Microbiological Aspects of Ready-to-Eat Foods of Relevance to the Middle East

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What Are Ready-to-Eat (RTE) Foods?
• RTE Foods are foods that are ordinarily consumed in the same state as that in which it is sold. (NSW Food Authority)
• Cooked meats, luncheon meat/cold cuts, cheese, pre-prepared meals, sandwiches

Common RTE Foods in the Middle East
• Grilled meat, minced meat products (kebabs, burgers), shawarmas, stuffed sandwiches
• Bulk cooked rice, rice with meat or fish (biryani, machboos, products that are cooked and held hot)
• Cold foods and salads
• Hard and soft cheeses
• Hummus, foul (cooked and mashed beans)
• Indian curries
What is the Concern?

- Depends on food type, cooking or processing method, storage conditions, sanitation
- Undercooked or cross-contaminated meat products may contain pathogens such as \textit{Escherichia coli O157:H7} or \textit{Salmonella}.
- Cooked rice or starch products that have been held at temperatures under 140 °F or cooled in large containers may contain \textit{Clostridium perfringens}, \textit{Bacillus cereus} and \textit{Staphylococcus aureus}.
- Cold foods and salads may contain enterobacteriaceae.
- Cheese may contain \textit{Listeria monocytogenes}.

What is the Concern?

- \textit{E. coli O157:H7} (verotoxin) and \textit{Salmonella} can cause foodborne illness.
- \textit{C. perfringens} and \textit{B. cereus} are Gram-positive spore-forming rods that produce toxins. \textit{S. aureus} is a Gram-positive cocci that can produce a heat-stable toxin (re-fold).
- Enterobacteriaceae encompasses a large group of Gram-negative rod-shaped bacteria capable of causing foodborne illness.
- \textit{L. monocytogenes} can cause spontaneous abortion in pregnant women.
  - Unpasteurized cheese is a common food in Mexican homes.
  - Cultural habits can play a role in foodborne disease.
- Transmission of a range of pathogens via food handlers.
  - Viruses, parasites, infective bacteria

\textbf{Listeria monocytogenes}

- Bacterial cells entrapped in slimy mucilagenous coating
- Constitutes microbes colonizing on surface, associated polymers and water (90-95%)
- Develops within 12-24 hours of growth on a surface for \textit{Listeria} spp.
- Motility and flagellation of \textit{Listeria} spp. plays a role in biofilm formation
- Protection against environmental stress
- Resistance to cleaning and disinfection activities
- Difficult to remove or eradicate as compared to free living cells
Survival of *L. monocytogenes* vs. *Escherichia coli*

Criteria and RTE Food

- Manufactured versus point-of-sale food
  - Soft cheese versus prepared sandwiches
- Criteria in place for quality and safety of manufactured food
- Do not use two or three class sampling plans for point-of-sale foods
- Zero tolerance (c=0) is in reference to pathogenic bacteria at the level of the food manufacturer in an effort to minimize foodborne illness when used in conjunction with GMPs at the point-of-sale level.

Zero Tolerance

- People with lowered immunity are more susceptible to foodborne illness and intoxication; therefore limits on pathogens are set in place to protect those people.
- Bacteria are ubiquitous in nature.
- Sterilization of most food is not practical.
- Is the goal achievable?
  - Meat industry and *E. coli* O157:H7?
- Are limits achievable and based on scientific evidence?
## Product Testing versus Process Manufacturing: What Can be Done at the Process Manufacturing Level to Minimize Risk

- **Employee education**
  - Hygiene
  - Safe food handling practices
  - ATP
- **Sanitation Processes**
- **Time-Temperature control and monitoring**
  - Adequate cooking
  - Hot holding
  - Rapid and proper cooling of hot product
  - Safe cold storage
  - Adequate re-heating of product

## Questions