

ANTIMICROBIAL PROPERTIES OF EGG

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INTRODUCTION

The chicken egg is a vital source of high biological value proteins, vitamin, lipids and minerals and plays an important role in human nutrition. Egg helps in the growth and development of living organisms and provides protection against the infection due to its inherent properties. Besides the nutritional properties, eggs have been associated with various biological functions such as antibacterial properties, immunomodulatory activities, antineoplastic properties and protease inhibition activity. All these biological properties of egg help in the prevention, control and treatment of human and animal diseases.

DEFENCE MECHANISM OF EGG

The defense mechanism of egg may be due to presence of mechanical (physical) barriers as well as biological barriers.

(A)MECHANICAL (PHYSICAL) BARRIER: It consists of cuticle, shell and shell membrane.

Cuticle

It is a waxy membrane covering the egg shell. It prevents the micro-organisms from penetrating the egg. It acts effectively with in 96 hrs after the egg is laid. But it is seen that sometimes this layer is damaged by the enzymes of some bacteria like *Pseudomonas*, *Salmonella* and sometimes washing for several times can also damage this.

Shell

The shell of egg itself consisting of 2 layers; (a) outer –spongy layer (b) inner-mamillary layer. It contains about 7,000 – 17,000 pores. The micro-organisms at the outer surface of the shell can penetrate the shell barrier, if the shell pores are open, then the micro-organisms can easily make entrance into the egg. So, by nature, the cuticle surrounds to pores. For which both the cuticle and shell act as a barrier for microbial invasion. There is always a waxy layer called cuticle present above it to restrict the invasion of microorganisms through it.

Shell membrane

This is relatively less permeable to bacteria than the egg-shell itself. It basically acts like a filter. They can obstruct the penetration of micro-organisms for 2-3 days. Micro-organisms are just trapped inside this layer. These layers act as a physical barrier for bacteria.

(B) **BIOLOGICAL BARRIER:** It includes lysozyme, conalbumin (ovo-transferrin), avidin, cystain, ovomucoid, and ovo inhibitor

Lysozyme

Among birds, the chicken egg has the highest lysozyme content (3.5-4) %. Two types of lysozymes are found *i.e* lysozyme-C (chicken) and lysozyme-G (geese). It acts by breaking the bond between N-acetylglucosamine (NAG) and N-acetyl muramic acid (NAM) *i.e* (1-4) glucosidase of bacteria. It has both anti-bacterial and anti-viral activities. Lysozyme is also thought to be capable of inactivating viruses by binding their DNA and forming insoluble complexes.

Conalbumin

This is an iron-binding protein whose content in chicken egg-white approximately about 12-14%. It can bind with ions of iron, copper, zinc and aluminum. This protein inhibits bacterial multiplication by limiting them of iron that is essential for their growth.

Ovo transferrin

It also has a broad-spectrum antibacterial property. It can also act as an immunomodulator by activating the function of macrophage.

Avidin

It binds with biotin with high affinity and essential for growth of many micro-organisms. Hence, it is always treated as a natural anti-bacterial agent. It can also inhibit the growth of both gram negative and positive micro-organisms by binding with their surface receptor.

Protease inhibitor

These are also important group of biologically active substances with antimicrobial properties in egg white. Most important are cystatin, ovomucoid, ovo-inhibitor. Proteases play an important role in intracellular protein degradation, bone remodeling, and antigen presentation. Their activity increases under pathological conditions such as inflammation or cancer metastasis.

Cystatin

It inhibits ficin and papain, cathepsins, papain like peptidases. It controls protein decomposition. It participates in inflammatory and immune response.

Ovomucoid

It inactivates the proteolytic enzymes essential for bacterial multiplication in chicken egg and inhibits trypsin activity.

Ovoinhibitor

It protects the egg against the development of molds during storage or incubation.

(C) pH OF EGG

The pH of the egg immediately after laying is 7.4-7.9. It is close to optimal value of growth of many bacteria. In stored conditions, the pH ranges from 9 or >9, in which bacteria cannot grow further.

DEFENCE MECHANISM OF EGG YOLK

Vitelline membrane provides a physical barrier to yolk. Immunoglobulin like “IgY” antibody is transferred from hen to chick, which gives it protection.

IMPORTANT PROTEINS IN EGG ALBUMEN

Protein	Relative amount in albumen	Characteristics
Ovalbumin	54%	Phosphoglycoprotein
Conalbumin	13%	Binds with iron
Ovomucoid	11%	Inhibits trypsin
Lysozyme	10%	Lyses some bacteria
Ovomucin	1.5%	Sialoprotein
Flavo-protein	0.8%	Binds riboflavin
Ovo inhibitor	0.1%	Inhibit proteases
Avidin	0.05%	Binds biotin

CONCLUSION

Egg is an important source of various biologically active substances having potential or therapeutic applications along with their nutritive properties. As the nutritional composition of egg can be manipulated by using various diets, the concept of designer egg has arisen for production of various functional eggs. Hence, constant research should be carried out to explore the new and innovative use of known biological functions of egg constituents to contribute to their commercial use in treatment, control and prevention of various chronic and infectious diseases in human and animal population. Also, the properties of biologically active substances in egg may become an important alternative to antibiotic treatments, controlling the rampant development of antibiotic resistant microorganisms.