7. SUMMARY

Egg is an important food item and there has been an increasing importance of consuming eggs among the people. The emerging per capita egg consumption reveals that there is widespread demand for eggs from the people. Eggs are known for their nutritional importance and consumption of eggs eliminates nutritional deficiencies in the human body. Egg is a rich source of important vitamins, minerals, proteins and cholesterol which are very vital for smooth process of metabolism activities in the human body. On account of increasing demand for eggs, there has been increasing establishment of poultry farms among the farmers. The backward poultry farms are being transformed into modernized farms with the state of art technologies. The small layer farmers expand their farm activities in the emerging poultry sector.

This sector fetches an attractive profit margin and contributes a decent share in the nation’s gross domestic product. In spite of the layer farms are operated at an alarming growth rate, they are not free from certain growth obstacles in their pathway. The outbreaks of diseases and resulting overproduction of eggs are matter of great concern. This leads to heavy economic losses to the farmers and sellers. The export chances are temporarily cut by the foreign importers. Therefore, egg producers and sellers are forced to find any means of preservative methods to preserve their eggs for certain periods. There are many conventional preservative methods available to preserve the poultry eggs. However, it is find it difficult to preserve large numbers of eggs. Each preservative technique has its own advantages and disadvantages.
Keeping these factors, it is beneficial to find cost-beneficial and effective preservative method(s) to preserve eggs. The merits and defects of several egg preservative techniques already available were studied. Based on this, slightly modified preservative techniques were found and these were evaluated. The present study analyzed the effectiveness of different preservative techniques of eggs with the objectives of (1) To find various preservation techniques available to preserve the poultry eggs, (2) To study the changes in the physical parameters of sample eggs during the storage period, (3) To find out changes in the protein, cholesterol and fatty acid contents in the sample eggs during the storage period and (4) To analyze the microbial growth in the sample eggs during the storage period.

The sample eggs were collected from the 20 week old hens and 60 week old hens. In order to find the effect of hen age on egg qualities under different preservative techniques, eggs from different ages of hens were collected. These hens were reared in the commercial cage system. The sample eggs were collected on the day of eggs laid and immediately they were processed for preservation. To find out the effect of washing of eggs on egg qualities, the sample eggs of 20 week and 60 week old hens were divided into two groups such as “unsanitized eggs” and “sanitized eggs”. The sanitizer used in this analysis was kersholin. The preservative techniques taken for analysis were vegetable oils mixture coating, paraffin wax coating, glycerin coating and silicon oil coating. The refrigerator storage technique was also taken for analysis for comparison.
For vegetable oil coating, rice bran oil, corn oil, coconut oil and neem oil were taken in the ratio of 2:2:1:3 and this mixture of vegetable oil were used to coat the shell surfaces of the sample eggs. Regarding the paraffin wax, a solid state of paraffin wax was heated till it turned into gel like state and then it was allowed to cool. This liquid form paraffin wax was used to coat the sample eggs. Glycerin and silicone oil were purchased and coated over the shells of the sample eggs. These eggs were stored at room temperature up to eighth week storage period. The sample eggs were stored in refrigerator at 4°C to 5°C and these eggs were kept up to a period of sixteen weeks in order to know the efficacy of child temperature on egg quality. These eggs were tested once in a week and observations were noted down.

The physical parameters such as egg weight, shape index, specific gravity, shell strength, mean shell thickness and Haugh unit were taken for analysis. The chemical quality of the sample eggs was analyzed with respect to changes in the protein, cholesterol and fatty acids contents. The counting of colonies of microbes was made to know the contamination of eggs.

Among the physical quality parameters, changes in the egg weights are considered as an important factor. Usually egg weight decreases with the increasing storage time and temperature. The analysis of changes in egg weights reveals that

- Egg weights of control eggs highly decreased at the eighth week.
- Minimum decreases in egg weights were found in the sample eggs coated with silicone oil and this is followed by eggs coated with vegetable oils.
The mean egg weights of silicone oil coated and vegetable oil coated eggs were found to be closer to the mean egg weight of fresh eggs during the storage period.

Haugh unit is an important measurement to analyze the albumen quality. The albumen in the fresh eggs is seen in the form of thick and solid state. The albumen became watery with the increasing storage time and temperature. Based on the albumen quality, eggs are categorized into different grades such as excellent, good, fair and poor.

The Haugh unit values decreased heavily in the control eggs during the eighth week of storage period.

Eggs coated with silicone oil and eggs stored in refrigerator maintained their Haugh unit values more than 60 during the entire storage period and therefore these eggs retained good quality up to the end of the storage period of eighth week.

The quality of egg shell is associated with the specific gravity and mean shell thickness too. Eggs having higher values of specific gravity are desirable by the egg producers and sellers because low amount of damages are there. On evaluating the effectiveness of preservative methods with respect to specific gravity,

Specific gravity of control eggs was highly decreased at the eighth week.

Eggs coated with silicone oil produced better results. The mean specific gravity values of silicone oil coated eggs in all types of sample eggs were...
found to be nearer to the mean specific gravity value of the fresh eggs during the storage period.

Shell strength is very essential since it protects the eggs from damages and cracks during handling and transportation. There is a natural cuticle called bloom over the surfaces of the shell and it protects the shell from invasion of foreign bodies from outside.

- The shell strength of 20 week old hens was found to be more strength than that of 60 week old hens.
- The present study found that the mean values of shell strength among different preservative techniques were not statistically different from one another irrespective of sanitization.

The shape index is another physical quality of egg which facilitates for the convenient accommodation of eggs in the trays so that the eggs are protected from cracks and damages. The length and width of eggs were taken for analysis in measuring the shape index.

- The shape index of the sample eggs of all types experienced minimum differences among them however these differences are not significant one.
- The size of the eggs differed due to hen age. It was found that the size of the younger hens’ eggs was relatively small when compared to older hens’ eggs. The slight changes in the mean values of length, width and shape index are not a matter of great concern from the egg quality point of view.
The mean shell thickness was calculated after removing the membrane which jointed from the inner side of shell.

- There were no any drastic and notable changes in the mean shell thickness of the sample eggs that belong to younger and older age hens during the storage period of eighth weeks.

- Regarding the mean shell thickness of sanitized and non-sanitized eggs of 20 week old hens, no changes were found during the entire experiment. Slight changes were found in both the sanitized and non-sanitized eggs of 60 week old hens.

Yolk colour is an important one from the consumers’ perception point of view. In general the colour of yolk is yellow. However, the there are different types of yellow colour such as pale yellow, medium yellow, golden yellow, dark yellow and so on. The yolk colour of the sample eggs in the present study was classified into four main categories such as pale yellow, medium yellow, golden yellow and dark yellow with reference to yolk colour fan.

- The observations made from the analysis revealed that maximum of the sample eggs had pale yellow and medium yellow yolks and a few eggs had golden and dark yellow yolks.

- The observations also clearly stated that there were no any significant relationship between the storage period and yolk colour; preservative techniques and the yolk colour.
The chemical qualities of eggs were analysed with respect to protein, cholesterol and fatty acid compositions.

- Regarding the protein content, only least variations were found among the sample eggs during the storage period.
- The composition of cholesterol fluctuated over the period of storage. This fluctuation differed from one preservative method to another.
- Fatty acids such as Myristic, Palmitic, Palmitoleic, Steric, cisoleic, Linoleic, Linolenic, Arachidonic, EPA and DHA were identified and quantified.
- The share of each of this fatty acid was same both in the 20 week and 60 week old hens’ eggs.

Microbial contamination is one of the main reasons for reducing egg quality. The contamination of eggs was mainly due to invasion of microorganisms such as *Salmonella* bacteria. The microbial analysis produced the results that

- Lesser number of bacteria colonies was found in the sanitized sample eggs that belong to 20 week and 60 week old hens than non-sanitized eggs.
- Of different preservative techniques, eggs with oil coated (Vegetable oil and Silicone oil) had lesser amount of bacterial count throughout the storage period.
- Among the hens of different ages, the sanitized eggs of 20 week old hens had lesser amount of bacterial colonies when compared to the sanitized eggs of 60 week old hens. Eggs of 60 week old hens had thinner shell and
low specific gravity and eggs of 20 week old hens had thicker shell and relatively higher specific gravity. The microorganisms easily penetrated through the shells of 60 week old hens.

It was concluded that the combined work of sanitizing and oiling (Vegetable oil and Silicone oil) was effective in controlling the penetration of microorganisms.

Though there are different quality parameters available to analyze the interior and exterior qualities of the sample eggs, the quality parameters such as changes in egg weight, Haugh unit, specific gravity and egg contamination are the major quality parameters which attract the consumers and producers to pay keen interest on them. The other quality parameters such as shape index and egg shell thicknesses are also important traits however minimum changes in these traits do not affect the egg quality to a considerable extent. These changes are common among the eggs and they differed from one environment to another and one preservative technique to another.

Based on this analysis, the sample eggs coated with oil especially silicone oil produced an excellent result in changes in egg weight, Haugh unit values, specific gravity and exposed to microbial contamination minimally. The vegetable oil mixture coated eggs also produced better results in changes in egg weight and lesser amount of microbial contamination during the storage period and eggs stored in refrigerator kept better values of Haugh units during the storage period. However increasing microbial colonies in the refrigerated eggs during the storage period is a matter of great concern.

Thus, silicon oil coating and vegetable oil mixture coating are recommended as good egg preservatives for long storage period.