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Enhancing Hygiene and Prolonging Shelf Life: Methods for Cleaning and Preserving Table Eggs

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Abstract

Eggs are commonly acknowledged for their high nutritional value, as they are efficiently digested, absorbed, and utilized by the body. With their high biological value, egg proteins are often regarded as perfect proteins. Eggs are abundant in essential nutrients, with the exception of vitamin C. However, due to their perishable nature, maintaining the quality of eggs becomes a crucial factor in marketing them effectively. Although the contents of chicken eggs are sterile on laying, the shell surface may be contaminated with many micro-organisms - on average there may be 130,000 bacteria on the shell of an egg. Some of the contaminating micro-organisms can be pathogenic, food-poisoning bacteria such as *Salmonella* species, which are often found in chicken droppings, but pathogens are very rare in chicken eggs. Along with the preservation of eggs cleaning techniques are also equally important. Oil treatment, immersion of eggs in in liquids, thermal processing, cold storage and pickling are the common procedures for preservation. By following various methods of preservation, we can increase the shelf life of eggs to a limit without losing the interior quality.

Key words: Egg, preservation, water glass, thermos-stabilization

Introduction

All techniques employed for preserving eggs are intended to prevent the introduction and proliferation of spoilage or harmful microorganisms, which could render the eggs unpalatable or hazardous to health. Poultry egg is of the highest quality at the time of laying. Consequently, every process of preservation begins from the point of production itself. Normally, an egg shell contains a wide variety of microorganisms on its surface, with an average of 130,000 bacteria on the egg shell and most of which are responsible for the spoilage of eggs. Most of these species, which come from nest litter or bird excreta, can spoil the egg but are not harmful to health, such as *Pseudomonas fluorescens*, which causes 'green rot' and odours when it is allowed to enter the egg and grow.

The quality characteristics of the shell to be considered are cleanliness, smoothness, soundness and shape. Two of the most desirable shell qualities (cleanness and soundness) are primarily controlled by production and egg handling practises. As a routine for the production of quality eggs on the farm, the following practises are recommended. Collection of eggs at least 3 times a day and use of a clean container with ventilated sides and bottom. Ideally, filler flat can facilitate rapid cooling of eggs quickly to 50^{o}F or less at 75-85 percent relative humidity. Chicken eggs are naturally well shielded from any form of microbial infection by their calcite shells and cuticle coating. Egg white or albumen forms a second line of protection since it is very alkaline and includes microbial inhibitors such as lysozyme, and very few microorganisms can live in fresh eggs. This degradation starts when the egg is laid and involves proteolytic changes that thin the white and weaken the chalazae so that the yolk is no longer centrally suspended, dehydration and carbon dioxide loss that increase the size of the air cells. Such staling and microbial invasion and spoilage can be avoided and the shelf life of the egg can be extended by artificial preservation, either in the shell or as liquid eggs.

Egg cleaning

Egg cleaning can be done using two methods: A) dry cleaning and B) wet cleaning

A) Dry cleaning

A slightly dirty egg can be cleaned with an egg brush or rubbed with a sanding sponge, loofa, and paper towel with a gentle rubbing motion. Eggs that have visible faeces, dirt, or other substances that cannot be removed through dry cleaning should be segregated and properly discarded in a hygienic manner, away from clean, intact eggs. Hand-abrasive blocks are the most straightforward method of dry cleaning to remove dirt or stains from the surface of eggshells. Abrasives were connected on mechanically rotated wheels so that the eggs could be easily cleaned by placing the individual eggs against the rotating abrasive surface. Although mechanical equipment for dry cleaning of shell eggs has been developed, wet cleaning procedures have rendered it obsolete. The limitation of dry cleaning is weakness of the shell.

B) Wet cleaning

Washing may cause microorganisms to enter through the pores of the shell, as egg shells are porous. When eggs cool, they contract and may draw water into the egg. Hence, it is recommended to clean eggs promptly upon obtaining them. This would help to reduce the potential for contamination and loss of internal quality. For the clean appearance of eggs, washing is more effective than dry cleaning. The wash water should be maintained at a temperature of 41-44^{o}C and if the egg wash chemical or sanitizer is used, the pH should be greater than 10.5 to minimise the

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potential for contamination. If sufficient temperature water is used without any chemicals and the water is not recirculate, the pH of the water must not be taken into account. Through using clean water and paying close attention to the difference in temperature between the eggs and the washing water, the eggs can be well cleaned with a minimum reduction in quality. It is also necessary to dry the eggs after washing. Egg washing should be carried out in a dedicated room with adequate drainage. Various commercial instruments are available to assist with egg washing/sanitising/drying.

Egg preservation

1. Oil treatment

The egg is safeguarded through the application of an oil coating, which creates a thin film on the shell's surface and covers the pores. This protective measure involves dipping the egg into a bowl containing tasteless, odourless, and colourless edible oil that is free from fluorescent substances. The eggs are immersed for a certain period, allowing any excess oil to drain off. For optimal results in terms of internal consistency, it is recommended to provide this treatment within a few hours. While applying a coating alone is beneficial, eggs receive superior protection when they are washed prior to the coating process. Food-grade mineral oil, which is light in nature, is commonly used for this purpose. Although cotton seed oil, groundnut oil, and linseed oil serve as effective sealants, food-grade mineral oils are preferred due to their lower susceptibility to oxidative changes during storage.

2. Immersion in liquids

In rural settings, liquids like lime water and water glass are commonly utilized. These traditional methods have been employed for preserving the quality of shelled eggs, especially for home use, by preventing moisture evaporation from the eggs. Depending on the specific liquid used, microbial decomposition can be hindered through chemical intervention or physical mechanisms.

a. **Lime water treatment:** The lime water is prepared by mixing about one kg of quick lime (calcium oxide) in about one liter of boiling water. The fluid is left to settle overnight and the clean supernatant liquid is poured out into a jar. Approximately 250 g of table salt and 4-5 litres of cold water are added to this solution. The purpose of adding sodium chloride is to increase the specific gravity of water and reduce the chance of breakage of eggs. On the mixture setting down the solution is strained through muslin cloth. Eggs are soaked in thin, clear fluid for 24 hours, then removed, dried and arranged in filler flats. Eggs can be kept in good edible condition at room temperature for 2-3 months. The preservative effect of lime water is partly due to its alkalinity. It deposits a thin layer of calcium carbonate on the egg shell and partially seals the pores. The only drawback however, is that the taste of lime can be detected in eggs.

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b. **Water glass method:** The water glass is prepared by diluting 1 part of sodium silicate with 10 parts, of water and the eggs are left immersed over right in water glass. It deposits a thin precipitate of silica on the surface of egg shell, possesses intrinsic antiseptic properties and dose not impart odour or taste to the eggs. Egg can be stored at 13 to 15°C for six months.

3. Thermal processing

This includes flash heat treatment, thermos-stabilization and simultaneous coating.

c. **Flash heat treatment:** was introduced by Romanoff and Romanoff (1944) based on the immersion of egg in boiling water for 5 seconds. This resulted in egg with superior storage characteristics at storage temperature of either 5°C or 21°C (41 to 70°F). Immersion for only 3 seconds in boiling water was effective in reducing bacterial spoilage in fresh eggs.

d. **Thermo-stabilization:** This process is suitable for fertile eggs, as it kills embryos and is thus also known as the 'de-fertilization' method. It essentially consists of immersing eggs in hot water or oil at 140°F for 14 minutes which tends to coagulate the albumin. Simultaneous oil treatment and thermos-stabilization complement each other by preserving the inner quality of the egg. The problem with the commercial application of thermos-stabilization is that the temperature of the egg white coagulation depends on the pH of the egg white. The temperature attained by the egg is influenced by the size of the egg, the starting temperature of the egg, the agitation of the heating medium as well as time and temperature. Treated eggs remain edible for 3 to 4 weeks even during the summer months.

4. Cold storage

This is the best and most effective form of commercial storage. Cold storage eggs must be clean, unbroken and free from fungus and other infections. A temperature of 0°C or 30-32°F and a relative humidity of 85-90 percent are recommended for the cold storage of eggs for 5 to 8 months. Eggs can be stored at 10-12°C or 50-55°F for a limited shelf-life of 2 to 3 months with a relative humidity of 60-70 percent. To improve their shelf life, eggs can undergo oil treatment before being placed in cold storage. When stored in a cold environment, shell eggs can maintain their quality for up to six months. A final concern in the preservation of egg quality is the maintenance of flavour; eggs will pick up flavours from storage areas, such as onion, garlic, oranges, decaying vegetable matter, oil, gasoline or organic solvent.

5. Pickling

The eggs can be preserved by pickling also. It can be done with eggs of small size like that of quail eggs as it will allow proper penetration of pickling solution throughout the egg. The Central Avian Research Institute has developed a technique for pickling of quail eggs.

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Conclusion

The quality of poultry eggs is at its maximum when they are freshly laid, highlighting the importance of initiating preservation measures right from the production stage. Delaying the processing of eggs can result in diminished shelf life and compromised interior quality. To prevent microbial contamination and spoilage, a range of preservation methods can be employed, whether preserving eggs in their shells or as liquid egg products. Although there are other well-established preservation techniques available, the aforementioned methods stand out as the most natural and easy approaches to effectively preserve eggs, ensuring their safety for consumption and maintaining their health benefits.

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