Safe Handling of Eggs from Small and Backyard Flocks

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Eggs are a versatile and economical source of important nutrients, making them a great addition to any menu. Like any food of animal origin, eggs and egg products must be handled carefully. The cartons of all eggs sold in the United States must contain the following safe handling instructions: ***To prevent illness from bacteria: Keep eggs refrigerated, cook eggs until yolks are firm, and cook foods containing eggs thoroughly.***

Although eggs and poultry have inherent food safety issues, many different foods have been sources of illness, as shown in Figure 1. It is important to remember that all food should be handled safely to prevent food-borne illness.

Figure 1. Contribution of different food categories to estimated domestically-acquired illnesses and deaths, 1998-2008*

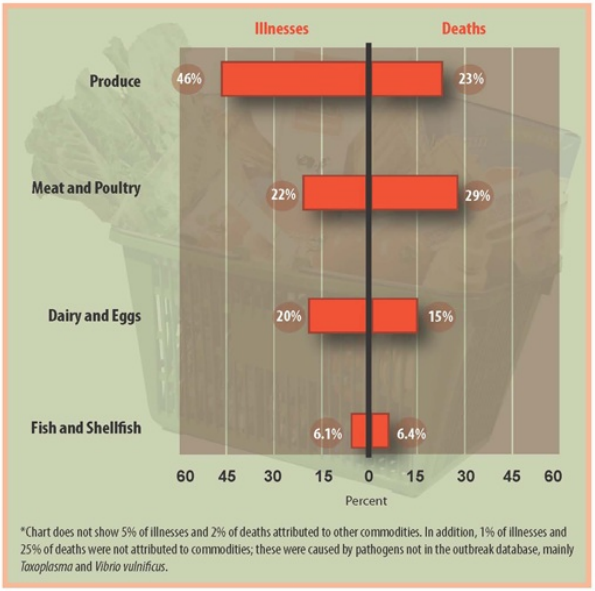

*Chart does not show 5% of illnesses and 2% of deaths attributed to other commodities. In addition, 1% of illnesses and 25% of deaths were not attributed to commodities; these were caused by pathogens not in the outbreak database, mainly *Toxoplasma* and *Vibrio vulnificus*.

Source: Painter JA, Hoekstra RM, Ayers T, Tauxe RV, Braden CR, Angulo FJ, Griffin PM. Attribution of foodborne illnesses, hospitalizations, and deaths to food commodities by using outbreak data, United States, 1998–2008. Emerg Infect Dis [Internet]. 2013 Mar [date cited]. http://dx.doi.org/10.3201/eid1903.111866

(http://www.cdc.gov/foodborneburden/attribution-image.html#foodborne-illnesses)

Safe handling of eggs begins before the eggs are laid with maintaining a healthy flock and collecting clean eggs and then continues throughout the whole production and distribution systems to retail.

Management Considerations

The most important step in the safe handling of eggs is the production of clean eggs. Several steps can be taken on the farm to minimize the potential contamination of eggs:

- **Make sure that there are enough suitable nests.** Typically one nest for every five hens is sufficient, but the nest ratio can go to one nest for every eight (1:8) hens without an increase in floor eggs. The problems arise because all the hens will try to use the same nest. It does not help if you have five nests but all 25 hens try to lay in the same one to two nest boxes. This leads to possible breakage as well as increased potential for fecal contamination.
- **Try to get the hens to use all of the nests.** Hens prefer nests that are out of the way and a little darker than the rest of the house. Unless you are using roll-away nests (the egg rolls out after the hen leaves the nest), make sure that you have enough clean bedding to reduce the incidence of breakage by cushioning the eggs and to help keep the eggs clean.
- **Supplement or change nest litter as needed.**
- **Provide roosts, and make sure the roosting areas are higher than the nest boxes.** Hens will typically roost at the highest perch. This will discourage the hens from roosting in and thereby soiling the nest boxes. Do not place the perches over the nests.
- **Collect the eggs as frequently as possible, but at least once a day.** Twice a day is better.
- **Maintain a healthy flock with these practices:**
  - Keep litter and nest boxes dry.
  - Use safe drinking water and keep water and drinkers clean.
  - Keep feed dry and feeders clean.
  - Control rodents, flies, and beetles.
- **Sanitize any equipment received from other farms.**

To Wash or Not to Wash

There is a big debate on whether to wash eggs, with both sides making good arguments. The state you live in largely determines whether to wash all eggs. Some states require that you wash eggs, while others do not. Even poultry specialists cannot agree, with some strongly recommending washing, while others say that eggs should not be washed. Internationally, the United States requires commercial eggs to be washed, while the European Union does not allow any shelled eggs to be washed, but it also does not allow dirty eggs to be sold as shelled eggs. As the number of eggs produced in extensive management systems (which increases the number of eggs laid outside the nest box) increases in the European Union, EU regulators reassessed their position on egg washing. A recent multi-year study came to the same conclusion as Brant and Starr (1962) that egg washing should be strongly considered, but Europe decide to leave their regulations unchanged.

Historically, Japan did not allow egg washing, but when the number of food-borne illnesses caused by salmonella increased, that country recently implemented egg washing, building on the experiences of the United States. Egg washing was just one of a range of measures taken to reduce the number of salmonella cases in Japan. Vaccination of flocks against *Salmonella enteritidis* has also been implemented. Fewer than one in 20,000 eggs now carry salmonella on the shell at the farm gate, and the incidence in the egg contents is even lower.

Research on egg washing done in the early 20th century was used by both the United States and Europe to develop their egg-handling requirements, with dramatically different conclusions. The egg-washing method used in these studies consisted of a wire basket that could hold 50 to 60 eggs being lowered into a rotating washing machine. The water was about 120°F and contained a sanitizing agent. The eggs were submerged for about three minutes. In commercial settings, eggs could be washed for different lengths of time and in water that could be dirty, or at the wrong temperature or without sanitizer. As a result of this possibility, Britain prohibited the washing of Class A table eggs. There was a price penalty for dirty eggs, and dry cleaning was encouraged when necessary. Around the same time, the U.S. Department of Agriculture (USDA) published a 34-page report titled Improved Methods, Techniques, and Equipment for Cleaning Eggs (https://archive.org/details/improvedmethodst757walt) . Based on this report, several key recommendations were made for egg cleaning in commercial egg-processing facilities in the United States:

1. Do not attempt to clean excessively dirty eggs.
2. Avoid the use of wash water containing more than 2 ppm of iron.
3. Do not recirculate the wash water.
4. Use odorless cleaning materials.
5. Wash eggs as soon as practical after they are laid.
6. Maintain wash water at a temperature that is at least 20°F (~11°C) higher than that of the eggs through all washing operations (wetting, cleaning, and rinsing).
7. Moisten eggs with stained shells and adhering dirt before eggs are submitted to cutting-spray wash and brushes.
8. Have a water spray with sufficient force to cut away loose dirt before brushing.
9. Use abrasive materials in brush bristles to increase the abrasive power of ordinary brushes.

10. Maintain an accurate control of the sanitizer-detergent level within the wash water.
11. Use a final rinse for the washed eggs.
12. Dry washed eggs completely before packing them.

Egg washing can reduce the number of microorganisms on the shell of an egg. Egg washing does have its risks, however, if not done properly. In an early egg survey in Hawaii (1991), of the 106 dozen eggs tested for salmonella, 10 cartons were positive and seven of the 10 were traced back to a processor with a faulty egg-washing process. In addition, washing eggs using immersion type washers is not allowed in commercial egg-processing facilities in the U.S..

Assuming that you are given a choice in your state, what should you do? Recent research from North Carolina State University would strongly recommend washing eggs. Regardless of the production system, an egg that appears clean will still have bacteria on the shell (reported as the number of colony-forming units growing from a swab of the surface; the higher the number, the more bacteria on the egg shell). These bacteria including many types, of which salmonella is only one. Unwashed clean eggs were found to have log(10) 4.5 colony-forming units. This can be reduced to log(10) 0.5 after proper washing. By comparison, unwashed eggs with fecal material will have log(10) 9.5 colony-forming units which is reduced to only log(10) 4.5 with proper washing.

For a small layer flock, egg washing does not need to be as extensive as that recommended for larger commercial operations. The first recommendation, however, holds true for all egg operations, regardless of size: do not use eggs that are excessively dirty. Eggs should be washed before they are put in the refrigerator, with running water (no immersion) that is warmer than the temperature of the egg. Use a brush if necessary. If a detergent is used, rinse the eggs. Dry the eggs completely before packing them.

Refrigeration – Important or Not

In the United States, all eggs must be stored at or less than 45°F shortly after being laid and throughout the entire distribution system. As a result, you will find eggs in refrigerated displays, often near the milk and other dairy products. In many European countries, however, eggs are typically sold on an unrefrigerated shelf, often near the bakery supplies. Why the dramatic differences? Eggs are not refrigerated in Europe because of the concern for condensation that can form on eggs when they go from cold to warm environments as would occur when eggs are taken from a refrigerated display and transported home in a warm car. This condensation was speculated to facilitate the growth of bacteria on the shell, increasing the probability of bacteria making their way into the egg. The rules, therefore, stress that eggs should not be refrigerated before sale to the final consumer. However, there is no research to support this position. Recent research has shown that condensation, or "sweating," on eggs has no influence on the internal microbial population of properly washed eggs.

In Europe, it is realized that eggs should be kept cool. The Chartered Institute of Building Services Engineers requires that supermarket temperatures should be 66.2° to 69.8°F in the winter and 69.8° to 73.4°F in the summer. Room temperature is considered to be between 68° to 77°F. Britain recommends that once eggs are taken home, they be kept at less than 68°F. This is considerably higher than the 45°F required in the United States, possibly because Britain requires vaccination against *Salmonella enteritidis,* so it considers a lower storage temperature acceptable. Salmonellae reach the inside of the egg in two ways. The contamination of the shell is one way, but *Salmonella enteritidis* can settle in the reproductive tract and be shed with the eggs. Because of Britain's vaccination requirement against *S. enteritidis,* the likelihood of contaminating the eggs is considerably less. Britain estimates that it costs 14¢ per hen to vaccinate a flock. If each hen lays about 260 eggs, that works out to 0.05¢/egg or 0.65¢/dozen.

Storage Conditions

Eggs should be stored in a clean carton on a shelf in the refrigerator. Placing them in the door opens them to frequent changes in temperature and the possibility of damage as the door is opened and closed throughout the day. It is also best to store the eggs large end up. When storing with the small end up, the yolk tends to get stuck in the small end and will break when the egg is cracked open.

References

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