

NUTRITIVE VALUE OF EGG

The egg is one of the most complete and versatile food which provides essential nutrients. It consists of approximately 10% shell, 58% white and 32% yolk. Neither the colour of the shell nor that of the yolk affects the egg's nutritive value. The average egg provides approximately 313 kilojoules of energy, of which 80% comes from the yolk.

The nutritive content of an average large egg (containing 50 g of edible egg) includes:

- 6.3 g protein
- 0.6 g carbohydrates
- 5.0 g fat (this includes 0.21 g cholesterol).
- Eggs contain every vitamin except vitamin C.
- Eggs are a good source of minerals like iron and phosphorus and also supply calcium, copper, iodine, magnesium, manganese, potassium, sodium, zinc, chloride and sulphur.

To avoid the possibility of foodborne illness, fresh eggs must be handled carefully. Even eggs with clean, uncracked shells may occasionally contain bacteria called *Salmonella* that can cause an intestinal infection. The most effective way to prevent egg-related illness is by knowing how to buy, store, handle and cook eggs—or foods that contain them—safely.

SOME FOOD SAFETY TIPS:

Buy Right

Choose only refrigerated eggs with clean and uncracked shells. Check the "best before" date on the package. When shopping, pick up eggs and other cold foods last so that they stay cold.

Storing Eggs

Eggs should be refrigerated as soon as possible in the coldest section of the refrigerator, usually the body of the fridge and use them within 3 weeks for best quality.

One should not crack the shell of an egg until it is ready to use. Hard boiled eggs can be stored in a sealed container in the refrigerator for up to one week.

Eggs (whether raw or cooked) should not be kept at room temperature for more than two hours. Eggs that have been at room temperature for more than two hours should be thrown out. Foods spoil quickly in the danger zone temperature range of **4°C** to **60°C**

Keep Clean

Before and after handling raw eggs washing of hands, utensils, cutting boards, knives carefully with soap and warm water, for at least 20 seconds is always necessary. This helps avoid potential cross contamination and can help prevent the spread of foodborne illness.

Cook Thoroughly

Cooking eggs and egg-based foods, make sure they are cooked thoroughly to at least 74°C (165°F) to ensure they are safe to eat. Foods containing raw or lightly cooked eggs may be harmful to vulnerable people such as young children, the elderly, pregnant women and people with weak immune systems.

After cooking serve egg dishes immediately and refrigerate leftovers in containers within two hours. Eat leftovers within three to four days for best quality or freeze for later use.

Uncooked food preparation made with raw eggs could contain *Salmonella* and should not be tasted or eaten until they are cooked thoroughly. When making foods that don't get cooked and contain eggs (such as icing, eggnog or Caesar salad dressing), use pasteurized egg products instead of raw eggs.

Taking eggs to work or school or picnic

If taking eggs to work school or picnic then take full boiled eggs preferably.

EGG QUALITY

Quality has been defined by Kramer (1951) as the properties of any given food that have an influence on the acceptance or rejection of this food by the consumer. Egg quality is a general term which refers to several standards which define both internal and external quality. **External quality** is focused on shell cleanliness, texture and shape, whereas **internal quality** refers to egg white (albumen) cleanliness and viscosity, size of the air cell, yolk shape and yolk strength.

INSPECTION OF EGGS

Inspection of Eggs by density:

The Inspection of eggs by this method is carried out by water, wherein eggs samples to be inspected are put in a container filled with water and the results are interpreted as following:-

- If the egg rests lying on its side touching the bottom of the container, its age is less than 24 hours.
- If the egg rests at the bottom of the container, forming an angle of 30° with its surface, its age would be around 4 days.
- If the egg rests at the bottom of the container, rising from one of its sides and forming 45° angle with its surface, its age would be around one week.
- If the egg floats and a big part thereof appears above the water surface, then it is old and not safe for consumption.

Inspection by light

The basis working of this method depends on the transparency of the eggs and light penetration therein, and the inspection is carried by putting the eggs in an apparatus (comprising a box closed from all sides, with one side having a hole of the size of an egg and fitted with an electric bulb) between a source of light and the eye, where the existence of yolk rounded in a transparent medium can be observed.

An unsafe egg would appear in one or more of the following conditions.

- *Egg white and yolk are mixed*
- *Yolk adheres to the shell of the egg*
- *Yolk is mottled*
- *Egg white seems dark and mixed with other colours*
- *If the air-vacuum appears big and foreign bodies appear inside the egg*

EGG DEFECTS

Individual egg defects can be discussed in two heads: **shell defects** and **internal defects**.

Shell Defects:

Body-checked eggs

The shells of body-checked eggs are marked by grooves and ridges called 'checks'. These are usually at the ends of the egg, especially the pointed end.

Checks at the middle, or 'waist', often completely encircle the egg. Such defects are the result of repairs to damage caused by stress or pressure when the egg is in the shell gland. This stage of development usually occurs in the last hours of the light period or the first half of the dark period.

The percentage of body-checked eggs increases with flock age: at 35 weeks it can be up to 1%; at 60 weeks it can be 9%.

Cause: Ageing of bird, Incorrect lighting programme, Crowding, Diseases etc.

Cage marks

'Cage marks' is the term used to refer to dirty marks, dirty lines or translucent lines on the shell when eggs are collected.

In well-managed flocks, the incidence of this problem should be under 5%.

Dirty marks or lines are due to rusty or dirty wires in the cage floor or roll-out trays.

Flat-sided eggs

Eggs are said to be flat-sided when part of the shell is flattened or indented. Often the adjoining part of the shell is wrinkled.

Flat-sided eggs normally make up less than 1% of total production. They are most commonly produced by pullets in early lay and may be the result of double ovulation or being held over an extra day in the shell gland. Incidence can vary with the strain of bird.

Cause: Disease; traditionally linked with infectious bronchitis, Stress, e.g. frights and disturbances, Crowding, Incorrect or changes in the lighting programme.

Fly marks

Fly marks are caused by flies leaving droppings on the egg shell.

This defect should not occur under good management. Any incidence is unacceptable.

Cause: Eggs exposed to large numbers of flies

Fungus or mildew on shells

Eggs affected by a fungus may have a green coating of powdery material or a black, beard-like growth on the shell. Sometimes such eggs are said to be affected by mildew.

This defect should not occur under good management. Any incidence is unacceptable.

Cause: Poor hygiene during handling, storage and transport, warm storage conditions or excess cool room storage of eggs with other produce and old eggs.

Gross cracks

The term 'gross cracks' refers to large cracks and holes, which usually result in a broken shell membrane. The incidence of gross cracks increases with the age of the hen. It ranges from 1 to 5% of total production.

Cause: *Reduced shell strength due to-* Ageing, Poor nutrition, High shed temperatures, Mechanical damage caused by birds' beaks and toenails, Infrequent egg collection, Rough handling, Diseases such as infectious bronchitis etc.

Hairline cracks

Hairline cracks, i.e. very fine cracks, usually run lengthwise along the shell. As they are difficult to detect, candling efficiency needs to be maximised). Their presence in fresh eggs can be revealed by careful squeezing or tapping. The crack becomes more obvious as the egg ages.

The incidence of this problem varies with flock age, but is usually 1 to 3% of total production.

Cause: *Reduced shell strength due to:-* Ageing, Poor nutrition, Saline water, Diseases, Mechanical damage caused by birds' beaks and toenails, High shed temperatures, Infrequent egg collection.

Misshapen eggs

Misshapen eggs are those whose shells differ obviously from the smooth, 'normal' shape. They include eggs with shells marred by flat sides or body checks (ribs or grooves), and eggs that are too large or too round.

The incidence of misshapen eggs varies considerably depending on how severely the eggs are judged. Normally, up to 2% of production is downgraded due to these faults. The incidence of misshapen eggs can vary with the strain of bird, but they are most often produced by pullets coming into lay, or hens late in lay, often as a result of double ovulation.

Cause: Immature shell gland, Defective shell gland, Diseases, e.g. infections bronchitis, Stress, Crowding etc.

Mottled or glassy shells

When parts of the egg shell are translucent, it appears mottled or glassy. Such shells can also be thin and fragile.

The incidence is variable. Such eggs are not usually downgraded unless the condition is very obvious or the shells are thin.

Cause: *Failure of the egg shell to dry out quickly after laying, which is made worse by:* - High humidity in the layer shed, Crowding, in some Diseases.

Pimples

Pimples are small lumps of calcified material on the egg shell. Some can be broken off easily without damage to the shell while others may leave a small hole in the shell.

An incidence of about 1% of total production is common.

Cause: Thought to be caused by foreign material in the oviduct, which may be associated with: - Ageing of bird, Poor nutrition, Strain of bird etc.

Pinholes

Pinholes, or very small holes in the egg shell, usually affect less than 0.5% of total production.

Cause: *May result from faulty laying down of the egg shell or from pimples being knocked off the shell. Both problems are thought to be associated with:* - Ageing of bird, Poor nutrition, Strain of bird, Damage from toenail points or other small sharp projections.

Sandpaper or rough shells

The terms 'sandpaper shells' and 'rough shells' refer to eggs with rough-textured areas, often unevenly distributed over the shell.

The incidence is normally less than 1% of total production, but may be higher for some strains of bird. It is also higher in early lay, often as a result of double ovulation, which produces one shell-less egg and another one with extra shell deposits.

Cause: Diseases- e.g. infectious bronchitis, infectious laryngotracheitis or avian encephalomyelitis, Defective shell gland. Disturbances at the time a hen is due to lay can cause the egg to be held over for another day, Incorrect or changes in lighting programme, Water shortages.

Stained eggs

All or part of the egg shell may become stained by various substances, e.g. blood, faeces.

The incidence of stained eggs varies, partly because stains may be caused by a variety of substances. Smears of blood are more common on eggs from pullets in early lay.

Cause: Blood from a prolapsed cloaca, cannibalism or vent picking, Faecal contamination, Water stains, Sanitisers used in egg washing, Grease and oil stains, Certain drugs produce mottled shells or white shells in breeds that normally lay brown eggs. The drug chlortetracycline produces yellow shells.

Star cracks

Star cracks are fine cracks radiating outwards from a central point of impact, which is often slightly indented.

The incidence varies with flock age but is usually 1 to 2% of total production.

Cause: Poor nutrition, Saline water, Diseases such as infectious bronchitis, High shed temperatures, Mechanical damage caused by birds' beaks and toenails, Infrequent egg collection, Rough handling.

Thin-shelled eggs and shell-less eggs

Eggs with very thin shells, or no shell at all around the shell membrane, look unattractive and are highly susceptible to damage.

The incidence of these eggs varies from about 0.5 to 6%. They are commonly produced by pullets coming into lay, particularly by birds that have matured early. Some birds continue to lay this type of egg.

Cause: Immature shell gland, Defective shell gland, Disturbances causing eggs to be laid before calcification of the shell is complete, Poor nutrition, Saline water, Diseases, e.g. infectious bronchitis and eggdrop syndrome.

Internal defects:

Blood spots

Blood spots vary from barely distinguishable spots on the surface of the yolk to heavy blood contamination throughout the yolk. Occasionally blood may be diffused through the albumen or white of the egg.

The incidence varies between strains of bird and can be as high as 10%. Between 2 and 4% of all eggs contain some blood.

Cause: Blood vessels rupturing in the ovary or oviduct, affected by:- Levels of vitamin A and vitamin K in the diet, Vitamin K antagonists (e.g. the drug sulphaquinoxaline and a component of lucerne meal), Fungal toxins, Lighting programme, Frights and disturbances, Avian encephalomyelitis, Strain of bird etc.

Discoloured whites

The normal, slightly yellow-green colour of egg white may darken to an objectionable yellow or green, as shown, or may even become pink.

This problem is rare.

Cause: Excess of the vitamin riboflavin, Cyclopropene fatty acids in cottonseed and certain weeds-e.g. marshmallow, Ageing of the eggs and/or poor storage conditions.

Meat spots

Most meat spots are pieces of tissue from body organs, but some may be partially broken-down blood spots. They are usually brown in colour, and found in the thick albumen, chalazae, or the yolk. They range in size from 0.5 mm to more than 3 mm in diameter.

The incidence of meat spots ranges from less than 3% to 30% or more. It varies with the strain of bird, increases with the age of bird and may be higher in brown eggs. Many meat spots are too small to be detected by candling, especially in brown eggs. Less than 1% of eggs are usually downgraded because of meat spots.

Cause: Ageing of bird.

Mottled yolks and discoloured yolks

The colour of the yolk may be uneven or patchy, as shown, or vary from the desired colour range (deep-yellow to orange-yellow).

Some degree of mottling occurs in more than 50% of all eggs. The severity of mottling increases as eggs become stale. Discoloured yolks are rare.

Cause: *Mottled yolks have been attributed to:-* Poor handling and storage, Thin shells, Gossypol in cottonseed meal, Treatment for worms, Certain antioxidants (Do not feed gallic acid or tannic acid to laying hens), Raw soybean meal.

Off odours and flavours

Some eggs may have an unusual or unacceptable odour or taste, although their appearance is normal. They differ from rotten eggs, which are obviously defective and smell putrid.

Off odours and fl avours are rare in fresh eggs stored correctly.

Cause: Old eggs, High storage temperatures, Poor storage conditions, Strongly fl avoured feed ingredients, Micro-organisms, Persistent layers of off-flavoured eggs.

Pale yolks

The colour of the yolk is due to substances called carotenoids. The nutritional value of the egg is not affected by the yolk colour. Yolks of more intense colour may be required for specific markets.

However, the carotenoid content in the ingredients of poultry feed is not constant; the pigmentation properties of the carotenoids can be weakened or lost in a variety of ways. These fluctuations in carotenoid content and availability concern both the poultry nutritionist and the feed producer. Because of such fluctuations, naturally-occurring carotenoids cannot be relied upon to provide the desired yolk colour or to provide a consistent colour. Therefore, nature-identical yellow and red carotenoids, such as apoester and canthaxanthin, are commonly added to feed in order to achieve the desired egg yolk colour. Consumed by the laying hen, these supplemental carotenoids are readily transferred to the blood and then deposited in the yolk to provide pigmentation.

Cause: Deterioration of pigment concentrates, Insufficient carotenoids in the feed, Insufficient pigment in birds that are coming into lay, Oxidising agents or pigment antagonists in the feed, Inadequate mixing of feed, Storage of feed in damp and/or hot conditions.

Rotten eggs

Bacterial or fungal contamination of the egg can produce black, red or green rots. The egg looks and smells putrid when broken out.

Under conditions of good management, the incidence of rotten eggs is very low, rising slightly in summer. Such eggs must be eliminated during grading, as they have such a detrimental effect on product image. It is unacceptable for even one rotten egg to reach the consumer.

Cause: Faecal contamination, Improper washing procedures, High storage temperature and humidity, Old eggs.

Roundworms in eggs

Some eggs may contain one or more roundworms. These nematodes are intestinal parasites of hens.

The incidence is quite rare.

Cause: Roundworm infestation of the intestinal tract. Roundworms migrate from the cloaca into the oviduct, where they may be enclosed in the egg.

Watery whites

When an egg broken onto a flat surface has a watery, spread-out white, this usually indicates that the egg is stale. The height of the white and the weight of the egg are used to calculate a value in Haugh units on a scale of 0 to 110; the lower the value, the staler the egg.

A minimum Haugh unit measurement of 60 is desirable for whole eggs sold to the domestic consumer. Most eggs leaving the farm should average between 75 and 85 Haugh units.

The development of watery whites is chiefly due to the increasing age of the egg. The rate of development is increased by high storage temperature and low humidity (see figure 4). As birds age, the Haugh unit value of their eggs decreases by about 1.5 to 2 units per month of lay (see figure 3). Some birds consistently produce eggs with watery whites (Haugh units less than 30) later in lay.

Cause: Old eggs, High storage temperature and low humidity, Ageing of bird, Diseases- e.g. infectious bronchitis and egg drop syndrome, Fungal toxins, Ammonia, Rough handling, Incorrect packing, Strain of bird, Birds which persistently lay eggs with watery whites.

JUDGEMENT OF EGG AND EGG-PREPARATIONS:

Condemned for human consumption

- ☞ Infertile hen's egg. The hen egg is infertile if it was withdrawn from the hatchery after the 7th day of incubation.
- ☞ At withdrawal of hatched egg of other poultry-species disregarding the day of withdrawal.
- ☞ Broken and organoleptically disordered eggs, those that are mould-spotted, rotted or having mixed yolk and albumen, blood-ring, parasites or otherwise degusting.
- ☞ Eggs infected with pathogenic bacteria or the number of facultative pathogen or saprophyte bacteria or the residue level is over the predetermined value laid down in regulations or contaminated with other foreign material.

Approved for human consumption (after heat-treatment)

If the egg or its shell is contaminated, ruptured or depressed, or having reduced, swimming, floating yolk, or blood spotted or meat spotted, or frozen.

Egg product

Condemned for human consumption

If the egg-preparation is prepared from water-bird's egg or it was treated with a prohibited compound (or it is added to the preparation).
