***Egg Microbiology***

Eggs are laid by female animals of many different species but the egg that most often consumed by humans is the chicken egg and have been eaten by humans for thousands of year, eggs consist of a protective eggshell, albumen (egg white), and vitellus (egg yolk), contained within various thin membranes. Egg yolks and whole eggs store significant amounts of protein and choline.

The hen’s egg is an excellent example of a product that normally is well protected by its intrinsic parameters:

**Externally:** a fresh egg has three structures, each effective to some degree in retarding the entry of microorganisms:

1-The outer waxy shell membrane(the more thickness prevent microorganisms entrance and after long time of storage may be cracked)

2-The shell

3-The inner shell membrane

The shell of the hen’s egg is permeated by a variable number of pores ranging from 7 000 to 17000 ,they are large enough for bacteria to pass through.The diameters of the pores are in the range of 6 - 23 μm .The most important contribution of the shell is to provide a mechanical protection. Shell eggs are contaminated with microorganisms on the outer surface from:

Fecal matter-

-Nesting materials

Feeds-

Air-

Equipment.-

**Internally:** lysozyme is present in egg white, this enzyme is quite effective against Gram-positive bacteria cell wall. Egg white also contains avidin, which forms a complex with biotin, thereby making this vitamin unavailable to microorganisms. In addition, egg white has a high pH about 8-9 and contains conalbumin, which forms a complex with iron, thus rendering it unavailable to microorganisms.

On the other hand, the nutrient content of the yolk material and its pH in fresh eggs make it an excellent source of growth for most microorganisms. Freshly laid eggs are generally sterile. However, in a relatively short period of time after laying, numerous microorganisms may be found on the outside and, under the proper conditions, may enter eggs, grow, and cause spoilage. The speed at which microbes enter eggs is related to:

Temperature of storage-

Age of eggs-

- Level of contamination.

***Microorganisms that cause egg spoilage:***

Egg shells can harbor different types of bacteria, namely **Pseudomonas**, **Alcaligenes** , **Proteus**, **Citrobacter**, **Micrococcus**, **Streptococcus**

***E. coli***, **Enterobacter**, **Enterococcus**, **Micrococcus** and **Bacillus**.

The different types of spoilage are designated as rot. Some examples are:

- Green rot, causing greening of albumen because of growth of *Pseudomonas fluorescens*

-Black rot, causing muddy discoloration of yolk because of H2S production by *Proteus vulgaris*

-Red rot by *Serratia mercescens*, caused by production of red pigment.

- On some occasions, molds from genera Penicillium, Alternaria, and Mucor can grow inside eggs, especially when the eggs are oiled, and produce different types of fungal rots

**Salmonella**

Salmonella, the name of a group of bacteria, is the most common cause of food poisoning. Salmonella have been known to cause illness for over 100 years.Most people infected with Salmonella develop diarrhea, fever, abdominal cramps, and vomiting 12 to 72 hours after infection.

Salmonella also can invade an egg in several ways. One way is by the contamination of egg shells with fecal matter, infected ovaries of laying hens ,the bacteria, the bacteria are present in the intestines and feces of infected humans and animals, including chickens, and can be passed to the eggs when chickens sit on them, can be the source of Salmonella in the yolk. Liquid egg can be contaminated with bacteria from the shell of washed eggs as well as from the breaking equipment, water, and air

In regards to the destruction of salmonellae in boiled shell eggs, it is generally recognized that cooking until the entire yolk is solidified is sufficient to destroy *Salmonella. enterica*

To prevent illness from bacteria: keep eggs refrigerated, cook eggs until yolks are firm, cook foods containing eggs thoroughly,discard any broken egg ,don’t eat raw egg and eggs shouldn’t be frozen with their shells.

Wash hands, utensils, equipment, and work surfaces with hot, soapy water before and after they come in contact with eggs and egg-containing foods

***Characteristics of Salmonella***

Salmonella are Gram-negative rods, belonging to the family of Enterobacteriaceae. They are generally motile with peritrichous flagella, facultative anaerobic, most subspecies of Salmonella produce hydrogen sulfide, ferment glucose mostly with the formation of gas and reduce nitrate to nitrite.

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**Procedure**

**A/**

1-Wash egg shell by sterilized warm water and detergent or soap with using sterilized brush.

2-Put egg inside %70 ethyl alcohol solution for 10 minute.

3-After removing ethyl alcohol from the egg surface expose the egg to the flame of Bunsen burner.

4-Make a hole in egg shell from one side and expose to the flame.

5-Empty the egg component in sterilized beaker, and mix it gently.

6-Transfer 10 gm from the egg mixture to 90 ml normal saline ,mixed well up down 25 times ,then serial dilution take place.

7-Transfer from each dilution 1 ml to petri dish plates of nutrient agar and potato dextrose agar .

8-For total count incubate at 35-37 C̊ for 24-48 hr and for fungi incubate at 25 C̊ for 2-3 days.

**B/**

Salmonella Prsumptive Test

1-Put an egg in lactose broth or tetrathionate broth and incubate for 24 hr at 35 C̊ (the purpose of this step is for activation of Salmonella )

2-After 24 hr of incubation transfer a loop full of this media to petridish plate contain solidifying Brilliant green agar and streak it .

3-Incubate for 24 hr at 35C̊ , presence of sheen red colony indicates probability of contamination the egg with Salmonella.

-Salmonella Shigella Agar (SS Agar) is a differentially selective medium for the isolation of pathogenic enteric bacilli, especially those belonging to the genus Salmonella

-Hektoen enteric agar (HEK )is a selective and differential agar. HEK contains indicators of lactose fermentation and hydrogen sulfide production; as well as inhibitors to prevent the growth of gram positive bacteria.

-DCA agar - Deoxycholate Citrate Agar is a solid bacteriological growth medium, salmonella strains that cause food poisoning and *Salmonella Paratyphi*