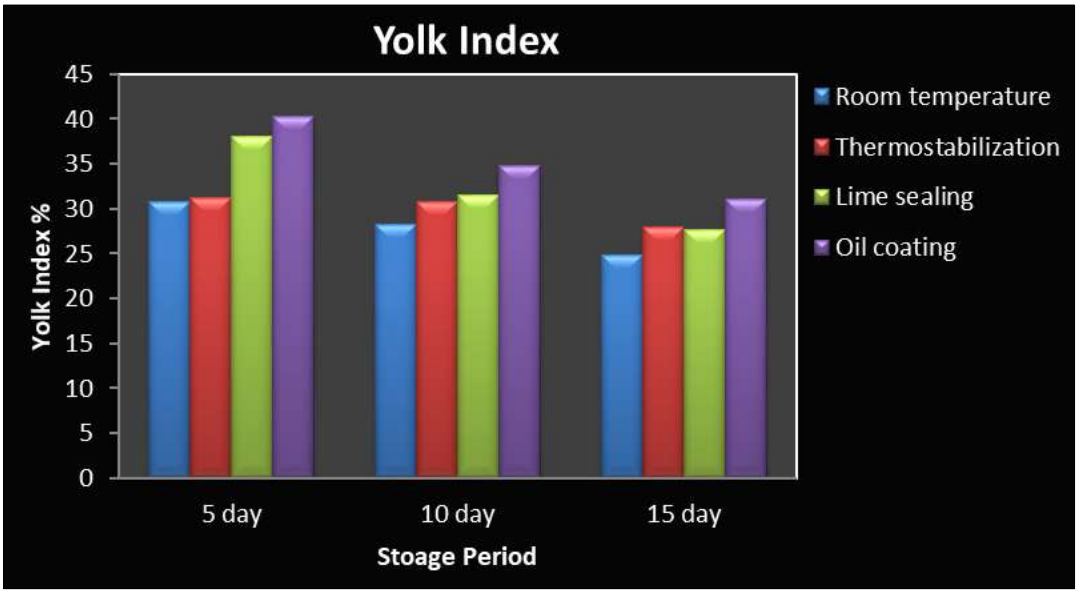

Fig 5: Impact of preservation methods and storage time on yolk index in Vanaraja chicken egg

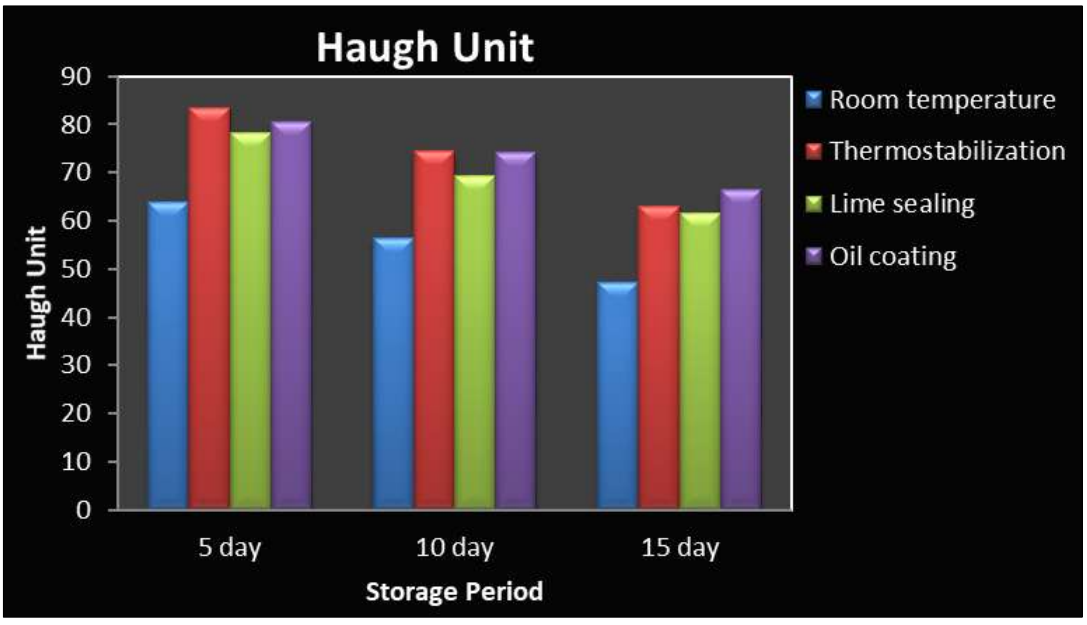

Fig 6: Impact of preservation methods and storage time on Haugh unit in Vanaraja chicken egg

Conclusion

Based on the study's findings, it can be said that as storage time increases, egg weight, albumen and yolk height, albumen index, yolk index, and Haugh units all decline. On the other hand, when storage duration increased, the rate of egg weight loss increased. This leads us to the further conclusion that the kind and length of storage have an impact on egg quality. It has been demonstrated that using preservation techniques including oil coating, lime sealing, and heat stabilization results in eggs of higher quality than leaving untreated eggs at room temperature. Eggs should be preserved and protected at room temperature via oil coating, lime sealing, and heat stabilization techniques in locations without refrigerated facilities, particularly in rural areas. Eggs stored at high temperatures without treatment degraded very quickly and were no longer edible after a week.

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