

## Microorganisms Associated with Food

### Common Bacteria Present in Food:

The different physiochemical and biological characteristics of bacteria make them important in food and which are very useful for the complete study of bacteria in food biotechnology. The bacteria which are important in food biotechnology are explained briefly:

#### (1) **Acetobacter:**

Gram-negative bacteria oxidize ethanol to acetic acid. They are rod shaped motile bacteria found on fruits and vegetables.

#### (2) **Aeromonas:**

They are gram-negative, facultative anaerobic, psychrophilic rods and which are commonly found in fish, frog and other mammals.

#### (3) **Alcaligenes:**

They are gram-negative rod shaped bacteria present in feeds, soil, water and dust. The important species are *Alcaligenes viscolatis*, which produces ropiness in milk and *Alcaligenes metalcaligenes* gives a slimy growth on cottage cheese.

#### (4) **Alteromonas:**

These organisms are gram-negative aerobic rods. The important species is *Alteromonas putrefaciens*.

#### (5) **Arthrobacter:**

It is a gram-positive bacterium predominant in soil.

#### (6) **Bacillus:**

It is a gram-positive spore forming aerobic or facultative anaerobic organism. Different species may be mesophilic or thermophilic, proteolytic or non-proteolytic gas forming or not. The

important species are *Bacillus subtilis* and *Bacillus stearothermophilus* (these are hyperthermophilic and spore producing bacteria).

**(7) Brevibacterium:**

It is also a gram-positive, bacteria produces orange red pigment and helps ripening.

**(8) Brothothrix:**

These are gram-positive non spore forming bacteria found in many food items.

**(9) Campylobacter:**

It is gram-negative, spiral shaped rods. The species *Campylobacter jejuni* is associated with gastroenteritis in human.

**(10) Clostridium:**

These are gram-positive, spore forming rods. These are obligate (strict) anaerobes. Many species are capable of fermenting carbohydrate and produce acids and gases. *Clostridium botulinum* (causes botulism). *Clostridium perfringens* (causes gas gangrene and food poisoning) are the most important species in food biotechnology.

**(11) Corynebacterium:**

These are gram-positive, rod-shaped bacteria that are sometimes involved in the spoilage of vegetable and meat products. Most are mesotrophs and the important species, *Corynebacterium diphtheriae*, causes diphtheria in humans.

**(12) Citrobacter:**

These enteric bacteria are slow lactose-fermenting, gram-negative rods that typically produce yellow colonies.

**(13) Desulfomaculum:**

It is a gram-negative rod and inhabitants of the soil, fresh water and the rumen. It is a sulfur oxidizing bacteria.

**(14) Escherichia:**

It is a gram-negative, non-sporulating, motile and facultative anaerobic bacteria commonly referred as coliform and which are indicator organisms.

**(15) Enterobacter:**

These are enteric gram-negative coliform bacteria like *E. coli*.

**(16) Erwinia:**

These are gram-negative enteric rods especially associated with plants. *Erwinia carotovora* is the most important organism responsible for spoilage of food.

**(17) Flavobacterium:**

These are gram-negative rods characterized by their production of yellow to red pigments on agar and by their association with plants. Some are mesotrophs, and others are psychrotrophs, where they participate in the spoilage of refrigerated meats and vegetables.

**(18) Gluconobacter:**

It is a gram-negative, rod shaped bacterium which can oxidize ethanol to acetic acid and can cause ropiness in beer.

**(19) Hafnia:**

These are gram-negative enteric rods important in the spoilage of refrigerated meat and vegetable products.

**(20) Halobacterium:**

These are obligate halophiles and causes discoloration on the foods high in salt such as salted fish.

**(21) Klebsiella:**

These are gram-negative, non-sporulating, non-motile and facultative anaerobic bacteria commonly referred as coliforms and which are indicator organisms. *Klebsiella pneumonia* is the

causative organism for bacterial pneumonia in human.

**(22) Lactobacillus:**

These are gram-positive, rod shaped, microaerophilic bacteria typically occur on most vegetables, along with some of the other lactic acid bacteria. Their occurrence in dairy products is common. It can ferment the carbohydrate lactose and can produce acids and gas. The important species are *Lactobacillus bulgaricus*, *Lactobacillus delbrueckii*, *Lactobacillus pentosus*, *Lactobacillus acidophilus* and *Lactobacillus casei*.

**(23) Leuconostoc:**

They are gram-positive bacterium. The most important species is *Leuconostoc mesenteroides*.

**(24) Listeria:**

These are gram-positive and non-sporing rods. The most important organism is *Listeria monocytogens* which are causing the spoilage to fish and fish products.

**(25) Micrococcus:**

These are gram-positive cocci and are inhabitants of mammalian skin and can grow in the presence of high level of salt.

**(26) Moraxella:**

These short gram-negative rods they do not form acid from glucose. The most important species is *Moraxella bovis*.

**(27) Mycobacterium:**

These are gram-positive rods. The most important species are *Mycobacterium tuberculosis* (causative agent of tuberculosis), *Mycobacterium leprae* (causative agent of leprosy) and *Mycobacterium bovis*.

**(28) Pediococcus:**

These are gram-positive, homofermentative cocci that exist in pairs and tetrads. These are lactose

Fermenting bacteria.

**(29) Proteus:**

These enteric gram-negative rods are aerobes that often display pleomorphism. These organisms are motile and typically produce swarming growth on the surface of moist agar plates. They are typical of enteric bacteria in being present in the intestinal tract of humans and animals. One important species is *Proteus vulgaris*.

**(30) Pseudomonas:**

These are gram-negative rod shaped motile bacteria. These are typical soil and water bacteria and they are widely distributed among fresh food especially vegetables, meats, poultry, and seafood products. These are one of the largest food borne bacteria.

**(31) Photobacterium:**

These are coccobacilli and can cause phosphorescence of meat and fish.

**(32) Propionibacterium:**

These are gram-positive, small, nonmotile rod shaped bacteria can ferment carbohydrates. These bacteria are commonly present in cheese and cheese related products.

**(33) Salmonella:**

These are gram-negative enteric bacteria are considered to be human pathogens. The most important pathogen is *Salmonella typhi* and *Salmonella paratyphi*. These organisms cause enteric fever.

**(34) Serratia:**

These gram-negative rods that belong to the family Enterobacteriaceae are aerobic and proteolytic and produce red pigments on culture media and in certain food. *Serratia liquefaciens* and *Serratia marcescens* are the most prevalent of the food borne species; it causes spoilage of refrigerated vegetables and meat products.

**(35) Shigella:**

Shigella is a gram-negative, non-sporulating, motile and facultative anaerobic bacterium and can cause bacillary dysentery in human. *Shigella dysenteriae* is the causative organism. Other *Shigella species* are *Shigella flexneri*, *Shigella boydii* and *Shigella sonnei*.

**(36) Staphylococcus:**

These gram-positive, cocci occur in the form of grape like clusters and which include *Staphylococcus aureus*, causes several diseases in human including food borne gastroenteritis.

**(37) Streptococcus:**

These are also gram-positive cocci which occur in the form of long or short chains. It will cause pyogenic infection in human (*Streptococcus pyogenes*).

**(38) Vibrio:**

These are gram-negative straight or curved rods. The most important organism is *Vibrio cholerae* which causes the disease cholera.

**(39) Yersinia:**

These are gram-negative rods and include the causative agent of human plague, *Yersinia pestis* and some species are causing food borne gastroenteritis