Food hazards

FOOD QUALITY AND SAFETY - Prof. Angel Angelov, Assoc. Prof. Velitchka Gotcheva

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FOODBORNE ILLNESS OUTBREAKS

Bugs Through the Ages: The Foodborne Illness Fight

BY **ROSS ANDERSON** | JAN 03, 2011

A new year is supposed to inspire us all to ponder our future in the context of our past. In the case of foodborne illness, that takes us back some 23 centuries to the spring of 323 BC. In just a few years, Alexander the Great and his army had conquered much of the ancient world when they stopped to rest for a while in Babylon, about 50 miles south of present day Baghdad.

According to Greek historians, the 32-year-old ruler was staying at the Palace of Nebuchadnezzar when he developed a bad stomachache. Over the next few days, he stayed in bed, suffering recurring bouts of fever, abdominal pain and chills. The illness worsened steadily until, on June 11, he died.

For centuries, historians suspected he was poisoned by his rivals. But more recently, doctors at the University of Maryland studied the historical accounts of his symptoms and death and concluded that the emperor probably died of water or foodborne illness--possibly Salmonella typhi, or typhoid fever.

Food safety – a global problem

- Major public health issue for all countries
- **1 800 000 people die each year** from diarrhoeal diseases, most cases attributed to contaminated food or drinking water (WHO, 2007)
- Cases of food poisoning are **constantly rising** (5-10 % of the population in industrialised countries)

Food safety – a global problem

- **New hazards** are discovered every year, associated with the presence of chemical contaminants or toxins that form when food is processed or prepared
- Increasing food allergies

Food safety – a global problem

- Foodborne illnesses
  - a problem in developing and developed countries alike
  - place a burden on healthcare systems
  - seriously affect infants, young children, the elderly and those who are already ill
  - undermine the economy and national development efforts, as well as international trade

Key factors in food safety

- Growing number of operators who intervene in the food chain between the primary producer and the consumer

- Inadequate hygiene controls at various steps of production and distribution, as well as in the consumer's own kitchen

Key factors in food safety

- Change in the way food is prepared and consumed: shorter cooking times, more consumption of raw products, less canning and more freezing, more fermented products, cold-smoked fish, etc.
- More consumption outside the home in restaurants, canteens, etc.

Key factors in food safety

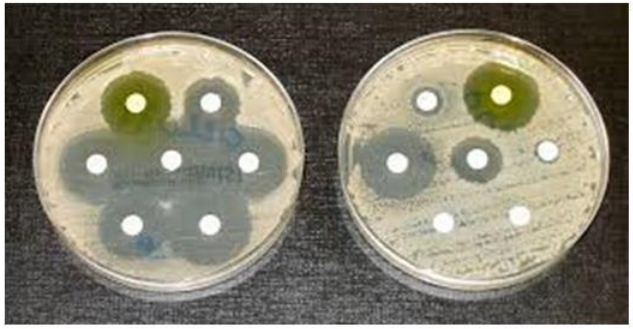
- More preparation of ready-to-cook or ready-to-eat food
- Greater susceptibility of products to spoilage (e.g. less salt or sugar used)
- Increased demand for meat or fish (more prone to contamination)
- Longer food preservation periods - complexity of the food chain, greater distance between field and consumer's table

Key factors in food safety

- Larger quantity of food involved - result of industrialisation of the agrifood chain and centralisation of distribution systems
- More international trade, more transport and storage - fewer guarantees that the cold chain has been maintained
- Better detection of bacterial contamination (more cases are reported)
- More exotic products in the diet
- Less respect for growing seasons

Key factors in food safety

- Microorgasnisms CHANGE!!!
- MO adapt to sanitation chemicals – biofilm formation
- Increased/ aquired resistance to antibiotics - metyciline-resistant *S. aureus* (MRSA)
- Exchange of DNA – virulent factors - emerging pathogens (***E. coli* O104:H4**)



Key factors in food safety

Main factors leading to foodborne illness outbreaks (FBI) in France (Source 'Conserver mieux' - CTCPA, 1997)

Contamination of raw materials:	54 %
Non-respect for the cold chain during meal preparation:	40 %
Error in the preparation process:	35 %
Too much time between preparation and consumption:	25 %
Contamination by equipment:	21 %
Contamination by employees:	17 %
Non-respect for the hot chain:	14 %

Food hazards

- Microorganisms and their toxins

- Chemical compounds

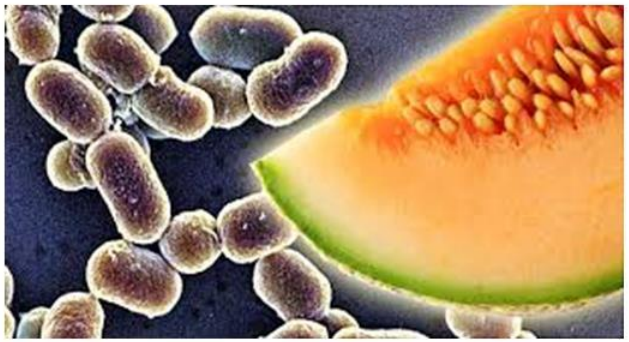
- Hard non-soluble physical objects

Biological hazards

- Microorganisms causing food spoilage
  - At high concentrations can be organoleptically sensed (food colour, texture, smell, taste)
  - Lower risk because of organoleptic indications

Biological hazards

- **Food pathogens**
  - No organoleptic indication for presence of dangerous levels
  - High risk – cause food diseases, death
  - May effect large numbers of people



Biological hazards

Bacteria

Listeria monocytogenes

Clostridium botulinum

Clostridium perfringens

Escherichia coli O157:H7

Campylobacter jejuni

Salmonella spp.

Staphylococcus aureus

Yersinia enterocolitica

etc.

Viruses

Hepatitis A & E

Norwalk virus group

Rotavirus

etc.

Protosoa, parasites

Cryptosporidium sp.

Giardia sp.

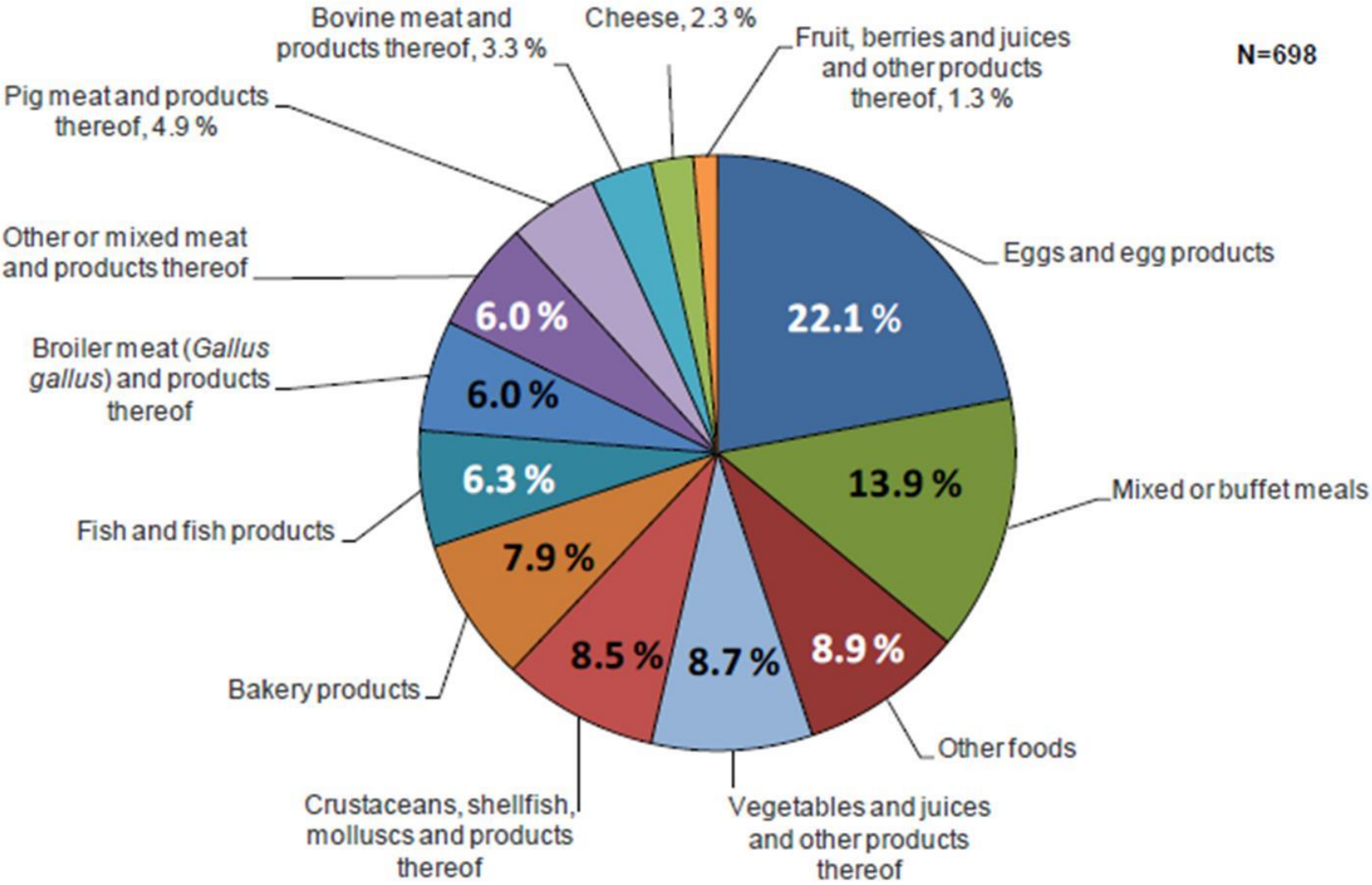
Taenia sp.

etc.

General control measures

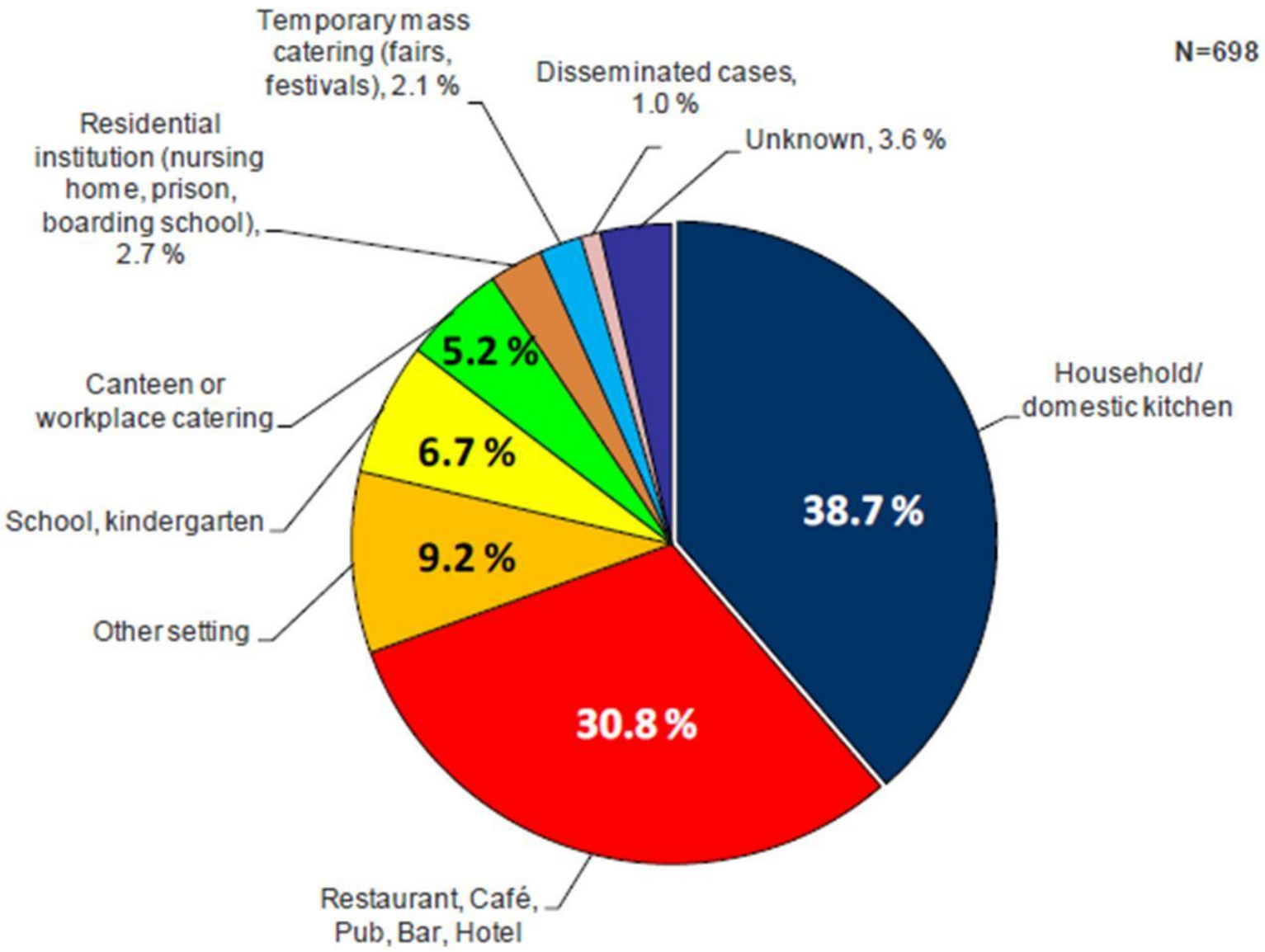
- Prevention of contamination
- Good hygiene of equipment, environment, workers
- Control of technological parameters (temperature, time, pressure, etc.…)
- Prevention of cross-contamination
- …..

Figure OUT4. Distribution of strong evidence outbreaks by food vehicle in the EU, 2010



Ref: Scientific report of EFSA and the European Centre for Disease Prevention and Control

Figure OUT5. Distribution of strong evidence outbreaks by settings in the EU, 2010



Ref: Scientific report of EFSA and the European Centre for Disease Prevention and Control

Chemical hazards

Naturally occurring

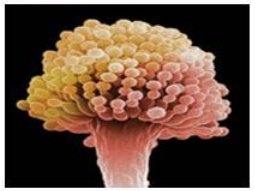
Introduced

May affect large or smaller numbers of people

Natural chemical hazards

Natural food compounds

- Allergens - gluten, lactose, beta-casein, nuts, etc..
- Mycotoxins - aflatoxins (*Aspergillus flavus*), ochratoxins (*Asp. ochraceus*), zearalenone, fusariotoxins
- Bacterial toxins (Shiga-toxin), seafood toxins, histamine
- Poisonous plants, fungi (mushrooms)



Inroduced chemical hazards

Introduced deliberately or not- in foods throughout the food chain

- Agriculture - fertilizers, pesticides, fungicides, insecticides, antibiotics, hormones, heavy metal contamination, etc.

- Food processing - migration of chemicals from contact surfaces and environment, cleaning chemicals, machine oils, food packaging, food additives above the legal limits (Regulation 1333/2008)

General control measures

- Control of suppliers (growers of plant raw materials, animal production operations, etc.)
- Facility – chemical control programme
  - control of incoming ingredients, packaging
  - production operations
  - chemical migration – paints, contact surfaces
  - sanitation and maintenance, pest control
  - allergen management
- Employee practices – education, supervision

Physical hazards

Foreign hard or sharp non-soluble bodies, which could cause injuries

- Health risk for individual consumer/few consumers
- Metal, glass, wooden particles, stones, bone fragments, hard plastic fragments
- Different opinions regarding size of physical hazards, most widely recognised limit – **2 mm**

Physical hazards

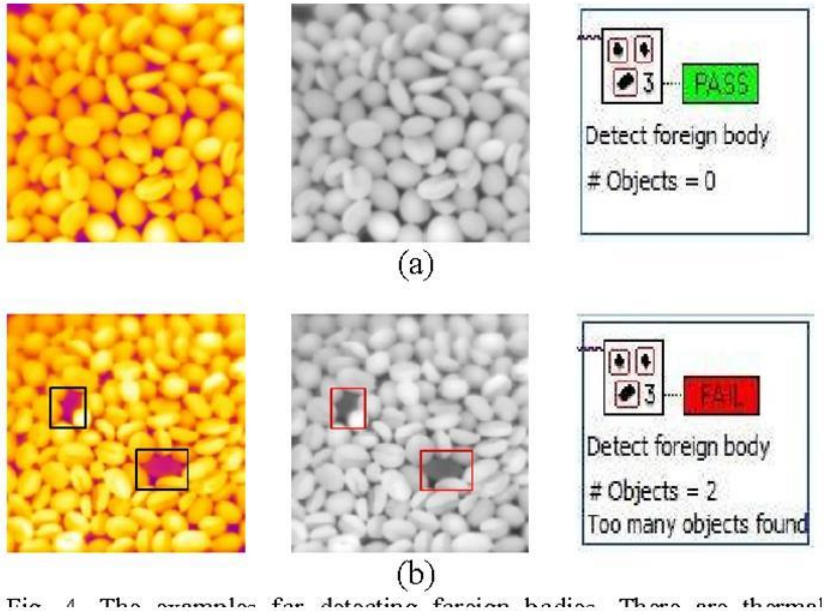
- Other foreign objects such as hairs, soft plastic, insect fragments, dirt, etc. **<u>are quality issues</u>**, **<u>not physical hazards</u>**!

General control measures

- Control of foreign objects in incoming raw materials & ingredients
- Facility – strict compliance with GMPs (light fixtures, equipment
- Processes/procedures – comprehensive evaluation
- Special precautions – metal detectors, magnets, x-ray sifters, aspirators, “riffle boards”, etc.
- Employee practices – education, supervision

Detection of foreign bodies

- Metal detection
- Magnets
- Optical sorting systems
- Microwave imaging (reflecting)
- Nuclear magnetic resonance imaging
- Surface penetrating radar
- Electrical impedance
- Ultrasound
- X-rays
- Separation systems



Infrared thermography – detection of foreign bodies in roasted coffee