
Enterobacteriaceae

Are a large family of Gram-negative bacteria. Family *Enterobacteriaceae* often referred to as “enterics”

Major features:

- Gram-negative rods
- Ferment glucose with acid production
- Reduce nitrates into nitrites
- Oxidase negative
- Facultative anaerobic
- Non-capsulated except *Klebsiella*
- Non-fastidious
- Non spore forming
- Grow on bile containing media (MacConkey agar)
- All except *Klebsiella*, *Shigella* and *Yersinia* are motile

Virulence and Antigenic Factors of Enteric

- Ability to colonize, adhere, produce various toxins and invade tissues
- Some possess plasmids that may mediate resistance to antibiotics
- Many enteric possess antigens that can be used to identify groups
 - O antigen – somatic, heat-stable antigen located in the cell wall
 - H antigen – flagellar, heat labile antigen
 - K antigen – capsular, heat-labile antigen

Clinical Significance of Enterics

- Based on clinical infections produced, enterics are divided into two categories:
 - Opportunistic pathogens – normally part of the usual intestinal flora that may produce infection outside the intestine
 - Primary intestinal pathogens – *Salmonella*, *Shigella*, and *Yersinia* sp.

1- *Escherichia coli*

- Biochemical test

- Ferments Glucose, Lactose, Mannitol, Maltose A/A with Gas.
- Positive indole and methyl red tests
- H₂S negative and phenylalanine deaminase negative.
- Negative Voges-Proskauer test and Simmons citrate
- Usually motile
- Urease negative

Infections

- Wide range including meningitis, gastrointestinal, urinary tract, wound, and bacteremia

- **Gastrointestinal Infections**

- 1- Enteropathogenic (EPEC) primarily in infants and children
- 2- Enterotoxigenic (ETEC) traveler's diarrhea (watery diarrhea without blood)
- 3- Enteroinvasive (EIEC) – produce dysentery (watery diarrhea with blood)
- 4- Enterohemorrhagic (EHEC serotype 0157:H7) associated with hemorrhagic diarrhea and hemolytic-uremic syndrome (HUS)
- 5- Enteroaggregative (EaggEC).

Antigenic Structure

- Somatic O
- Capsular K
- Flagellar H

Culture media

Aerobic or facultatively anaerobic. Produce large grayish, Thick white, moist smooth opaque colonies, Grows between 10 – 40 C° optimal at 37 C°

- 1- On MacConkey agar: lactose fermenter (dry, pink colony)
- 2- On blood agar: Many pathogenic strains are haemolytic on blood agar.
- 3- EMB (eosin methylene blue): green metallic sheen is showed.

2- *Klebsiellae*

Usually found in intestinal tract

Wide variety of infections, primarily pneumonia, wound, and UTI.

General characteristics:

- Some species are non-motile
- Negative Indole and Methyl red
- Positive Voges-Proskauer test and Simmons citrate
- H₂S negative
- Phenylalanine deaminase negative
- Most urease positive
- KIA A/A + gas
- Has both O and K antigens
-

Klebsiella species

Usually found in GI tract

- Four major species
- *K. pneumoniae* is mostly commonly isolated species
- Possesses a **polysaccharide capsule**, which protects against phagocytosis and antibiotics AND makes the colonies moist and mucoid
- Has a distinctive “yeasty” odor
- Frequent cause of nosocomial pneumonia
- On MacConkey agar: lactose fermenter (pink colony with surrounding media)

3- *Enterobacter* species

Comprised of 12 species; *E. cloacae* and *E. aerogenes* are most common

Isolated from wounds, urine, blood and CSF

Major characteristics (*Enterobacter cloacae*)

- Colonies resemble *Klebsiella*
- Motile
- Indole negative, MR negative, VP positive, and citrate positive

- H₂S negative, Urease negative, Catalase positive

4- *Serratia* species

Seven species, but *S. marcescens* is the only one clinically important.

Frequently found in nosocomial infections of urinary or respiratory tracts

Implicated in bacteremia outbreaks, cardiac surgery, and burn units

It may be resistant to antibiotics

Major characteristics

Ferments lactose slowly on MacConkey agar

Produce characteristic pink pigment, especially when cultures are left at room temperature.

- Indole negative, MR negative, VP positive, and Citrate positive
- H₂S negative,
- Urease positive
- Catalase positive