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Popular Article

The Humble Egg: A Powerhouse of Essential Nutrients

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Abstract:

Eggs are among the most nutritious, affordable, and widely consumed foods worldwide. They provide high-quality protein, healthy fats, vitamins, minerals, choline, and other essential nutrients. A typical egg consists of the shell, shell membranes, albumen (egg white), and yolk, each serving important nutritional and biological functions. Chicken eggs are the most commonly consumed, while duck, quail, goose, turkey, and guinea fowl eggs are also eaten in different regions. Egg formation is a fascinating biological process involving the ovary and oviduct, where the yolk, albumen, membranes, and shell are formed sequentially. Humans have consumed bird eggs for thousands of years, and the domestication and selective breeding of poultry over centuries transformed egg collection into modern egg production. Today, eggs remain an important source of complete nutrition and high-quality protein in the human diet.

Why Egg is Healthiest Food on Planet?

The egg is one of the most familiar and widely consumed animal-derived foods across the globe. FAO (2023) reported a substantial rise in egg consumption over recent decades, particularly in developing nations. Population expansion, rapid urbanization, and improved household incomes have all contributed to this growing demand. Beyond its affordability and availability, the egg has gained importance because it provides several essential nutrients in a relatively small serving.

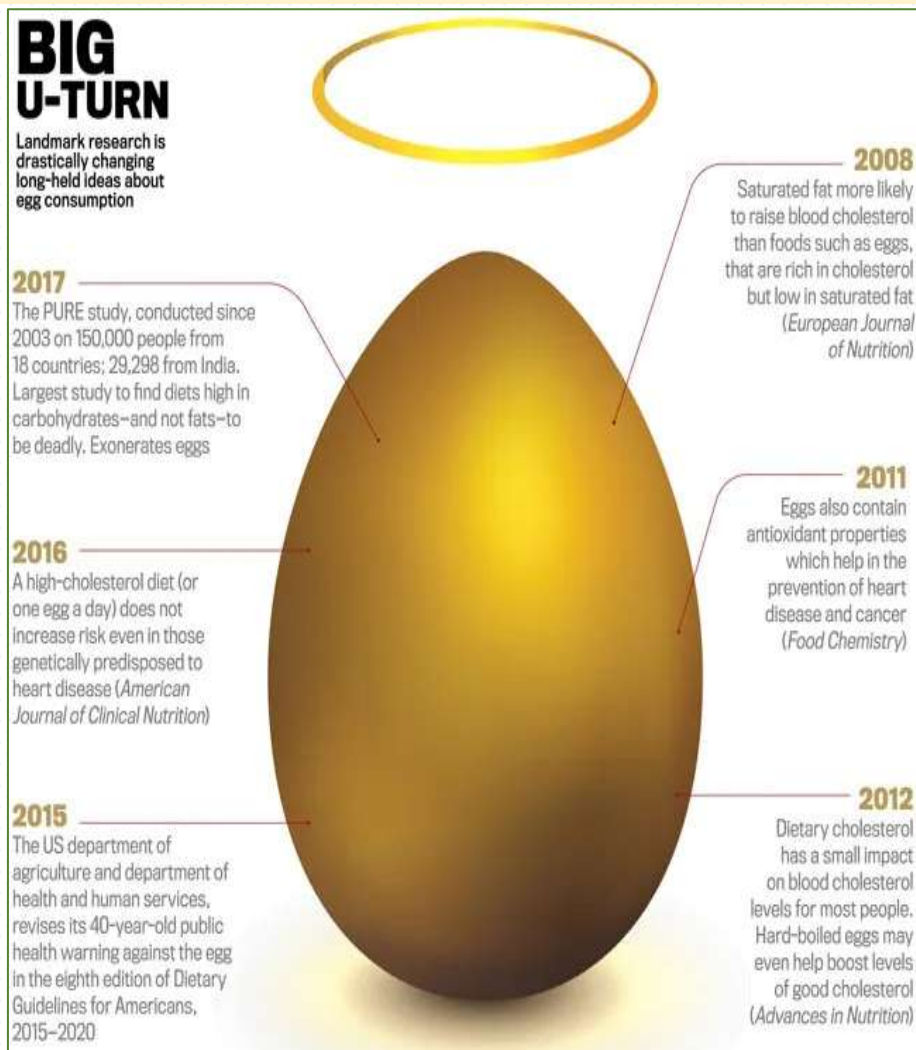
The Egg Takes a Big U-Turn: From a Simple Food to a Modern Nutrition Powerhouse

Over the past two decades, the humble egg has undergone a remarkable transformation. Once viewed simply as an inexpensive breakfast food, the egg has now emerged as a **nutrient-dense, affordable and versatile food**, increasingly recognized for its contribution to protein, micronutrient and healthy-diet requirements.

In India, this change can be clearly seen in the rising availability and production of eggs. Egg production increased from **55.56 billion eggs in 2008–09 to 149.11 billion eggs in 2024–25**.

During the same period, per-capita availability increased from **48 eggs per person per year to 106 eggs per person per year**.

A medium-sized chicken egg supplies approximately 75 kcal of energy and provides high-quality protein with a well-balanced amino acid profile. Eggs contain only a small quantity of carbohydrates, while their proteins are considered nutritionally valuable because they provide essential amino acids required for normal growth, tissue repair, and maintenance of body functions. The fat fraction of the egg contains a considerable proportion of unsaturated fatty acids, along with smaller amounts of saturated fatty acids.



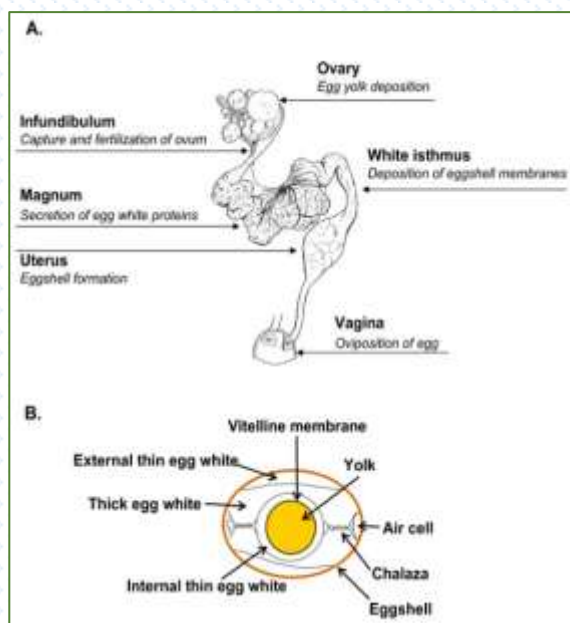
For many years, eggs received considerable attention because of their relatively high cholesterol content. A medium-sized egg may contain around 220 mg of cholesterol (Dussaillant *et al.*, 2017). However, cholesterol itself is not simply a harmful substance; it is an essential component involved in several physiological processes. It contributes to the synthesis of steroid hormones, including testosterone and oestradiol, participates in vitamin D production, and serves as a precursor for bile acids, which are important for the digestion and absorption of dietary fats (Hernandez *et al.*, 2021). Current evidence suggests that eating eggs does not necessarily result in a substantial increase in blood cholesterol concentrations in healthy individuals (Lopez-Sobaler *et al.*, 2017).

Inside an Egg: Three Distinct Parts

Although an egg appears simple from the outside, it is a highly organized biological structure. A typical chicken egg consists primarily of the shell, albumen or egg white, and yolk, with each part serving a different purpose (Gonzalez *et al.*, 2018).

The egg white is particularly valued for its protein content. It contains several proteins with different biological properties, including ovalbumin, ovotransferrin, ovomucoid, lysozyme, and ovomucin.

These proteins provide a broad range of amino acids and contribute substantially to the nutritional quality of the egg (Ramirez-Crespo *et al.*, 2022).



Component	Total (%)	Water (%)	Protein (%)	Fat (%)	Ash (%)
Whole egg	100	65.5	11.8	11.0	11.7
Albumen	58	88.0	11.0	0.2	0.8
Yolk	31	48.0	17.5	32.5	2.0
		Calcium carbonate (%)	Calcium phosphate (%)	Magnesium phosphate (%)	Organic matter (%)
Shell	11	94.0	1.0	1.0	4.0

The yolk, in contrast, is the principal reservoir of fat and many other nutrients within the egg. Its lipid fraction is composed predominantly of triglycerides, which account for approximately 66% of yolk lipids. Phospholipids, mainly phosphatidylcholine, contribute around 28%, while cholesterol esters account for approximately 6% (Gonzalez *et al.*, 2018). The yolk also contains carotenoid pigments, which are responsible for its characteristic yellow or orange colour and add to its nutritional significance.

Thus, an egg can be viewed as a naturally packaged food containing high-quality protein, lipids, vitamins, minerals, and biologically active compounds. Its combination of nutritional value, versatility, accessibility, and relatively low energy content makes it an important component of diets around the world.

Chicken eggs are the most commonly consumed poultry eggs worldwide. However, eggs from other birds, such as quail, duck, turkey, and ostrich, are also suitable for human consumption and provide valuable nutrients, particularly high-quality protein.

Egg Components:

Eggs contain a wide range of bioactive compounds that contribute to their nutritional and functional value:

- **Sialic acid:** An important component of cell membranes and glycoproteins, with roles in cell recognition, immune function, and neurological development.
- **Phosvitin:** A highly phosphorylated yolk protein with strong metal-binding and antioxidant properties.
- **Choline:** An essential nutrient important for brain development, neurotransmitter synthesis, cell membranes, and lipid metabolism.

- **Lutein and zeaxanthin:** Carotenoid antioxidants concentrated in the yolk that support eye health and help protect the retina from oxidative damage.
- **Immunoglobulin Y (IgY):** An antibody naturally present in egg yolk, particularly in eggs from immunized hens. IgY has been investigated for passive protection against pathogens such as rotavirus and enterotoxigenic *E. coli* and may have applications in gastrointestinal health.

Egg Allergens:

Egg is also a recognized food allergen, particularly in children. The major allergenic proteins are found mainly in the egg white:

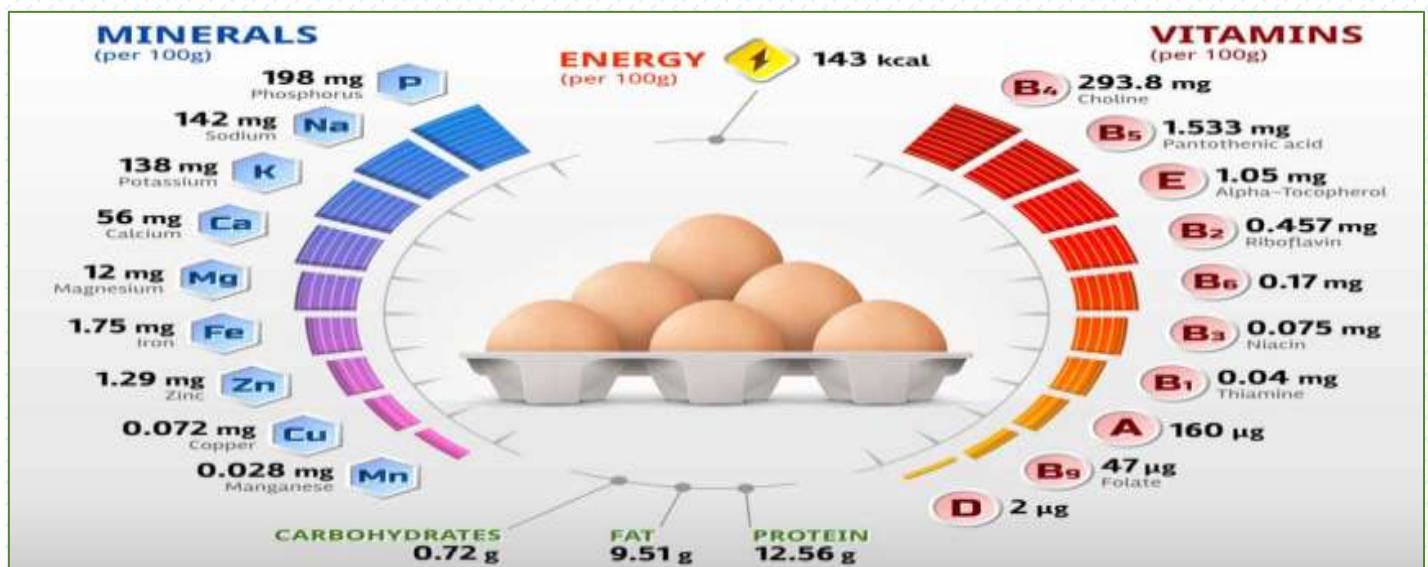
- **Ovalbumin (~54%)** – the most abundant egg-white protein and an important allergen.
- **Ovotransferrin (~12%)** – an iron-binding protein with allergenic potential.
- **Ovomucoid (~11%)** – a major allergen and relatively resistant to heat and digestion.
- **Lysozyme (~3.5%)** – an antimicrobial enzyme that can also cause allergic reactions in susceptible individuals.

Egg allergy may produce different clinical manifestations:

- **Skin:** itchy or bumpy rashes, hives, redness, and eczema.
- **Gastrointestinal tract:** abdominal cramps, nausea, vomiting, and diarrhea.
- **Respiratory tract:** sneezing, runny or watery eyes, nasal congestion, coughing, or wheezing.

Egg Facts:

Eggs are a simple yet nutrient-rich food that can contribute to a balanced diet by supporting muscle



maintenance, healthy weight management, pregnancy nutrition, brain activity, and eye health. A large egg provides approximately 6 g of high-quality protein, along with a range of essential vitamins and minerals. With only about 70 calories per large egg, it offers a convenient way to obtain valuable nutrients without a high energy load, making it a practical addition to meals for people of different age groups.

Type of Eggs:**Chicken egg****Turkey egg****Quail egg****Pigeon eggs****Goose eggs****Pheasant eggs****Duck eggs****Ostrich eggs (2kg)****Emu egg**

Eggs obtained from different bird species show noticeable differences in size, shell appearance, yolk characteristics, albumen proportion, and overall composition. Chicken eggs are the most familiar, but eggs from quail, duck, goose, turkey, pigeon, pheasant, ostrich, and emu also have distinct physical and nutritional features. The relative contribution of albumen and yolk can vary between species because of differences in egg size, breed, age, and production conditions. Therefore, these values should be considered as approximate rather than fixed characteristics.

Egg Type	General Size	Shell Characteristics	Yolk Characteristics	Distinctive Feature
Chicken	Medium	White, cream, or brown	Yellow to orange	Most widely consumed and commonly available
Quail	Very small	Light coloured with dark speckles	Relatively large for egg size	Attractive spotted shell and convenient serving size
Duck	Large	Usually white to pale green/blue	Large, rich-coloured yolk	Rich flavour and creamy texture
Goose	Very large	Thick, generally white	Large and nutrient-rich	Considerably larger than chicken eggs
Turkey	Large	Cream-coloured with characteristic speckling	Large, yellow-orange yolk	Similar in general structure to chicken eggs but larger
Pigeon	Small	Usually, white	Relatively small yolk	Small egg with delicate shell
Pheasant	Small to medium	Often olive, brown, or speckled	Proportionally prominent yolk	Distinctive naturally coloured shell
Ostrich	Extremely large	Thick, hard, cream-coloured	Large yolk with substantial albumen	One egg is equivalent to many chicken eggs
Emu	Very large	Dark green to deep green	Large yolk	Recognizable for its striking dark-green shell

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