OTHER FOODBORNE INFECTIOUS BACTERIA

PHR 250

OTHER FOODBORNE INFECTIOUS BACTERIA

- Infectious bacteria only
- May be transmitted by food, water or contact
- Some are not conclusively proved to be foodborne—criteria for “foodborne”

Categories
- Historic foodborne agents
- Sometimes foodborne
- Questioned foodborne pathogens

Historic foodborne agents
- *Brucella* spp.
- *Corynebacterium diphtheriae*
- *Mycobacterium bovis*

*(1) Brucella* spp.
Species of concern are:
- *B. abortus* (cattle)
- *B. melitensis* & *B. ovis* (sheep & goats),
- *B. suis* (swine), and
- *B. canis* (dogs; although rare).

*Brucella* spp.
- Brucellosis (Malta fever) is a worldwide problem.
- Incidence of brucellosis in the US:
  - ~ <0.5 cases per 100,000
- Most reported from California, Florida, Texas, and Virginia.
**Brucella spp.**
Transmission of *Brucella* is usually zoonotic. The organism is carried and shed by animals.
- Livestock such as cattle (beef and dairy) are a primary source of the pathogen, at least in the US.
- Some pets (e.g., dogs) also a source.

**Brucella spp.**
Food vehicles:
- Unpasteurized milk (cows, sheep, or goats) and milk products.
- Carcasses of infected animals (including swine and buffalo) don’t typically lead to consumer infections.

**Brucella spp.**
- Incubation period is 5 d–2 mo.
- Recurrent, prolonged, febrile, systemic infection.
- Recurrences are common and may be accompanied by arthritis.
- Antibiotic treatment

**Brucella spp.**
- Pasteurization will destroy the *Brucella*—avoid drinking raw milk and eating raw-milk cheese
- No vaccines available for humans.
- Live vaccines available for animals, may cause disease in humans.

(2) **Corynebacterium diphtheriae**
- Diphtheria first clinically described by Hippocrates in the 4th century B.C.
- An epidemic swept Europe in the 17th century. Called “El garatillo” (the strangler) in Spain & the “gullet disease” in Italy.
- Reached American colonies in the 18th century—whole families wiped out.

**C. diphtheriae**
- Toxigenic (phage-mediated) infection, usually of upper respiratory tract
- Life-threatening
- Controlled by vaccination of humans (no animal hosts)
**C. diphtheriae**
- Milkborne outbreaks recorded in the US before widespread practice of immunization and pasteurization of milk (machine milking?).
- No foodborne outbreak reported in recent years in the US.

**Mycobacterium bovis**
- Most common means of contracting the disease is through inhalation of aerosols containing the agent.
- Tuberculosis caused by *M. bovis* indistinguishable from *M. tuberculosis*; infects consumers via the digestive tract → extrapulmonary tuberculosis more likely
- Food vehicles: Mainly raw cows' milk and its products.
- In 2002, California lost its TB-free status after three herds tested positive for the disease.

**Mycobacterium bovis**
- Most heat-resistant of milk-borne pathogens are *M. bovis* and *C. burnetii*.
- The heat resistance of *M. bovis* provided the basis for the conditions of high-temperature, short-time pasteurization (72°C, 15s) of milk.

**Bacteria rarely foodborne**
- *Clostridium difficile*
- *Coxiella burnetii*
- *Streptococcus pyogenes*
Bacteria rarely foodborne

*Clostridium difficile:*
- Free-living in soil & sediments
- Can contaminate foods, but not specifically shown to be foodborne
- Causes diarrhea after antibiotics—altering flora allows *C. difficile* to grow in intestinal tract, produce toxin, & cause watery diarrhea.

Bacteria rarely foodborne

*Coxiella burnetii:*
- Globally distributed
- Causes Q-fever
- Primary reservoirs: sheep, cattle, goats, companion & wild animals, birds, ticks

Coxiella burnetii

- Commonly airborne (risk to vets & herdsman in contact with animals, especially at parturition)
- Can be shed in milk of infected animals (basis for low-temperature, long-time pasteurization)
- *C. burnetii* is a highly infectious agent.
- Resistant to drying, heat, and a number of disinfectants.
- It can survive for long periods in the environment.

Streptococcus pyogenes (= Group A)

- Groups B, C, D, F, and G
- Based on a combination of antigenic, hemolytic, and physiological traits
- Groups A and D can be foodborne & cause human illness.
- Group A = one species (*S. pyogenes*) with 40 antigenic types.

Streptococcus pyogenes

- Most common vehicle is raw cows' milk, but any food (potato salad, eggs, egg salad, and rice pudding) may be contaminated by infected handler.
- Infective dose is low (est. <1000 cells).
**Streptococcus pyogenes**
- CDC (U.S., ’98–’02): 1 outbreak, 4 cases, 0 deaths
- CAST: 52,000-500,000 cases, 150 deaths/yr, $540/case

**Questioned foodborne pathogens**
- *Aeromonas hydrophila*
- *Enterococcus spp.*
- *Plesiomonas shigelloides*
- *Pseudomonas aeruginosa*

**Aeromonas hydrophila**
- Some strains can cause illness in fish and humans.
- Often found in human intestines (normal and diarrheal); proposed cause of diarrhea in humans (especially young children).

**Enterococcus (fecal Strep.) spp.**
- The genus *Enterococcus* is new name for fecal *Streptococcus*.
- Experiments have failed to cause illness in human volunteers.
- Transmission via food and water is proposed, but unproven.

**Plesiomonas shigelloides**
- Found in humans with watery diarrhea (causation not proved, but two outbreaks have been documented in Japan) or with septicemia, often accompanied by meningitis.
- Most reported cases of gastroenteritis involve people with pre-existing health problems (e.g., cancer, sickle-cell anemia).
**Plesiomonas shigelloides**
- Suspected to be waterborne — disease agent might be present in unsanitary water used for drinking, recreational purposes, or rinsing foods to be eaten raw.
- Eating contaminated, raw shellfish may lead to illness. All reported foods involved with cases of gastroenteritis were of aquatic origin (salted fish, crabs, and oysters).

**Pseudomonas aeruginosa**
- Opportunistic pathogen
- Alleged to cause gastroenteritis in humans if ingested in large numbers.
- Can be isolated from soil and water and is commonly associated with spoilage of food such as eggs, cured meats, fish and milk.

**Pseudomonas aeruginosa**
- *P. aeruginosa* is pathogenic only when introduced into areas lacking normal defenses such as tissue damage of mucous membranes and skin, severe burns, intravenous or urinary catheters.
- Transmission via food and water is proposed, but unproven.

**“Emerging foodborne pathogens”**
- Agents not previously recognized as foodborne
- Agents in food, not previously recognized as pathogenic
- Problems with Koch's postulates
- "Old" agents, newly named

**Summary**
- "Emerging" vs disappearing foodborne pathogens (affluent countries)
- On-farm measures vs zoonoses
- Some agents that occur in foods may threaten only "vulnerable" populations
- Some alleged pathogens may be virtually harmless

**“At risk” populations, U.S.**
- Age > 65 29,400,000
- Pregnant women 5,657,900
- Newborns 4,002,000
- Cancer outpatients 2,411,000
- Nursing home residents 1,553,000
- AIDS patients 135,000
- Organ transplant patients 110,270
### "At risk" populations, U.S.

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