Basic Egg Facts

BLOOD SPOTS
Also called meat spots. Occasionally found on an egg yolk. Contrary to popular opinion, these tiny spots do not indicate a fertilized egg. Rather, they are caused by the rupture of a blood vessel on the yolk surface during formation of the egg or by a similar accident in the wall of the oviduct. Less than 1% of all eggs produced have blood spots.

Mass candling methods reveal most eggs with blood spots and those eggs are removed but, even with electronic spotters, it is impossible to catch all of them. As an egg ages, the yolk takes up water from the albumen to dilute the blood spot so, in actuality, a blood spot indicates that the egg is fresh. Both chemically and nutritionally, these eggs are fit to eat. The spot can be removed with the tip of a knife, if you wish.

CARTON DATES
Egg cartons from USDA-inspected plants must display a Julian date—the date the eggs were packed. Although not required, they may also carry an expiration date beyond which the eggs should not be sold. In USDA-inspected plants, this date cannot exceed 30 days after the pack date. It may be less through choice of the packer or quantity purchaser such as your local supermarket chain. Plants not under USDA inspection are governed by laws of their states.

JULIAN DATES
Starting with January 1 as number 1 and ending with December 31 as 365, these numbers represent the consecutive days of the year. This numbering system is sometimes used on egg cartons to denote the day the eggs are packed. Fresh shell eggs can be stored in their cartons in the refrigerator for 4 to 5 weeks beyond this date with insignificant quality loss.

COLOR
Egg shell and yolk color may vary, but color has nothing to do with egg quality, flavor, nutritive value, cooking characteristics or shell thickness.

- Shell:
The color comes from pigments in the outer layer of the shell and may range in various breeds from white to deep brown. The breed of hen determines the color of the shell. Breeds with white feathers and ear lobes lay white eggs; breeds with red feathers and ear lobes lay brown eggs. White eggs are most in demand among American buyers. In some parts of the country, however, particularly in New England, brown shells are preferred. The Rhode Island Red, New Hampshire and Plymouth Rock are breeds that lay brown eggs. Since brown-egg layers are slightly larger birds and require more food, brown eggs are usually more expensive than white.

- White:
Egg albumen in raw eggs is opalescent and does not appear white until it is beaten or cooked. A yellow or greenish cast in raw white may indicate the presence of riboflavin. Cloudiness of the raw white is due to the presence of carbon dioxide which has not had time to escape through the shell and thus indicates a very fresh egg.

On very rare occasions, a hard-cooked egg white may darken to a caramel shade due to a high amount of iron in the cooking water or to a carbonylamine-type reaction. Using fresh eggs and cooling them quickly after cooking helps to prevent this darkening.

- Yolk:
Yolk color depends on the diet of the hen. If she gets plenty of yellow-orange plant pigments known as xanthophylls, they will be deposited in the yolk. Hens fed mashes containing yellow corn and alfalfa meal lay eggs with medium yellow yolks, while those eating wheat or barley yield lighter-colored yolks. A colorless diet, such as white cornmeal produces almost colorless yolks. Natural
yellow-orange substances such as marigold petals may be added to light-colored feeds to enhance yolk color. Artificial color additives are not permitted. Gold or lemon-colored yolks are preferred by most buyers in this country. Yolk pigments are relatively stable and are not lost or changed in cooking.

Sometimes there is a greenish ring around hard-cooked egg yolks. It is the result of sulfur and iron compounds in the egg reacting at the surface of the yolk. It may occur when eggs are overcooked or when there is a high amount of iron in the cooking water. Although the color may be a bit unappealing, the eggs are still wholesome and nutritious and their flavor is unaffected. Greenish yolks can best be avoided by using the proper cooking time and temperature and by rapidly cooling the cooked eggs.

Occasionally several concentric green rings may be seen in hard-cooked egg yolks. A yolk develops within the hen in rings. Iron in the hen's feed or water as the rings are formed may cause this coloring.

Sometimes a large batch of scrambled eggs may turn green. Although not pretty, the color change is harmless.

It is due to a chemical change brought on by heat and occurs when eggs are cooked at too high a temperature, held for too long or both. Using stainless steel equipment and low cooking temperature, cooking in small batches and serving as soon as possible after cooking will help to prevent this. If it is necessary to hold scrambled eggs for a short time before serving, it helps to avoid direct heat. Place a pan of hot water between the pan of eggs and the heat source.

**COMPOSITION**

- **Shell**
  - Outer covering of egg, composed largely of calcium carbonate
  - May be white or brown depending on breed of chicken
  - Color does not affect egg quality, flavor, cooking characteristics, nutritive value or shell thickness

- **Yolk**
  - Yellow portion of egg
  - Color varies with feed of the hen, but doesn’t indicate nutritive content
  - Major source of egg vitamins, minerals and fat and about half of the protein
  - Germinal Disc

- **Vitelline (Yolk) Membrane**
  - Clear seal which holds egg yolk

- **Chalazae**
  - Twisted, cord-like strands of egg white
  - Anchor yolk in center of egg
  - Prominent chalazae indicate freshness

- **Air Cell**
  - Pocket of air formed at large end of egg
  - Caused by contraction of the contents during cooling after laying
  - Increases in size as egg ages

- **Shell Membranes**
  - Two membranes—inner and outer shell membranes—surround the albumen
  - Provide protective barrier against bacterial penetration
  - Air cell forms between these two membranes

- **Thin Albumen (White)**
  - Nearest to the shell
  - Spreads around thick white of high-quality egg

- **Thick Albumen (White)**
  - Major source of egg riboflavin and protein
  - Stands higher and spreads less than thin white in higher-grade eggs
  - Thins and becomes indistinguishable from thin white in lower-grade eggs

**AIR CELL**

The empty space between the white and shell at the large end of the egg.
When an egg is first laid, it is warm. As it cools, the contents contract and the inner shell membrane separates from the outer shell membrane to form the air cell.

The candler uses the size of the air cell as one basis for determining grade. In Grade AA eggs, the air cell may not exceed 1/8-inch in depth and is about the size of a dime. The air cell of Grade A eggs may exceed 3/16-inch in depth. For Grade B eggs, there is no limit on air cell size.

As the egg ages, moisture and carbon dioxide leave through the pores of the shell, air enters to replace them and the air cell becomes larger.

Although the air cell usually forms in the large end of the egg, it occasionally moves freely toward the uppermost point of the egg as the egg is rotated. It is then called a free or floating air cell. If the main air cell ruptures, resulting in one or more small separate air bubbles floating beneath the main air cell, it is known as a bubbly air cell.

You can see the air cell in the flattened end of a peeled, hard-cooked egg.

**ALBUMEN**
Also known as egg white. Albumen accounts for most of an egg's liquid weight, about 67%. It contains more than half the egg's total protein, niacin, riboflavin, chlorine, magnesium, potassium, sodium and sulfur. The albumen consists of 4 alternating layers of thick and thin consistencies. From the yolk outward, they are designated as the inner thick or chalaziferous white, the inner thin white, the outer thick white and the outer thin white. Egg white tends to thin out as an egg ages because its protein changes in character. That's why fresh eggs sit up tall and firm in the pan while older ones tend to spread out.

Albumen is more opalescent than truly white. The cloudy appearance comes from carbon dioxide. As the egg ages, carbon dioxide escapes, so the albumen of older eggs is more transparent than that of fresher eggs.

When egg albumen is beaten vigorously, it foams and increases in volume 6 to 8 times. Egg foams are essential for making souffles, meringues, puffy omelets, and angel food and sponge cakes.

**CHALAZA**
Ropey strands of egg white which anchor the yolk in place in the center of the thick white. They are neither imperfections nor beginning embryos.

The more prominent the chalazae, the fresher the egg. Chalazae do not interfere with the cooking or beating of the white and need not be removed, although some cooks like to strain them from stirred custard.

**GERMINAL DISC**
The entrance of the latebra, the channel leading to the center of the yolk. The germinal disc is barely noticeable as a slight depression on the surface of the yolk. When the egg is fertilized, sperm enter by way of the germinal disc, travel to the center and a chick embryo starts to form.

**MEMBRANES:**

- **Shell Membranes**
  Just inside the shell are two shell membranes, inner and outer. After the egg is laid and it begins to cool, an air cell forms between these two layers at the large end of the egg.

- **Vitelline Membrane:**
  This is the covering of the yolk. Its strength protects the yolk from breaking. The vitelline membrane is weakest at the germinal disc and tends to become more fragile as the egg ages.

**SHELL** The egg's outer covering, accounting for about 9 to 12% of its total weight depending on egg size. The shell is the egg's first line of defense against bacterial contamination.

The shell is largely composed of calcium carbonate (about 94%) with small amounts
of magnesium carbonate, calcium phosphate and other organic matter including protein.

Shell strength is greatly influenced by the minerals and vitamins in the hen's diet, particularly calcium, phosphorus, manganese and Vitamin D. If the diet is deficient in calcium, for instance, the hen will produce a thin or soft-shelled egg or possibly an egg with no shell at all. Occasionally an egg may be prematurely expelled from the uterus due to injury or excitement. In this case, the shell has not had time to be completely formed. Shell thickness is also related to egg size which, in turn, is related to the hen's age. As the hen ages, egg size increases. The same amount of shell material which covers a smaller egg must be "stretched" to cover a larger one, hence the shell is thinner.

Seven to 17 thousand tiny pores are distributed over the shell surface, a greater number at the large end. As the egg ages, these tiny holes permit moisture and carbon dioxide to move out and air to move in to form the air cell. The shell is covered with a protective coating called the cuticle or bloom. By blocking the pores, the cuticle helps to preserve freshness and prevent microbial contamination of the contents.

Uses for eggshells vary from the thrifty (compost) to the creative (decorating).

**YOLK**
The yolk or yellow portion makes up about 33% of the liquid weight of the egg. It contains all of the fat in the egg and a little less than half of the protein.

With the exception of riboflavin and niacin, the yolk contains a higher proportion of the egg's vitamins than the white. All of the egg's vitamins A, D and E are in the yolk. Egg yolks are one of the few foods naturally containing vitamin D.

The yolk also contains more phosphorus, manganese, iron, iodine, copper, and calcium than the white, and it contains all of the zinc. The yolk of a Large egg contains about 59 calories.

Double-yolked eggs are often produced by young hens whose egg production cycles are not yet completely synchronized. They're often produced, too, by hens who are old enough to produce Extra Large eggs. Genetics is a factor, also. Occasionally a hen will produce double-yolked eggs throughout her egg-laying career. It is rare, but not unusual, for a young hen to produce an egg with no yolk at all.

In fertilized eggs, the yolk is the site of embryo formation.

It is the yolk which is responsible for the egg's emulsifying properties.

**FERTILE EGGS**
Eggs which can be incubated and developed into chicks. Fertile eggs are not more nutritious than nonfertile eggs, do not keep as well as nonfertile eggs and are more expensive to produce. Fertile eggs may contain a small amount of male hormone, but there are no known advantages.

**FREE-RANGE EGGS**
True free-range eggs are those produced by hens raised outdoors or that have daily access to the outdoors. Due to seasonal conditions, however, few hens are actually raised outdoors. Some egg farms are indoor floor operations and these are sometimes erroneously referred to as free-range operations. Due to higher production costs and lower volume per farm, free-range eggs are generally more expensive. The nutrient content of eggs is not affected by whether hens are raised free-range or in floor or cage operations.

**FRESHNESS**
How recently an egg was laid has a bearing on its freshness but is only one of many factors. The temperature at which it is held, the humidity and the handling all play their part. These variables are so important that an egg one week old, held under ideal conditions, can be fresher than an egg left at room temperature for one day. The ideal conditions are temperatures that don't go above 40°F. (4°C.) and a relative humidity of 70 to 80%.
Proper handling means prompt gathering, washing and oiling of the eggs within a few hours after laying. Most commercially produced eggs reach supermarkets within a few days of leaving the laying house. If the market and the buyer handle them properly, they will still be fresh when they reach the table.

It is not true that freshness can be judged by placing an egg in salt water. A carefully controlled brine test is sometimes used to judge shell thickness of eggs for hatching purposes but has no application to freshness of table eggs.

How important is “freshness”? As an egg ages, the white becomes thinner and the yolk becomes flatter. These changes do not have any great effect on the nutritional quality of the egg or its functional cooking properties in recipes. Appearance may be affected, though. When poached or fried, the fresher the egg, the more it will hold its shape rather than spread out in the pan. On the other hand, if you hard cook eggs that are at least a week old, you’ll find them easier to peel after cooking and cooling than fresher eggs.

GRADING
Classification determined by interior and exterior quality and designated by letters — AA, A and B. In many egg packing plants, the USDA provides a grading service for shell eggs. Its official grade shield certifies that the eggs have been graded under federal supervision according to USDA standards and regulations. The grading service is not mandatory. Other eggs are packed under state regulations which must meet or exceed federal standards.

In the grading process, eggs are examined for both interior and exterior quality and are sorted according to weight (size). Grade quality and size are not related to one another. In descending order of quality, grades are AA, A and B.

There is no difference in nutritive value between the different grades.

Because production and marketing methods have become very efficient, eggs move so rapidly from laying house to market that you will find very little difference in quality between Grades AA and A. Although grade B eggs are just as wholesome to eat, they rate lower in appearance when broken out. Almost no Grade B’s find their way to the retail supermarket. Some go to institutional egg users such as bakeries or foodservice operations, but most go to egg breakers for use in egg products.

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**Egg Quality**

<table>
<thead>
<tr>
<th>Break Out Appearance</th>
<th>Grade AA</th>
<th>Grade A</th>
<th>Grade B</th>
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<tbody>
<tr>
<td></td>
<td>Covers a small area</td>
<td>Covers a moderate area</td>
<td>Covers a wide area</td>
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<tr>
<td><strong>Albumen Appearance</strong></td>
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<tr>
<td></td>
<td>White is thick and stands high; chalaza prominent.</td>
<td>White is reasonably thick, stands fairly high; chalaza prominent.</td>
<td>Small amount of thick white; chalaza small or absent. Appears weak and watery.</td>
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<tr>
<td><strong>Yolk Appearance</strong></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Yolk is firm, round and high</td>
<td>Yolk is firm and stands fairly high</td>
<td>Yolk is somewhat flattened and enlarged</td>
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<tr>
<td><strong>Shell Appearance</strong></td>
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<td></td>
<td>Approximates usual shape; generally clean,* unbroken; ridges/rough spots that do not affect the shell strength are permitted.</td>
<td></td>
<td>Abnormal shape; some slight stained areas permitted; unbroken; pronounced ridges/thin spots permitted.</td>
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</tbody>
</table>
Usage

Ideal for any use, but are especially desirable for poaching, frying and cooking in shell.

Ideal for any use, but are especially desirable for poaching, frying and cooking in shell.

Good for scrambling, baking, and as an ingredient in other foods.

*An egg may be considered clean if it has only very small specks, stains or cage marks. Source: USDA

Grade AA

A 'Grade AA' egg will stand up tall. The yolk is firm and the area covered by the white is small. There is a large proportion of thick white to thin white.

Grade A

A 'Grade A' egg covers a relatively small area. The yolk is round and upstanding. The thick white is large in proportion to the thin white and stands fairly well around the yolk.

Grade B

A 'Grade B' egg spreads out more. The yolk is flattened and there is about as much (or more) thin white as thick white.

ORGANIC EGGS

Eggs from hens fed rations having ingredients that were grown without pesticides, fungicides, herbicides or commercial fertilizers. No commercial laying hen rations ever contain hormones. Due to higher production costs and lower volume per farm, organic eggs are more expensive than eggs from hens fed conventional feed. The nutrient content of eggs is not affected by whether or not the ration is organic.

SIZE

Several factors influence the size of an egg. The major factor is the age of the hen. As the hen ages, her eggs increase in size.

The breed of hen from which the egg comes is a second factor. Weight of the bird is another. Pullets significantly underweight at sexual maturity will produce small eggs.

Environmental factors that lower egg weights are heat, stress, overcrowding and poor nutrition.

All of these variables are of great importance to the egg producer. Even a slight shift in egg weight influences size classification and size is one of the factors considered when eggs are priced. Careful flock management benefits both the hens and the producer.

Egg sizes are Jumbo, Extra Large, Large, Medium, Small and Peewee. Medium, Large and Extra Large are the sizes most commonly available.

Sizes are classified according to minimum net weight expressed in ounces per dozen.

SIZE EQUIVALENTS

Although any size egg may be used for frying, scrambling, cooking in the shell or poaching, most recipes for baked dishes such as custards and cakes are based on the use of Large eggs. To substitute another size, use the following chart.
## Size Equivalents

<table>
<thead>
<tr>
<th>LARGE</th>
<th>JUMBO</th>
<th>X-LARGE</th>
<th>MEDIUM</th>
<th>SMALL</th>
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<tbody>
<tr>
<td>1</td>
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## To Make 1 Cup

<table>
<thead>
<tr>
<th>EGG SIZE</th>
<th>WHOLE</th>
<th>WHITES</th>
<th>YOLKS</th>
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<tbody>
<tr>
<td>Jumbo</td>
<td>4</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>X-Large</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Large</td>
<td>5</td>
<td>7</td>
<td>14</td>
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<tr>
<td>Medium</td>
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<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Small</td>
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<td>9</td>
<td>18</td>
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