Research Paper

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Extention of Shelf Life of Raw Eggs Using Soya Protein Based Eggshell Coating

Medical Science

KEYWORDS : Eggshell, Shelf life, protein coating, egg shell breaking strenght

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ABSTRACT

Whole eggs store significant amounts of protein and choline and are widely used in cookery. Despite the nutritional value of eggs, there are some potential health issues arising from egg quality, storage, and individual allergies. The objective of the study was to compare the impact of soya protein based coating and uncoated egg on the internal quality, functional properties and shelf life of the eggs. Eggs were coated with soya protein based coating and were kept for 4 weeks at the room temperature. The effectiveness of soya protein coating on functional properties, interior quality, and eggshell breaking strength of fresh eggs were evaluated during storage at room temperature for 4 weeks. The normal egg of day 1 was compared with the uncoated egg and soya protein coated egg of day 30. The results revealed that the pH of the coated egg has increased as compared to normal egg of day 1. There was a decrease in the haugh unit. There was rapid increase in the weight loss %. The eggshell breaking strength was decreased. The total solid of albumen and yolk has increased and decreased respectively after 4 weeks. The study concluded that coating the egg does not increase the shelf life of the egg and there was no positive effect of the functional, internal quality and shelf life of egg.

INTRODUCTION

Eggs consist of a protective eggshell, albumen (egg white), and vitellus (egg yolk), contained within various thin membranes. Egg yolks and whole eggs store significant amounts of protein and choline [1, 2] and are widely used in cookery. Despite the nutritional value of eggs, there are some potential health issues arising from egg quality, storage, and individual allergies. The egg's internal quality decreases with prolonged storage, and change index in albumen and yolk regarding temperature and carbon dioxide movement through the shell [3,4]. The eggs stored at room temperature or higher than recommended preserve the internal quality for a longer time since the shell becomes impermeable to carbon dioxide.

Eggs are highly perishable and potentially hazardous due to their high moisture and high protein content. Eggs are too refrigerated and stored in the refrigerator (33°F to 37°F) in their original carton. Storage of eggs in the carton reduces absorption of odours and flavours from other foods stored in the refrigerator. Eggs should be consumed within 3 to 5 weeks of the "pack date" listed on the carton. The leftover eggs may be stored in the refrigerator covered for 2 and 4 days, respectively. Cover egg yolks with water. Hard-boiled eggs may be stored in the refrigerator for 1 week, whereas pasteurized liquid eggs may be stored in the refrigerator for 10 days. Egg whites and pasteurized eggs may be stored at freezer temperatures for one year. Shell eggs should never be stored in the freezer. Dried eggs may be stored in tightly closed containers in the refrigerator for one year.

The increased consumer demand for high quality, extended shelf life, ready to eat foods has initiated the development of several innovative techniques to keep their natural and fresh appearance as long as possible and at the same time render them safe. Packaging has been an important element in these preservation concepts for providing the appropriate (mechanical and functional) protection to the commodity. Since synthetic packaging materials contribute to the environmental pollution, edible coatings and packages have been proposed to replace or complement conventional packaging. Biodegradable and edible films and coatings are made from naturally occurring polymers and functional ingredients, and formed on the surface of food products. Edible films and coating have long been known to protect perishable food products from deterioration and reduce quality loss. These films should have acceptable sensory characteristics, appropriate barrier properties (CO_2, O_2, water, oil), microbial, biochemical and physicochemical stability, they should be safe, and be produced by simple technology in low cost. Also they can act as effective carrier for antioxidant, flavour, and color, nutritional or anti-microbial additives [5].

METERIAL AND METHODS

The study was divided into 4 phases. Phase I include procurement and coating of the eggs. Eggs were taken from the local stores. 30 eggs were taken and they were coated properly with the soya protein based coating. The eggs were divided into two groups, Group 1(Controlled group)- Non-coated eggs and Group 2(Experimental group) - Coated with soy protein. The soy protein coating solution was prepared by mixing 5 g soya protein isolate, 3 g glycerol and 92 ml water. This coating solution was heated on 77 C on a hot plate. The pH of the solution was adjusted with 1.N NaOH to pH 10.5. After the preparation the eggs were properly coated with the solution. The eggs were immersed for 1 min in the solution. Phase II was observation phase. Eggs were kept for 4 weeks at room temperature. All eggs were stored at room temperature to accelerate internal quality changes. The eggs were properly observed on the regular basis. Phase III was testing phase, in this phase the different types of parameters were checked to see the shelf life of the egg. The parameters were examined according to the quality indicators and the functional properties of the eggs. The parameters included as Weight loss, pH measurement, Haugh unit, Foaming properties, Albumen & yolk and Eggshell breaking strength. The last phase was statistically analysis. Mean, standard deviation and ANOVA was used for analysis.

RESULTS AND DICUSSUION

The present study was conducted to evaluate the effect of soya protein based coating on the shell life of the egg. The eggs were coated with soya protein coatings. The results were compared with the normal egg of day 1 and uncoated egg and coated eggs of 30 days. The testing was done on different parameters that include pH measurement, haugh unit, eggshell breaking strength, total albumen solid, total yolk solid and foaming property.

Table 1: Mean score of attribute between the samples: normal egg (1st day) uncoated egg (30th day) and coated egg (soy protein)

Parameter	Egg(1st day)	Uncoated Egg(30th day)	Coated egg (soy protein)	P Value (ANOVA)
pH*	7.5±0.04	7.71±0.01	7.76±0.10	0.001
Haugh unit*	81.23±0.94	71.70±0.07	70.21±0.19	0.001
Weight loss*	0.00±0.00	11.2±0.01	11.5±0.08	0.001
Eggshell breaking strength	4.95±0.89	4.10±0.04	4.13±0.11	0.128
Total albumen solid*	11.47±0.05	19.05±0.35	20.19±0.09	0.000
Total yolk solid*	49.70±0.04	46.85±0.14	47.40±0.07	0.000

*Significance p<0.05

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pH Measurement – The above table showed that there was a rapid increase in the pH in the samples. As the storage time increase there was an increase in the pH value also. The pH of the normal egg (7.5) and the egg after 30 days had increased. But there was more increase in the mean value of pH of the coated egg with soya protein (7.76) as compared to uncoated egg (7.71). The results were statistically significant (p<0.05).

Haugh unit - The haugh unit is a measure of egg quality based on the height of albumen and the egg's weight. A fresh good quality has a haugh index around 80 and older eggs has lower haugh unit. The haugh unit tells about the grading quality of the egg. It decreases with the storage time. The haugh unit of the normal egg was 81.23 and it has decreased in all the three cases after 30 day. The mean value was decrease in the uncoated egg (71.70) and coated egg with soy protein (70.21). The grading of the egg has been decreased from "AA" to "A" and the difference were statistically significant between the egg of 1st day and eggs both coated and uncoated of 30th day (p<0.05)

Weight loss- There was a rapid decrease in the weight loss in all the eggs. There was a more weight loss in the coated egg with soya protein (11.5) as compared to uncoated egg (11.2). The above results showed that there was more water loss in all the eggs of 30th day as compared to egg of 1st day. As the storage time increases there was increase in the weight loss of the egg. The eggs gets denatured during the long storage time and the difference were statistically significant among egg of 1st day and eggs both coated and uncoated of 30th day (p<0.05)

Eggshell breaking strength- Egg shell quality was of considerable economic significance for commercial egg production. The shell protects the contents of the egg from mechanical impact to some extent, allows a controlled exchange of fluid and gas through the pores, and provides protection against microbial entry. Shell quality declines as the eggs gets older. There was decrease in the breaking strength from day 1 to day 30. There was decrease in the mean value of breaking strength of coated egg with soya protein (4.13) as compared to uncoated egg (4.10) but the difference were not statistically significant (p=0.128).

Total solid of albumen and yolk-
The total solid (dry matter) concentration of albumen has also been used as an indicator of egg freshness which is related to thinning or liquefaction of albumen. This liquefaction could occur due to protease enzymes, depolymerisation by hydroxyl ions at increasing pH values, and the interaction of ovomucin-lysozyme complex. Water contained in the albumen permeates the yolk and some nutrients contained in the yolk can permeate the albumen. These osmotic tracks and changes in albumen and yolk concentrations can be measured by the refractometric method. During storage the dry matter (DMA) increases due to mixing of the yolk into the albumen.

The increase in DMA during storage has been attributed to liquefaction of the yolk and subsequent mixing into the albumen. Liquefaction is a result of an enhanced interaction between lysozyme and ovomucin as the pH increases during storage. The chemical cleavage effect of pH on the O-glycoside link between trisaccharides and β-ovomucin has been considered to be responsible for the collapse of the albumen structure. In general, liquefaction would result in an increase of fluidity in egg albumen and is associated with a deterioration in egg quality.

Total solid of albumen- The total solid concentration of albumen of a normal egg on day 1 was 11.47 and the mean value of the total albumen solid of uncoated egg was increased on day 30 was 19.25 and similar results were found in the coated egg with soy protein (20.19). This showed that there was more increase in the total solid of albumen in coated eggs as compared to uncoated egg. Even there was increase in total solid of albumen was more in eggs both coated and uncoated of 30th day as compared to egg of 1st day. Statistically significant difference were observed between egg of 1st day and eggs both coated and uncoated of 30th day (p<0.05)

Total solid of yolk- The total solid concentration of yolk of a normal egg on day 1 was 49.70 and the mean value of the total yolk solid of uncoated egg was decreased on day 30 was 46.85 and similar results were found in the coated egg with soy protein (47.40). This showed that there was more decrease in the total solid of yolk in coated eggs as compared to uncoated egg. Even there was decrease in total solid of yolk was more in eggs both coated and uncoated of 30th day as compared to egg of 1st day. Statistically significant difference were observed between egg of 1st day and eggs both coated and uncoated of 30th day (p<0.05)

QUALITATIVE ANALYSIS OF EGGS

Table 2: Forming properties of egg samples: normal egg (1st day), uncoated egg (30th day) and coated egg (soy protein)

Samples (Eggs)	FOAMING PROPERTIES
Normal egg (1st day)	Excellent
Uncoated egg (30th day)	Excellent
Coated egg with soy protein (30th day)	Good

The table 2 depicts the forming properties of egg samples: normal egg (1st day), uncoated egg (30th day) and coated egg (soy protein). The whip ability of egg albumen can be assayed by measurement of foam volume and foam stability (amount of liquid released from the foam in a given time). The changes that occur in eggs during storage include: thinning of albumen, increase in pH, weakening and stretching of the vitelline membrane, and increase in water content of the yolk. Foam stability (FS) is determined by measuring the loss of liquid resulting from destabilization, i.e., leakage, measuring volume decrease, or density increase with time. The foaming property of a normal egg was excellent as the storage increases there is a decrease in the foaming property of the coated with soy protein but it was still excellent in the uncoated egg.

CONCLUSION

The work demonstrates that using of soya protein coating do not affect the shelf life of the egg. We can conclude from the present study that the soya protein coating has effect on the pH of the egg as it has increased from the normal egg of day 1. The total solids of albumen and yolk has increased and decrease rapidly. But there was no effect on the haugh unit, eggshell breaking strength, foaming properties. There was an increase in the weight loss % of the egg as there was loss of water from the egg. Coating of eggs will not have any positive effect on the shelf life of the egg.

Further studies should use different and better coating formulations such as those containing antioxidants and antimicrobial compounds on various perishable food products. Shelf-life studies of coated eggs in inoculated eggs also need to be performed

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