International Journal of Pharmaceutical Science Invention
ISSN (Online): 2319-6718, ISSN (Print): 2319- 670X
www.ijpsi.org Volume 12 Issue 3 ǁ May –June. 2023 ǁ PP. 41-44

Extraction of Bioactive Egg Compounds Used In Human Medicine

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Abstract
Egg, a highly nutritious food, contains high-quality proteins, vitamins, and minerals. This food has been reported for its potential pharmacological properties, including antibacterial, anti-cancer, anti-inflammatory, angiotensin-converting enzyme (ACE) inhibition, immunomodulatory effects, and use in tissue engineering applications. The significance of eggs and their components in disease prevention and treatment is worth more attention. Eggs not only have been known as a "functional food" to combat diseases and facilitate the promotion of optimal health, but also have numerous industrial applications. The current review focuses on different perceptions and non-food applications of eggs. The versatility of eggs from an industrial perspective makes them a potential candidate for further exploration of several novel components. Biologically active ingredients of hen eggs are widely used in human medicine. This review article is aimed to summarize the extraction of various bioactive egg components that are used in pharmaceutical industries due to their beneficial pharmacological actions.

Date of Submission: 11-05-2023 Date of acceptance: 23-05-2023

I. Introduction

The principal components of eggs include the egg shell, egg white, the yolk, and the eggshell membrane. In addition to food consumption, increasing attention has been given to exploring the unique biological values and functions of eggs and their comprehensive applications as a non-food resource in different industrial sectors. This review aimed to summarize and analyse the cost-effectiveness of this essential food product that can make the academic communities and industries explore its potential, its bioactive components. In addition, an overall understanding of its bioactive components and their potential in large-scale development for applications in biotechnology, medicine, pharmaceuticals, and nutraceuticals may give rise to future developments in the egg industry. Extensive studies have been carried out to identify and characterize the biologically active components of hen's eggs, apart from. the products already being produced by industries for various biomedical applications for human and veterinary medicine, and other potential applications in non-biological industries.

Functional properties of egg compounds

Egg Components in Improving Osteoporosis

Egg yolk phosvitin, a highly phosphorylated protein naturally found in nature, plays a vital role in the osteoblast differentiation process, similar to ascorbic acid. Real-time PCR analysis of cultured mouse osteoblastic MC3T3-E1 cells treated with ascorbic acid and phosvitin revealed a similar expression of osteogenic gene markers, including collagen type l, osteocalcin, runt-related transcription factor 2, and bone morphogenetic protein-2Phosvitin can effectively play the role of ascorbic acid in the osteoblast differentiation process when the former is unavailable, with immediate applications for individuals who are susceptible to bone loss, providing alternative treatment options for patients with osteoporosis. Industries currently manufacturing artificial bone and dental fixtures can replace them with a natural biological material containing eggshell waste to rapidly improve bone structure formation.

Wound Healing Potency of Egg Compounds

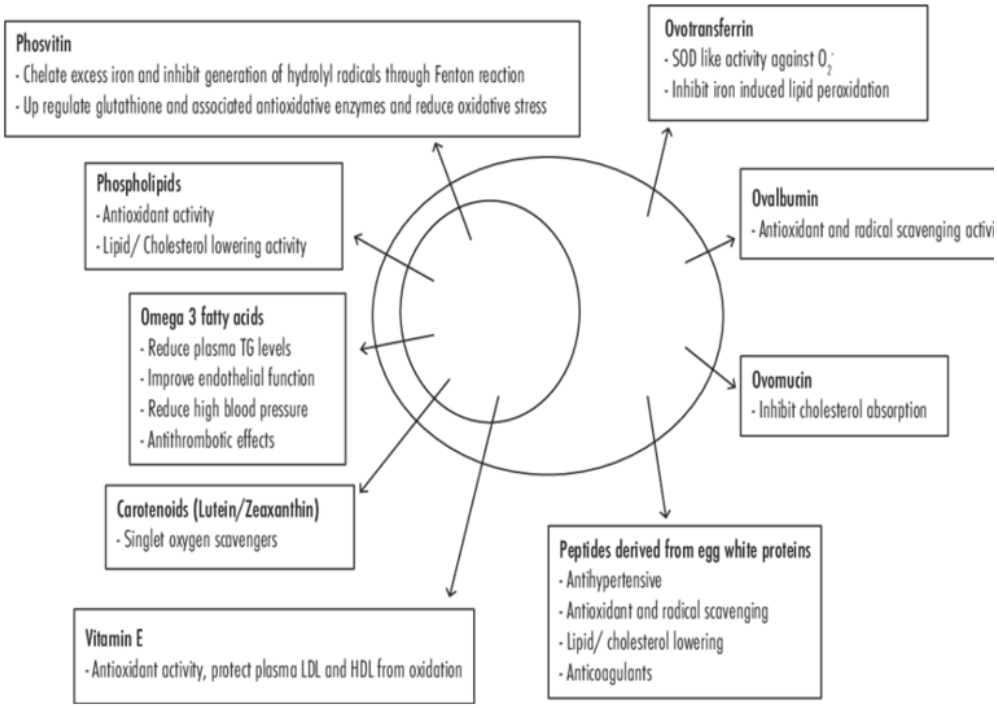
The use of egg shell membrane to improve biological and biodegradable matrices has gained attention as a new material for use in biological dressings in the wound regeneration process in split-thickness skin graft donors and in nerve regeneration enhancement in the sciatic nerves of rats. ESM, with its biodegradability due to

proteoglycans, has been successfully used to treat nonhealing wounds and burns. Manufacturing wound dressings from massive amounts of egg shell membrane industrial waste may have the market potential for solutions involving chronic wound healing. Similarly, egg white proteins displayed proliferative bioactivity, are involved in cell migration, and have rapid wound healing properties. A total of 33 proteins have been identified via LC-MS/MS in egg white, most of which play important roles in cell growth and development, signalling, motility, and proliferation. The bioactivity of these candidate molecules suggests that EW contains essential compounds that contribute to the growth of an embryo before fertilization.

Antioxidant Activity of Egg Bioactive Peptides

Various compounds obtained from eggs, including albumin, OVT hydrolysates, and phosvitin complexes exhibit antioxidant and anti-inflammatory properties. The peptide (NTDGSTDYGILQINSR) produced by pepsin, via trypsin hydrolysis, or lysozyme from albumen showed antioxidant and antimicrobial activity against both Gram-positive bacteria (Leucon Stoc mesenteries) and Gram-negative bacteria (Escherichia coli). Even with a limited number of studies exploring the use of antioxidants from animal sources, evidence has shown that the antioxidant property of egg proteins decreases after cooking, while gastrointestinal tract digestion increased the antioxidant potential of hydrolysed peptides obtained from egg proteins. The antioxidant activity of minute amounts of lutein and zeaxanthin contributes to ocular health improvement by preventing macular degeneration and the development of cataracts.

Functional characteristic	Egg compounds
Antibacterial	Lysozyme, Ovalbumin, Ovo transferrin Ovomucin, Avidin, Phosvitin , IgY
Anticancer	Lysozyme, Ovomucin, Ovo transferrin, IgY
Anti-inflammatory	Phospholipids, Lutein/Zeaxanthin, Ovo transferrin, High-density Lipoproteins, Phosvitin
Antioxidants	Ovalbumin, Ovomucin, Lysozyme, Cystatin, Ovoinhibitor, Phosvitin, Phospholipids, Lutein/Zeaxanthin, Vitamin E, Selenium, High-density Lipoproteins, Phosvitin
Antihypertensive	Bioactive peptides, Lysozyme, Ovomucin, Egg yolk hydrolysates, HDL



Isolation of egg Lecithin

Mix two eggs in a beaker and add 50ml acetone to it. Centrifuge for 5 minutes at 400 rpm. Extract ppt with 100ml chloroform-methanol mixture (2:1 V/V) and dry under nitrogen. Dissolve residue in petroleum ether and re precipitate with acetone. Collect the settled down ppt and store in chloroform-methanol system.

Uses: Antioxidant, lipid lowering activity, anti-inflammatory

Isolation of egg albumin

Dilute two egg whites in 100ml of water. Add 16.25 g of ammonium sulphate with continuous stirring. Remove ppt by filtration and saturate the filtrate by sodium ammonium sulphate. Centrifuge it to obtain ppt (albumin).

Uses: Antioxidant, scavenging activity, antibacterial.

II. CONCLUSION:

Various egg components, including lysozyme, avidin, IgY, lecithin, and bioactive peptides, display anti-cancer, antihypertensive, anti-inflammatory, and antimicrobial activities, and have great industrial opportunities in the pharmaceutical sector. In recent years, the cosmeceutical industry has taken advantage of the beneficial effects of egg yolk lecithin to expand its use in many skincare products. Meanwhile, the wastes generated from the egg processing industries can be more efficiently utilized by other textile and dye manufacturing industries. For instance, recycling egg waste for the removal of toxic pollutants from industrial effluents is a synergistic process between the two industries, decreasing the environmental impact of the waste generated. The future of the egg industry lies in generating functional eggs by enriching them with specific compounds or preparing transgenic eggs via genetic manipulation of chickens to fulfil the need for the production of specific proteins in the eggs to treat various diseases. Recent advancements in the largescale purification of compounds from eggs using newer methods such as supercritical technology and the separation of bioactive peptides via magnetic separation made it feasible for industrial preparations. Eggs harbouring biologically and industrially important peptides encourage the exploration for other efficient bioactive peptides in the future, not only by the scientific community but also by the industrial sector.

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