

Shigella spp. and *Yersinia enterocolitica*

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Shigella spp.

- Four species (*boydii*, *dysenteriae*, *flexneri*, *sonnei*) = serogroups
- Shigellosis = **bacillary dysentery**
- Host-adapted to **humans** (primates)

Characteristics of the disease:

- Infectious dose is 10–100 organisms
- Incubation period is ½–4 (usually 1–3) days; up to a week for *S. dysenteriae* 1

Characteristics of the disease:

- (illness on next 2 slides)
- Duration: 4–7 days; shedding up to 4 weeks; both shortened by appropriate antibiotics (multiple resistance common)

Illness:

- Diarrhea with fever and nausea
- Sometimes toxemia, vomiting, cramps, and tenesmus

Illness:

- Dysentery – blood and mucus in stools; may cause hemolytic uremic syndrome; most severe in infants (cf. *E. coli* O157:H7)
- Mild and asymptomatic infections occur

////// *Characteristics of the organism*

- Nonmotile, nonsporing, gram-negative short rods; close genetic relationship to *E. coli*
- Invades the colonic epithelium; many strains produce shigatoxin or shiga-like toxin

////// *Characteristics of the organism*

- Temperature range for growth (strain-dependent) 7–46°C, optimum 37°C
- pH range for growth 5–8, acetic acid stops growth at pH 6

////// *Transmission via food:*

- Fourth-ranked cause of foodborne disease in U.S., 1998–2002 (~735/yr), as reported by CDC
- CAST estimates 90,000–163,000 cases per year, ≤180 deaths, \$390 average cost/case

////// *Transmission via food:*

- CDC estimates ~90,000 cases per year, 14 deaths
- FoodNet (2005) ≈ 14,000 cases
- Survives well in neutral-pH foods, poorly in acid foods, may grow (e.g., in watermelon)

////// *Transmission via food:*

- Vehicles may be anything contaminated with infectious human feces:
 - water (2 outbreaks in U.S., 1994)
 - baked goods, fruits and vegetables, chicken, hamburger, potato salad, finfish implicated in outbreaks

////// *Isolation & identification:*

- Food at 4°C or frozen if held >24 hr
- Enrichment broths and selective media fairly typical for gram-negative bacteria
- Usually lactose-negative; many other biochemical tests apply

Isolation & identification:

- Species identification is largely serological.
- “Molecular” detection, typing and subtyping methods are available.

Treatment, prevention, summary

- Treatment with antibiotics (resistance)
- Prevention ≈ sanitation

Treatment, prevention, summary

- *Shigella* is widespread, potentially deadly; shed in human feces.
- Frequent transmission via food indicates frequent sanitation failure.

YERSINIA ENTEROCOLITICA

- *Yersinia* spun off from *Pasteurella*
- Includes *Y. pestis* (cause of plague)
- *Y. enterocolitica* is principal foodborne species; reservoir in swine

Characteristics of disease:

- Incubation usually 3–7 days, generally <10 days
- Acute febrile diarrhea
- Enterocolitis

Characteristics of disease:

- May mimic acute appendicitis
- Postinfectious arthritis in adolescents and young adults

Characteristics of organism:

- Gram-negative, nonsporeforming rods; facultatively anaerobic; motile by peritrichous flagella (only at temperatures $\leq 35^{\circ}\text{C}$)

Characteristics of organism:

- Growth range of temperatures is $-2-42^{\circ}\text{C}$, optimum $28-29^{\circ}\text{C}$
- In raw pork at 7°C , has grown to 10^9-10^{10} cells/g within 10 days

Characteristics of organism:

- pH range for growth is 4.2–9.0, with an optimum of 7–8
- Grows in the presence of 5% but not $>7\%$ NaCl
- Virulence is plasmid-dependent and is limited to a few serotypes

Transmission via food:

- CDC: 8 outbreaks (87 cases), 1998–2002
- CAST report: 3,250–20,000 cases/yr (1 death?); \$5,450 per case

Transmission via food:

- CDC estimates ~87,000 foodborne cases/year, 2 deaths
- FoodNet (2005) ~1,080

Transmission via food:

- *Y. enterocolitica* isolated from foods other than pork appears to be avirulent for humans
- Transmission via water & dairy products; tofu packed in spring water

■■■■ Isolation & identification:

- Samples held at 4°C if possible
- Cold enrichment: PBS; 4°C for 2-4 weeks (or 10°C, 3 days; 15°C, 2 days?)

■■■■ Isolation & identification:

- Enrichment culture sometimes treated with 0.5% KOH for 15 sec before plating – kills many competing organisms
- Selective media – use ≤32°C

■■■■ Treatment & prevention

- Treated with antibiotics other than penicillin and its derivatives.
- Foodborne yersiniosis is a highly specialized problem involving transmission from swine.

■■■■ Summary

- Should be prevented by careful handling & cooking of pork & avoiding cross-contamination of other foods; however, milk and dairy products have also been vehicles.