PROPER EGG HANDLING: FROM FARM OR GROCERY STORE TO TABLE

PNW PEER REVIEWED

PNW720

PACIFIC NORTHWEST EXTENSION PUBLISHING

WASHINGTON • IDAHO • OREGON

Proper Egg Handling: From Farm or Grocery Store to Table

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Abstract

Eggs are part of a healthy diet and contain many nutrients. Moderate egg consumption does not increase heart disease risk in healthy individuals. However, *Salmonella enteritidis* (SE) infections from eggs continue to be a significant cause of outbreaks of gastroenteritis. Symptoms of SE illness can be severe and result in hospitalization from dehydration or sepsis. This publication provides an overview of egg handling practices in the United States and also includes safe practices for handling, storage, and consumption of eggs from farm to grocery store to table.

Introduction

Eggs are part of a low-calorie diet and contain many nutrients required for good health. Eggs are high in protein (six grams per one-egg serving) and contain 14 key nutrients, including vitamins A, D, E, B12, and folate, and minerals, like iron and selenium (Figure 1) (Egg Nutrition Center 2022). Eggs have been defamed for their high cholesterol content. Although egg yolks do contain a high amount of cholesterol (up to 200 mg per yolk), and may slightly affect blood cholesterol levels, eggs also contain many nutrients that may help lower the risk for heart disease (Harvard T.H. Chan School of Public Health 2019). The most recent research shows that moderate egg consumption does not increase heart disease risk in healthy individuals and can be part of a healthy diet (Harvard T.H. Chan School of Public Health 2019).

Even though eggs are part of a healthy diet, SE infections from eggs continue to be a major cause of gastroenteritis (Figure 2). The Centers for Disease Control and Prevention (CDC) estimates that SE causes approximately 1.2 million illnesses and 450 deaths every year in the United States (CDC 2016). Chickens are the single largest reservoir host for SE, and contaminated poultry and poultry products are major sources of human infection (Shah et al. 2012). For example, in July 2010, CDC identified a nationwide, multi-state increase in the number of SE illnesses. From May 1 to November 30, 2010, a total of 3,578 illnesses were reported. Investigations suggested that shell eggs were a likely source of the infections. Ultimately, an egg producer in Iowa was found as the common source of the shell eggs associated with clusters of illness (CDC 2010). Eggs can become contaminated with SE before the shell forms (Jones et al. 1995), or as the egg leaves the hen, as eggs exit through the same passage as feces (Schoeni et al. 1995).

Figure 1. Eggs are part of a healthy diet but can cause illness if not handled properly. iStock: 486369214.

Symptoms of SE illness can include severe diarrhea, bloody diarrhea, fever, chills, abdominal discomfort, and occasionally vomiting. Most persons infected with SE bacteria develop diarrhea, fever, and

abdominal cramps 12 to 72 hours after infection. Illness usually lasts four to seven days. Most people recover without treatment, but serious bloodstream infections (sepsis) can occur, particularly in those who are very young, elderly, pregnant, or immunocompromised. Additionally, people infected with SE may need to be hospitalized due to severe dehydration caused by diarrhea (CDC 2012).

Although the risk of SE infection may deter people from consuming eggs, safe buying, storing, handling, and cooking of eggs will lower your risk for SE infection and provide you with a nutrient rich and healthy food option. This document will provide you with the background and information needed to ensure the eggs you buy and consume are safe.

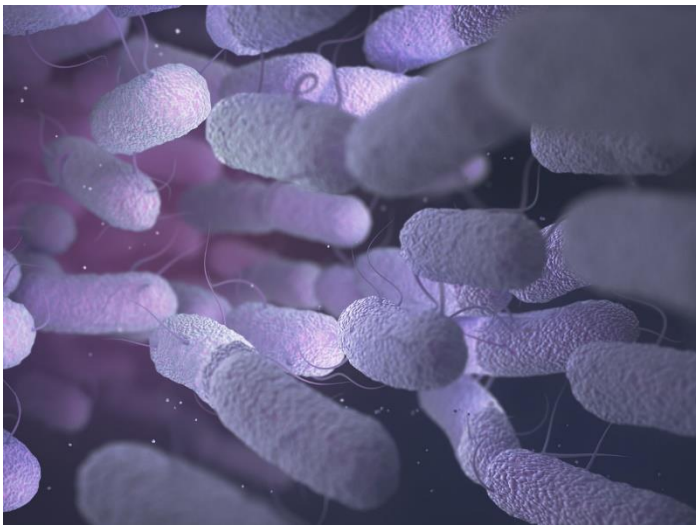

Figure 2. *Salmonella enteritidis* (SE) continues to be an important cause of foodborne illness. iStock: 624717220.

Why Do We Wash and Refrigerate Eggs?

To prevent SE, the United States Department of Agriculture (USDA) requires that all eggs produced commercially in the US be washed before they are sold. Commercial eggs are rinsed in hot water, dried, then sanitized (Figure 3). This process is required for all USDA-graded eggs. Many processors will then apply a coating of food-grade mineral oil to the eggs to keep them from drying out and to form a protective barrier between the inside of the egg and its external environment (FDA 2009). Unlike the US, the majority of egg producers in the UK vaccinate their hens to help prevent *Salmonella*. Egg producers in the UK usually do not wash or clean raw eggs before sending them to market in order to preserve the naturally occurring thin coating, called the "cuticle," on the outside of the eggs, which works as a protective barrier. Refrigeration of raw eggs is discouraged in the UK, since condensation occurring during cooling could allow for pathogens to enter the inside of the egg (FSN 2014). The food grade mineral oil applied to eggs in the US prevents condensation and pathogens from entering the inside of the egg. Egg producers in the US are starting to vaccinate laying hens, although it is currently not required by the Food and Drug Administration (FDA). The FDA did consider mandatory vaccination of hens for *Salmonella* but concluded that more information on the effectiveness of SE vaccines was needed before they would mandate vaccinations (FSN 2014).

Figure 3. Commercial egg production. iStock: 820746618.

Buying Eggs from the Grocery Store

Make sure you only buy refrigerated eggs. Visually inspect the eggs by opening the carton to make sure the eggs are clean and the shells are not cracked. Eggs should not be at room temperature for more than two hours, as it may allow SE to grow on the eggshell or inside the egg itself. Time between washing, transporting, purchasing, and refrigerating eggs should be minimized. Eggs should be purchased towards the end of your shopping trip and should be kept separate in your cart, away from ready-to-eat foods, such as produce. Keep eggs cold on your drive home by storing them in an insulated bag. Refrigerate

the eggs promptly when you get home. Eggs should be stored in their original carton. Store them within the refrigerator, and never in the door of the refrigerator (Figure 4). Eggs stored in the door of the refrigerator can experience temperature fluctuations from opening and closing the door. Your refrigerator should maintain a temperature of 40°F or below. Generally, use store bought eggs within three weeks for best quality.

Figure 4. Eggs should be stored within the refrigerator and never in the door. iStock: 000037399.

Buying Eggs from the Farm

Eggs should only be purchased from reputable farms that maintain the chicken flock and have healthy hens. The standards for buying eggs from the grocery store hold true for eggs purchased directly from a farm. If purchasing farm-fresh eggs, do not buy eggs that are being kept at room temperature, as SE can multiply rapidly at temperatures between 40°F and 140°F. Visually inspect the eggs to ensure eggs are clean and the shells are not cracked. Cracked, visibly soiled, or warm eggs should not be purchased. The time between purchasing and refrigerating eggs should be minimized, and eggs should be kept cold on your drive home by storing them in an insulated container. Be sure to refrigerate the eggs promptly when you get home, and follow the advice above for storing eggs in the refrigerator.

Handling Eggs from Your Own Hen House

If you keep chickens and eat the eggs they produce, it is very important to keep the eggs safe at every step. Free-range hens are more likely to lay contaminated eggs because of their increased exposure to dirt, feces, and broken eggs (Fanatico and Conner 2009). Make sure to keep bedding clean in the hen house and change it frequently. Collect eggs often (once a day is best) and begin cooling the eggs to below 45°F within 36 hours of collection (FDA 2009); the sooner the better (Figure 5). Eggs stored at room temperature can allow SE to grow in the egg, and embryos can develop in fertilized eggs held above 85°F for just a few hours (Fanatico and Conner 2009).

Figure 5. Collect eggs often and cool eggs shortly after collection. iStock: 67440435.

Before refrigerating eggs, clean debris off the eggs to reduce the possibility of contamination. Excessively

dirty eggs (i.e., eggs containing large amounts of feces, soil, or other debris) should not be consumed and should be discarded. When cleaning your eggs, use potable *running* water at least 90°F (warm to the touch) in temperature (WSDA 2014). This reduces the likelihood of water and bacteria being absorbed into the egg through its pores. Detergents are *not recommended* for cleaning eggs. Eggs can be cleaned using one of the following methods:

1. dry cleaning by lightly sanding minimal dirty areas with sandpaper;
2. using potable water in a hand spray bottle and immediately wiping dry with a single use paper towel; or
3. briefly rinsing with running water and immediately wiping dry with a single use paper towel (3) (WSDA 2014). Be sure to keep your eggs cold after washing, as it removes the waxy layer, known as the "cuticle" or the "bloom," that protects eggs from microbial growth (Parkhurst and Mountney 1988).

Selling Eggs

If you plan on selling eggs, please contact your state Department of Agriculture for information and regulations regarding the sale of eggs in your region, as regulations can vary. In Idaho, sale of eggs to foodservice operations are also regulated by the Department of Health and Welfare. More information on small-scale egg handling, including collecting, washing, and packing your eggs, is available at Appropriate Technology Transfer for Rural Areas (ATTRA), the Handbook for Small and Direct Marketing Farms (WSDA 2014), Idaho State Department of Agriculture, and Oregon Department of Agriculture.

Ideally, eggs that will be sold should be packed within 24 hours of laying, but the USDA requires packing within 30 days of laying. Prior to packing, eggs should be collected, cleaned, then immediately refrigerated. Washington State Department of Agriculture (WSDA) allows the use of the following methods for cleaning eggs prior to sale:

1. dry cleaning minimally dirty areas with sandpaper (1);
2. spraying eggs with potable water using a water bottle followed by drying with a single use paper towel (2); or
3. briefly rinsing with running water and immediately drying with a single use paper towel (3) (WSDA 2014).

Oregon Department of Agriculture allows for both dry cleaning or washing eggs. If eggs are washed, the washing solution must be maintained to ensure it is kept in reasonably clean condition. The wash water must be at least 20°F higher than the temperature of the eggs being washed and must contain an approved sanitizer. Cloth or wash rags used for cleaning eggs must be sanitary, single service cloths or rags, such as single service paper towels (Oregon Revised Statutes 603-022-0525 and 603-022-0530 [ORS 2022]).

In Idaho, wash water must be kept clean, potable, free of foreign material, maintained at 90°F, and at least 20°F warmer than the temperature of the eggs to be washed. Pre-wetting or soaking stained eggs cannot exceed five minutes, and the water temperature must meet the requirements as stated above. Washing and rinsing compounds must be approved by the United States Department of Agriculture or the Idaho State Department of Agriculture (Idaho Administrative Code §550 [IDAPA 2011]).

Check with your state agriculture agency for other approved methods of cleaning eggs. Prior to cooling, eggs should be kept at or below 60°F with 70 to 85% humidity. Small-scale producers should sell eggs within seven days of laying to keep their eggs as fresh, or fresher than, conventional eggs.

Cooking and Eating Eggs

The most important step for keeping yourself and those you cook for safe is to use best practices when cooking and handling eggs. Always follow the guidelines: *clean*, *separate*, *cook*, and *chill* whenever handling or cooking a raw product like eggs (Hillers and Aegerter 2009).

- **Clean**: Make sure you thoroughly wash all cooking areas, utensils, and your hands before and after preparing eggs.
- **Separate**: Keep raw eggs away from produce and other foods that are ready to eat. Eggshells that are contaminated with *Salmonella* can be very dangerous in the kitchen and should be disposed of in the trash or composted (Whiley et al. 2016).
- **Cook**: Eggs should be cooked to a minimum internal temperature of 160°F, which is when both the white and yolk are firm and not runny (Figure 6). Use a food thermometer when cooking casseroles and egg-containing dishes.
- **Chill**: If you prepare a casserole, either cook it immediately or refrigerate it and cook it within 24 hours. After cooking eggs or egg dishes, serve immediately, and refrigerate within 2 hours of cooking. Use refrigerated foods within 3 to 4 days. Eggs should be stored within the refrigerator and not in the door.

Figure 6. Eggs should be cooked to a minimal internal temperature of 160°F. iStock: 519518676

Safe recipes are key; these include recipes that use pasteurized eggs and egg products, with eggs heated to a minimum 160°F. If a recipe calls for raw eggs, such as in a carbonara or béarnaise sauce, either heat the eggs in a liquid or in a double boiler, stirring constantly until 160°F, or use pasteurized egg products (USDA 2011). Principle causes of *Salmonella* infection includes runny (undercooked) and improperly handled eggs (Hennessy et al. 2004). Avoid eating the egg dish if the whites and yolks are not firm.

Summary

Eggs are a healthy, economical, and safe meal option as long as you handle them correctly. Buying eggs that are un-cracked, stored at temperatures under 40°F, and kept cold during transportation are the first steps to minimizing your risk of SE infection. Eggs stored at room temperature are not safe to eat; avoid buying or storing eggs outside of a refrigerator. Collect eggs frequently and wash them thoroughly if you keep chickens and eat the eggs that they produce. Free-range chickens are more likely to lay eggs contaminated with dirt, feces, and cracked eggs. Cooked eggs should reach a temperature of 160°F, which is when both the white and yolk are firm. Recipes that call for raw eggs in the final product can be followed by using pasteurized eggs or egg products. As long as you practice safe handling and cooking of eggs, you can safely consume this nutritious food and avoid SE infection.

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