



Enterobacteriaceae

Genus *Salmonella* & *Shigellae*

Parameter	Typhoid salmonellae/salmonellosis	Enteric salmonellae/salmonellosis
Serovars	Typhi; Paratyphi A, B, C	Often Enteritidis and Typhimurium; more rarely: numerous other serovars
Infection spectrum	Humans	Animals and humans
Source of infection	Humans: infected persons, chronic carriers	Mainly livestock; possibly humans as well
Mode of infection	Oral	Oral
Transmission	Indirect: water, contaminated Food Direct: smear infection	Indirect: contaminated food
Infective dose	Small: 10^2 – 10^8 bacteria	Large: $>10^6$ bacteria; in most cases proliferation in food
Incubation time	1–3 weeks	1–2 days
Clinical picture	Generalized infection. Sepsis	Acute diarrhea with vomiting. Fever. Self-limiting infection in most cases
Diagnosis	Identification of pathogen in blood, stool, urine B.M, Antibody detection using Gruber-Widal quantitative agglutination reaction	Identification of pathogen in stool

What will you send to the lab?

- Enterocolitis : Stool sample (GSE).
- Enteric fever: Stool sample (GSE), **Blood sample** for bacterial cultivation and serology & **bone marrow** aspiration for bacterial cultivation if the previous are neg.
- Chronic carrier : Stool sample (GSE).

Gram stain slide

- Gram negative bacilli. (Motile).



Culture on macconkey agar & *Eosin methylene blue* agar

- Typical colonies appear transparent and colorless, sometimes with dark center. Colonies of *Salmonella* will clear areas of precipitated bile caused by other organisms sometimes present.



salmonella on macconkey agar

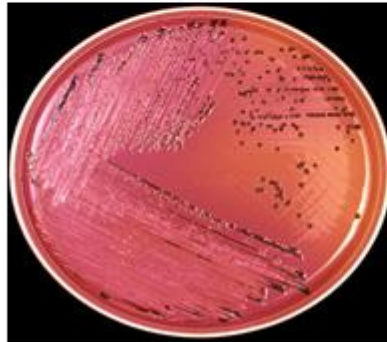


Salmonella on EMB Agar



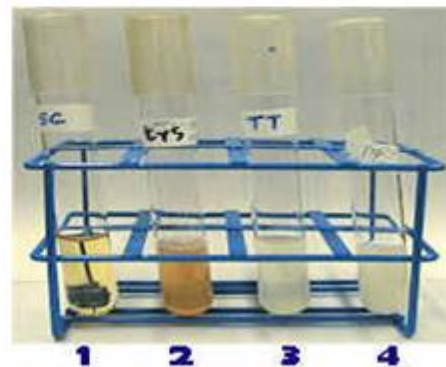
salmonella on XLD Agar **Xylose Lysine** **(XL) agar**

- *Salmonella* sp. after 24 hours growth on XLD agar. Xylose Lysine (XL) agar is used when trying to culture and isolate Gram-negative enteric bacilli. When XL agar is supplemented with sodium thiosulfate, ferric ammonium citrate, and sodium deoxycholate, it is then termed XLD agar, and is then an even more **selective medium** than XL alone. The presence of any **black colored** area indicates the deposition of **hydrogen sulfide**, (H_2S) under alkaline conditions.



salmonella on selenite f & tetrathionate broth

- 1: Selenite cysteine broth (sterile)
- 2: Selenite cysteine broth incubated with *Salmonella typhimurium*
- 3: Tetrathionate broth (sterile)
- 4: Tetrathionate broth with *Salmonella typhimurium*
- **Enriched medias**



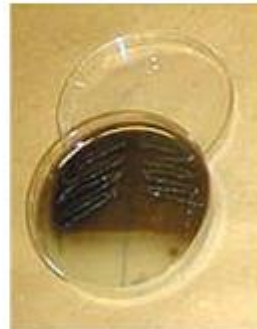
Bismuth agar for salmonella

• Before culturing

After culturing



**Bismuth sulphite
(BS)**



**Bismuth sulphite
(BS)**

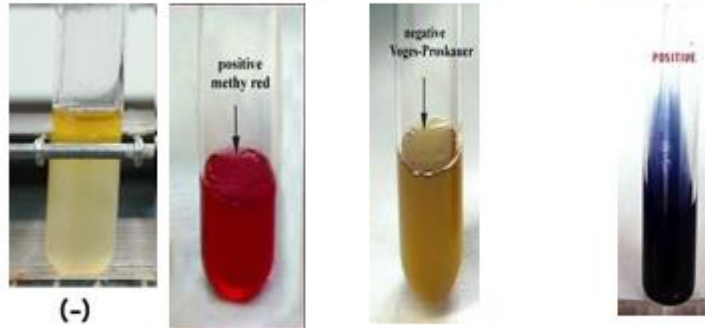
Salmonella shigella agar



MB-S1394 Salmonella Shigella (SS) Agar
Cultivated Shigella flexneri (L)
/ Salmonella typhimurium (R)

Imvic test for salmonella

- Indole -ve. Methyl red +ve. Voges-Proskauer test -ve. Citrate +ve.



Triple sugar iron test for salmonella

- Alkaline slant
 - Acid butt.
 - CO₂ gas production.
 - H₂S production.
- (Black color on the butt)



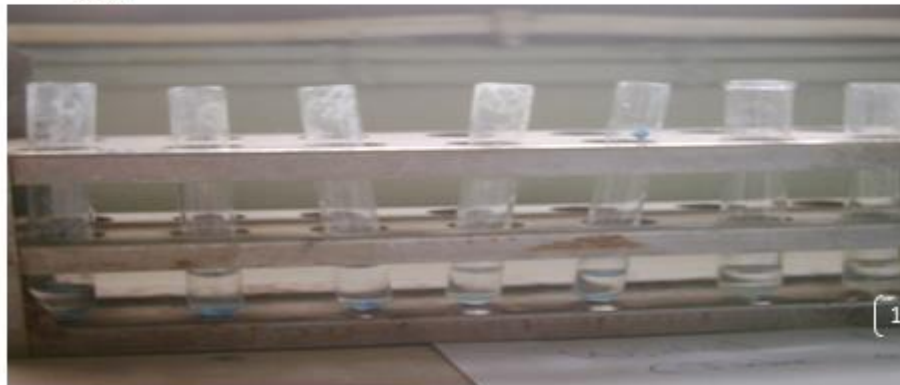
Urase test for salmonella

- Urase –ve for salmonella spp.
To differentiate it from proteus
which produces the same
reaction on TSI test.



Widal (tube agglutination) test

- Serum agglutination **Abs** rise sharply 2nd-3rd week of typhoid fever
- 1/10 1/20 1/40 1/80 1/160 1/320
1/640

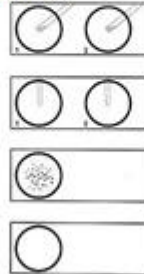


Widal slide agglutination test

Anti-o: appears 2nd – 3rd week and stays for weeks > 160 diagnostic

Anti-H: remains high reflects old infection or immunization >160.

Presence of anti-Vi occurs in carrier.

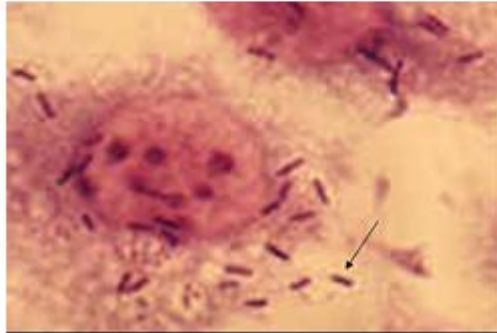


shigella

- Shigella is the causative pathogen in **bacterial dysentery**. The genus comprises
- the species *S. dysenteriae* (12 serotypes)
- , *S. flexneri* (6 serotypes)
- , *S. boydii* (23 serotypes)
- , and *S. sonnei* (1 serotype).
- Classified according to the O Ag into A, B, C, & D.
- Non motile
- ID₅₀ 100 M.O.

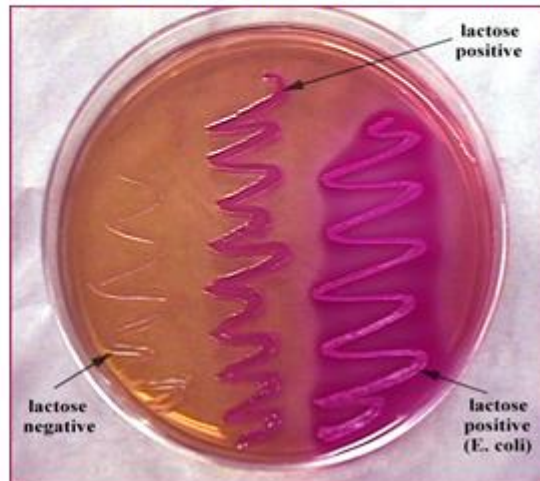
Gram stain for shigella

- Gram -ve bacilli



shigella on macconkey agar

- Non lactose fermenter except sonnei late lactose fermenter



Imvic test for sigella

- Indole -ve Methyl red -ve. Voges-Proskauer test -ve. Citrate -ve.

- or +ve.

- - + - +



(-)



Triple sugar iron test for shigella

- Alkaline slant
- Acid butt.
- No CO₂ gas production.
- No H₂S production.



Urase test for shigella

- Urase –ve for shigella spp.
To differentiate it from proteus



Ornithine decarboxylase test

- Used to differentiate between Shigella subtypes
all are –ve except subtype D



Methylene blue stain of stool

- To detect neutrophil in the stool as a sign of invasive M.O. Shigella, Salmonella or Campylobacter rather than a toxin producing M.O. E. coli V. cholera or clostridia

