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Egg Basics for the Consumer: Packaging, Storage, and Nutritional Information

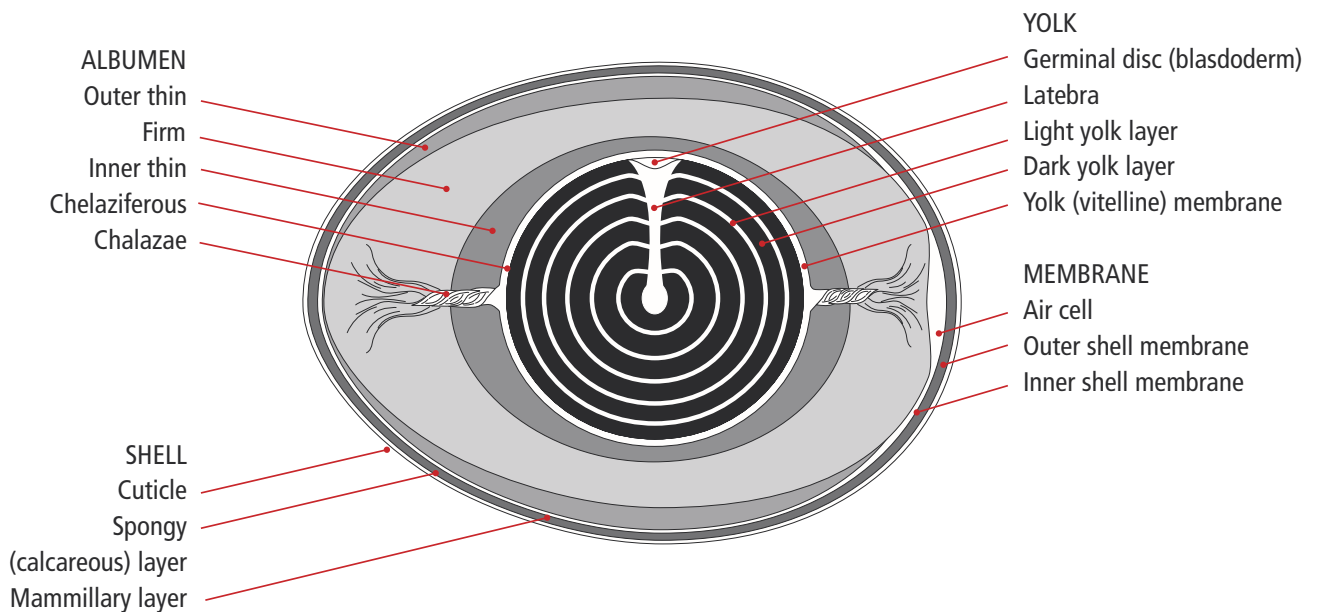
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The contents of an egg are neatly packaged by the hen in a shell made of calcium carbonate. A very thin coating of protein (the *cuticle*) covers the shell. The cuticle and shell, however, are not the only barriers protecting the egg from microbial insult. Just within the shell are two membranes that also act to block the movement of contaminants into the egg. The *albumen* (egg white) contains proteins that act to limit microbial growth.

The natural package might appear to be a complete defense system for the egg, but there are ways in which its defensive powers can be reduced or eliminated. The egg shell itself is not a solid structure: it contains 7,000 to 17,000 pores. Under normal conditions the cuticle prevents bacteria from entering the egg, but a cracked egg may permit bacterial entry.

Once you have the eggs in the kitchen...

If you buy your eggs in a carton, store them in that same carton. For the best maintenance of egg quality, place the closed carton of eggs on one of the shelves in your refrigerator (set at 32° to 40°F [0° to 4.4°C]). The egg cups commonly built into a refrigerator door do not provide the best egg storage. If stored in an open container, eggs can pick up unwanted flavors from other food items (onions, fish, etc.). Without the protection of the carton, eggs lose moisture and gas at a more rapid rate. This leads to a decline in the egg's functional properties (foaming, coagulation, etc.). Also, opening and closing the door will jar the eggs and cause the *chalazae* (twisted strands of protein on either side of the yolk) to break. Intact *chalazae* serve to anchor the yolk in the center of the egg.



Cleaning eggs

Do not wash eggs. If you purchase commercially produced eggs, they have been cleaned at the processing plant and no further cleaning is necessary. If you have your own chickens and find that you are collecting dirty eggs, washing them is not the best solution. Provide your hens with ample nest boxes that have plenty of good, clean nesting material. It is easier to produce clean eggs than to clean dirty eggs.

Improper washing can actually introduce contaminants into the egg. If you collect a recently laid egg or one that has been out in the sun, for instance, the egg will be warm. Placing that warm egg in a bucket of cold water will create a temperature differential and contaminants can be sucked into the egg through the pores in the shell. If you have a dirty egg, the safest way to clean it is to brush off the adhering dirt with a piece of sandpaper.

What changes take place with storage?

As an egg ages, it loses CO₂ and moisture through the shell pores. This causes the air cell within the egg to get larger. With this loss of CO₂, the egg's pH becomes more basic and structural changes take place in the albumen. The mechanisms involved are not completely understood, but the result is a thinning of the albumen. It is for this reason that fresher eggs fry better: the yolk is still well centered and protected by the thick albumen.

Why are some hard-cooked eggs easier to peel than others?

Ironically, the hard-cooked eggs that are most difficult to peel are usually “fresh” eggs. As mentioned above, properly handled eggs that are a few days old contain more CO₂ than old eggs, so their albumen has a lower (less basic) pH value. The difficulty you may encounter in removing the shell of a fresh hard-cooked egg has been associated with the low pH of the albumen. As stored eggs lose CO₂, the albumen pH rises; when these eggs are hard-cooked, they are easier to peel. Thus, eggs that have been stored in the refrigerator for about a week are usually easier to peel when hard-cooked. If you are unsure about the age of a carton of eggs, you can check the sell-by date on the carton. Regulations require that the sell-by date be no more than 30 days from the packing date. If more than 23 days remain before the sell-by date, the eggs may not peel well.

Why do boiled eggs have grayish-green yolks?

When eggs are boiled for a long period of time and cooled too slowly, iron and sulfur (two of the minerals in the eggs) form an iron-sulfur complex with protein. This complex has the characteristic grayish-green color associated with the yolks of overcooked eggs. This complex is not harmful, but it does detract from the appearance of some hard-cooked egg dishes. To avoid this discoloration, follow the steps below when you hard-cook eggs:

1. Place the eggs in a pot and add enough cold water to cover them.
2. Bring the water to a boil.
3. Cover the pot and turn off the heat.
4. Let the eggs cook in the hot water for 15 to 20 minutes.
5. At the end of the cooking time, cool the eggs quickly in cold running tap water or iced water.

Why are some egg whites cloudy?

Cloudy whites usually indicate very fresh eggs. The cloudy appearance is caused by carbon dioxide in the egg white. Egg shells are often treated with a tasteless, odorless, harmless, light mineral oil. The oil helps seal the shell's pores and slows down the loss

of the carbon dioxide that give whites their cloudy appearance. As the eggs age, carbon dioxide is lost and the egg whites become clearer.

Are eggs with yellow or straw-colored albumen wholesome?

Yes. Yellow-colored albumen merely indicates the presence of riboflavin (vitamin B₂). More than half of an egg's total riboflavin content is in the albumen.

Should eggs with calcareous deposits on the shell be discarded?

No. When a hen's egg shell formation is upset, harmless abnormalities will result. If the egg shell is fractured during formation, the hen will deposit an extra layer of calcium compounds to repair the fracture. Sometimes extra cuticle protein accumulates and causes a colored mass on the surface of the shell. At other times, extra calcium deposits accumulate to give the egg shell a bumpy surface.

What is the nutritional value of an egg?

The egg is a wonderful source of protein, unsaturated fatty acids, vitamins, and minerals. Nutritionists routinely compare other food proteins to eggs and they consider the egg to be the standard or perfect protein. Eggs are among the most complete, yet least expensive, protein foods.

The following vitamins are found in significant amounts in the egg: vitamins A, D, E, and K, and the B vitamins. Eggs also provide phosphorus and trace minerals to the diet.

Eggs can be eaten by every segment of the population, from infants to senior citizens. This is important to recognize, since some people have concerns about the amount of cholesterol in eggs. Cholesterol is a sterol that is manufactured and needed by the human body. Contrary to information in some news reports and magazine articles, research has shown that the amount of cholesterol that a person eats in foods has a variable and small effect on the amount of cholesterol in that person's blood. Reducing the amount of saturated fat in the diet, however, is very important. Eggs have a desirable unsaturated fatty acid-to-saturated fatty acid ratio of 2:1. Even persons who are advised by a doctor to restrict egg consumption can enjoy several "egg substitute" products made from 99% real egg. Such products use the egg white, which is cholesterol-free. A large chicken egg contains approximately 80 calories, and can therefore be well utilized by the nutrition-conscious dieter.

What goes into the feed of today's laying hen?

The poultry producer provides the hen with a balanced diet that meets all her needs for body maintenance and egg production. We know more about the nutrition of the chicken than about any other animal, including the human. The laying hen's diet is predominantly a corn and soybean mixture, but also contains vitamins and minerals and may contain other grains and by-product feeds such as fish, meat, or cottonseed meal.

NO HORMONES can legally be fed to chickens used for egg or poultry production.

What is the difference between a white-shelled egg and a brown-shelled egg?

A brown or pigmented egg shell is the result of a hen's depositing pigments on the shell during egg formation. Ultimately this is determined by the bird's genetic background. Our typical commercial egg layer, the Single Comb White Leghorn, is one of the Mediterranean breeds. Developed in Leghorn (Livorno, Italy), hens of this breed always lay white-shelled eggs. Our American breeds, such as the Rhode Island Red, New Hampshire, and Plymouth Rock, lay brown-shelled eggs. The brown pigment is oophyrin, a breakdown product of hemoglobin. The Araucana, or *Easter egg chicken*, is

from South America and lays green or bluish green eggs. This pigmentation results from oocyanin, a by-product of bile formation. The color of the egg shell is not determined by the bird's diet and is in no way related to the quality or nutritional value of the egg.

Are fertile eggs superior to infertile eggs?

No. The hen will ovulate and form eggs without ever being in contact with a cock. If the two sexes are maintained together, fertile eggs will be produced. This is not only desirable, but necessary, if the eggs are to be incubated for the production of chicks. The un-incubated fertile egg differs from the infertile egg by a matter of approximately 50,000 cells. This small difference, just distinguishable with the eye, has no effect on the nutritional value of the egg. There is no reason to produce fertile eggs for human consumption except to supply a few consumers who prefer this product.

What is the shelf-life of eggs?

Eggs have excellent keeping quality; the type of egg (brown, "organic," etc.) does not affect shelf-life. When kept in the egg carton (*not* in the egg tray in the refrigerator door) and properly refrigerated, clean eggs that are free of cracks will keep for months. Since eggs have very small pores in the shell, they can pick up odors from foods such as onions or fish that are stored next to them. This is another good reason for storing eggs in their retail carton or some other closed container.

DESIGNER AND SPECIALTY EGGS

Consumers are continually being presented with new terms and new information on the labels of the foods they purchase. The information that follows is intended to help consumers understand some of the terminology used in the labeling of today's market eggs.

Cage-free eggs

Most egg layers in this country are maintained in cages. Confinement and caging of birds has benefits for the birds (it keeps the birds away from their droppings and away from the disease agents that can cycle through the droppings) as well as for consumers and ranchers. *Some* consumers are philosophically opposed to this type of management system, however. In order to offer eggs that will be acceptable to these consumers, some ranchers raise their birds in a cage-free system. "Cage-free" does not mean that the birds are raised out of doors or that they are running free. Typically, the birds are maintained on the floor of a poultry house or barn. They may or may not have access to outdoor pens.

Range eggs or free-range eggs

To *range* birds means to allow them to graze or roam outdoors. Range eggs are not necessarily produced by hens that are always kept outdoors. A range egg rancher may employ a combination of barn and outdoor pens. The hens can choose to go outdoors in the daytime but typically are kept inside at night for protection from the elements and from predators. There are many opinions as to how much land per bird should be said to constitute a "range." There is currently no consensus on this point in terms of a market classification.

Organic eggs

The United States Department of Agriculture's National Organic Program has established regulations for organic food production. Hens producing eggs that are to be labeled "organic" must receive feed made from certified organic ingredients and must

be free to range outdoors. Details of the standards are available at <http://www.ams.usda.gov/nop>. The type of management system does not affect the quality of the eggs, their nutritional value, or their wholesomeness.

Lower-cholesterol eggs

According to Professor Roy Gyles of the University of Arkansas, “There are no breeds or strains of chickens that lay eggs of superior nutritional value with significantly ($P < 0.05$) lower cholesterol than other chickens.” Geneticists have tried to develop a strain of egg layers that would produce lower-cholesterol eggs, but their efforts at genetic manipulation have proven unsuccessful. Chickens, like humans, need cholesterol for their normal development. Hens that produce lower-cholesterol eggs would be unable to reproduce: the amount of cholesterol in their eggs would not be sufficient for development of a viable chick.

Animal nutritionists have been able to alter the diet of laying hens so that their eggs do contain less cholesterol than the standard egg. The US Food and Drug Administration (FDA) has stated that for a product to legally claim “less” or a “reduced” amount of a nutrient, it has to have 25% less of that nutrient than is present in the normal product standard.

Some producers sell eggs that are labeled as having “lowered fat and lowered cholesterol.” By the FDA, definition, this means that the eggs contain 25% less fat and cholesterol than a standard egg of the same size. A standard egg yolk contains 213 mg of cholesterol. The producers achieve these reductions in fat and cholesterol by selecting eggs from hens of certain ages that are fed on special diets. No drugs, hormones, antibiotics, or iodine derivatives are involved.

Eggs higher in vitamin E

By feeding hens on diets high in vitamin E, egg producers can produce eggs that contain significantly more vitamin E than ordinary eggs. Given its benefits, including its role as an antioxidant, some consumers may be interested in foods containing higher levels of vitamin E.

Omega-3 eggs

Egg producers can change the amount and type of fatty acids in yolk by feeding hens diets on varying amounts and types of fat. When flax seed, fish oil, or other feed ingredients high in omega-3 fatty acids are fed to hens, omega-3 polyunsaturated fatty acids accumulate in their eggs' yolks. Consumption of these fatty acids has been associated with normal brain and retinal development. Omega-3 fatty acids may also improve immune responses and reduce atherogenesis. Because of the benefits associated with eating foods that contain omega-3 polyunsaturated fatty acids, some egg production companies now market eggs with a higher content of these compounds.

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Egg Candling and Breakout Analysis, Publication 8134

Hatching Egg Sanitation, Publication 8120

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