THE UNIVERSITY OF MELBOURNE

FOOD20006

Food Microbiology & Safety

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Helen Billman-Jacobe

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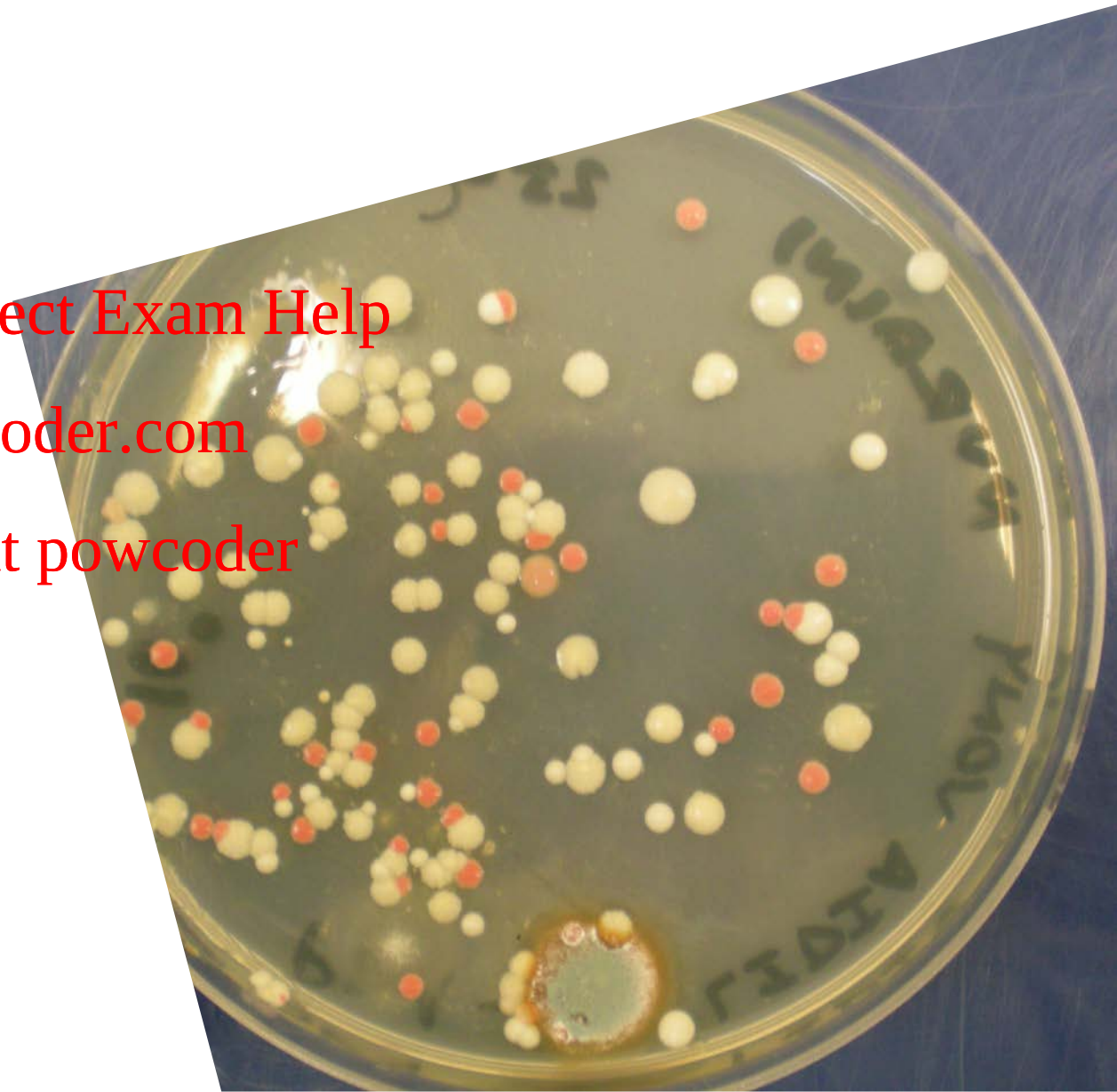
Normal microbiological quality of food



Ray and Bhunia Chapter 4

Intended learning outcomes

Describe the microbial types and their levels that can be expected under normal conditions in different food groups

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Raw and ready-to-eat meat products

Following slaughter, dressing, processing, the meat of animals and birds contain many types of bacteria from different sources

- normal flora: skin, hair, feathers, gastrointestinal tract
- farm environmental contaminants: feed, water, soil and manure
- abattoir: equipment, air, water and humans
- meat processing: equipment, air, water and humans

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The microbial load of fresh meat varies greatly

intact carcass ~10-1000 bacteria/cm^2

minced meat 10,000 – 100,000 bacteria/g

Chilled meat

Chilled meat is stored at low temperature; -1 to 5°C

- mesophiles will not multiply much at the low temperatures
- Psychrotrophs are a major problem
  - predominant psychrotrophs
    - lactobacilli and leuconostocs
    - *Brochthrix thermosphacta*
    - Some coliforms
    - *Pseudomonas, Serratia, Proteus*…..

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If products are kept under aerobic conditions then psychrothrophs can grow rapidly i.e. *Pseudomonas*

If products are kept under anaerobic conditions then the facultative anaerobes and anaerobes grow

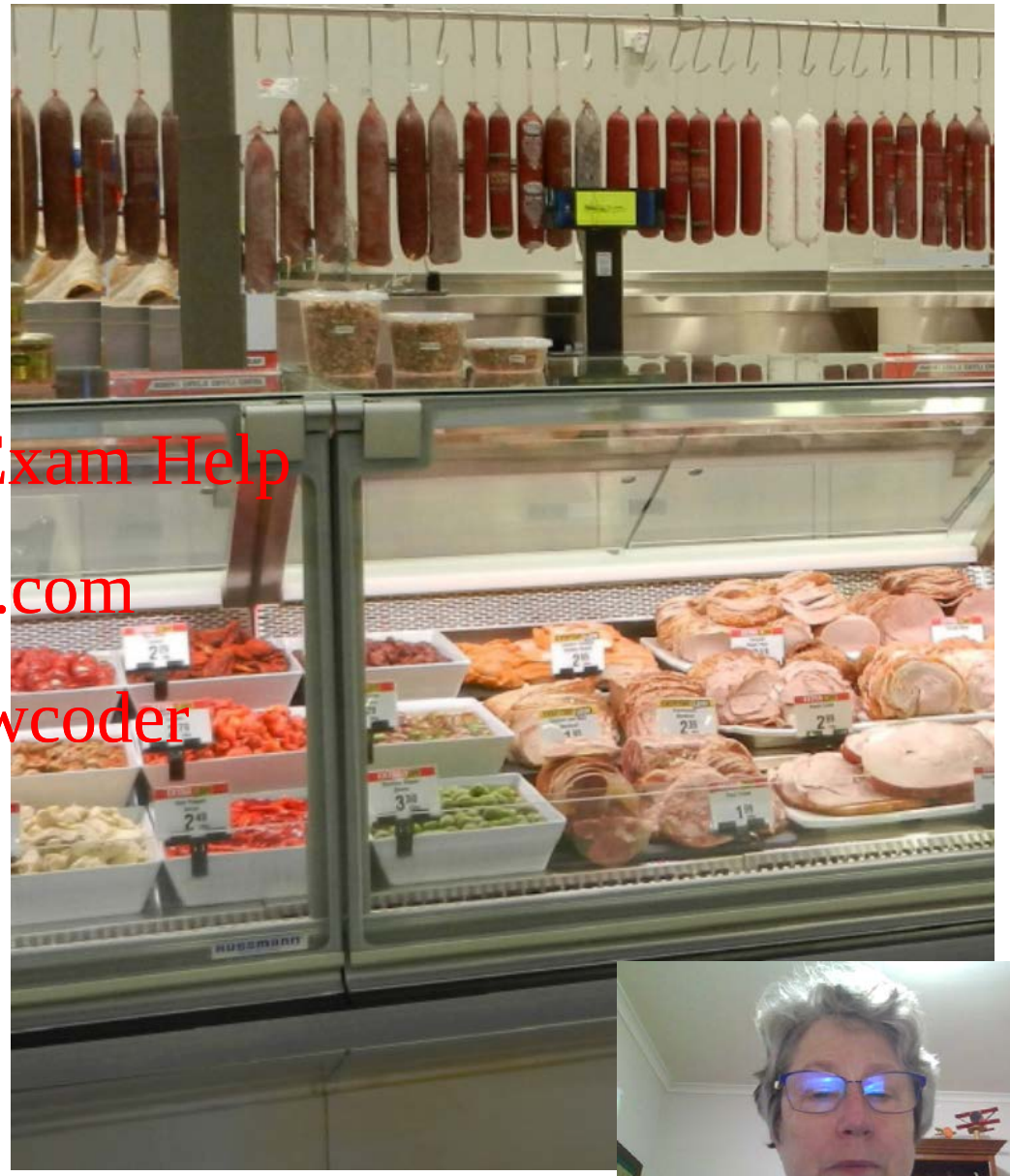
i.e. *Lactobacillus, Clostridium*

The intrinsic properties of the meat and extrinsic properties of storage determine which organisms grow

Low heat processed meat

Examples: frankfurters, ham, bacon

- Low heat processed meat has been subjected to temperatures ~70°C.
- The treatment kills most microorganisms except for some thermodurics and spores of *Bacillus* and *Clostridium*
- This expected microbial level ~10-100 bacteria/g
- LHP meet is expected to have a storage life of ≥50 days
- Further processing such as slicing can introduce additional bacteria yeasts and moulds that affect shelflife



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Raw and pasteurised milk

Raw milk contains, 10^3 bacteria per ml

- Refrigerated storage before pasteurisation: only psychrotrophs can grow
- Psychrotrophic pathogens such as *Listeria monocytogenes* can multiply in refrigerated for milk

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Pasteurised milk contains microorganisms that

- survive the heat of pasteurisation = thermodurics i.e. *Pseudomonas* and spores of *Bacillus* and *Clostridium*
- Enter the milk after heating but before packaging = post-pasteurisation contaminants
- Psychrotrophs can multiply in refrigerated, pasteurised milk
- Heat stable enzymes can affect product quality i.e. Proteases, lipases

Fish and shellfish

- Scale fish, crustaceans (prawns, lobster, crabs) and molluscs (oysters, mussels, scallops)
- Microbial population varies with the pollution level and temperature of the water where the animals lived
- Saltwater fish and shellfish and generally have different bacteria than freshwater fish and shellfish
- animals harvested from polluted water spoil rapidly
- Psychrotrophs can multiply
- If fish is not consumed fresh then it must be salted, dried, cooked or otherwise processed to preserve it

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Vegetables, fruits and nuts

- Microbial levels and types depend on the conditions of farming and harvesting
- Microbial load
  - vegetables ~ 10^3 – 10^5 bacteria/g
  - fruit ~ 10^3 – 10^6 bacteria/g
  - Nuts ~10^3 -10^4 bacteria/g
- Bacteria and moulds and yeast
- Bacterial endospores (*Bacillus* and *Clostridium*) and fungal spores
- Can also have pathogenic protozoa and parasites
- This vegetable products that are not consumed fresh can be processed to prolong the shelflife

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Cereals, starches and gums

Cereals = grains, flower, for cereals, pasta, baked products, dry mixes and frozen in refrigerated products

Starches = Flour of cereals, tapioca, potatoes and other tubers

Gums = stabilisers and gelling agents i.e pectin, agar, xanthan

Pulses = peas and beans

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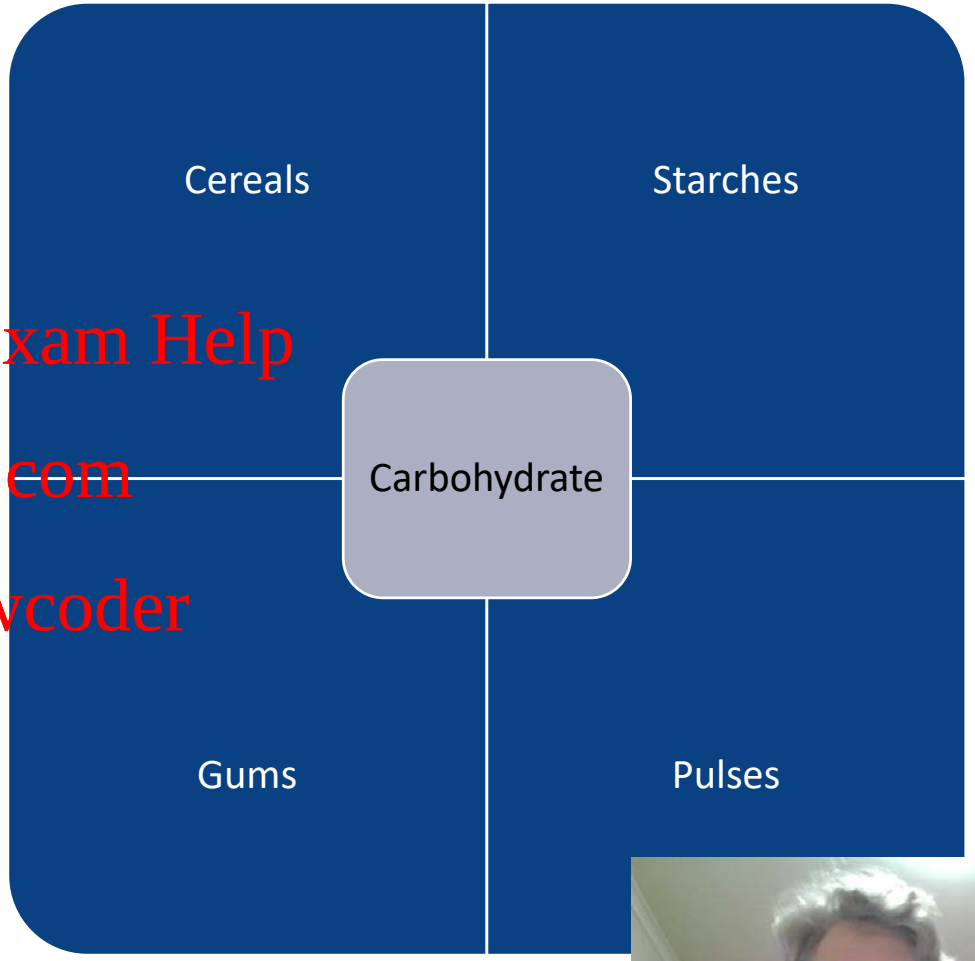

Unprocessed products may contain high bacterial levels

May contain mycotoxins from fungal growth during storage

Many products are dried (low Aw)- may contain bacterial spores

Canned foods

Food in tin cans are treated with a high heat during canning process

The amount of heat required depends on the pH

- pH≥4.6 are heated to obtain commercial sterility
- pH<4.6 heated to ~100°C

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"commercial sterility". Cans can still contain low numbers of thermophilic spoilage bacteria. These do not germinate if cans are stored below 30°C. If cans are stored ≥40°C spores germinate and products spoil.

Cans heated to ~100°C can contain spores of mesophilic bacteria which may be spoilage bacteria or pathogenic *Bacillus cereus*, *C. perfringens* or *C. botulinum*

Home bottled food

Home bottling is a method to preserve food however temperatures greater than 100°C cannot be achieved therefore home bottling relies on using food materials that are naturally acidic or are acidified by the addition of food acids.

Tomatoes and variety of fruit are popular for home bottling

pH neutral vegetables can be very risky due to the survival of *C. botulinum* spores

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Sugars and confectionery

In general, sugar and confectionery have low water activity (Aw ≤0.84) and some have a low pH

The low-water activity and low pH prevents germination of bacterial spores

Preserving fruit by making jam involves the application of heat and the lowering of Aw through addition of sugar and boiling off excess water

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Soft drinks, fruit and veg drinks, juices

pH range

fruit juices ≤pH4

vegetable juices ≥4.5

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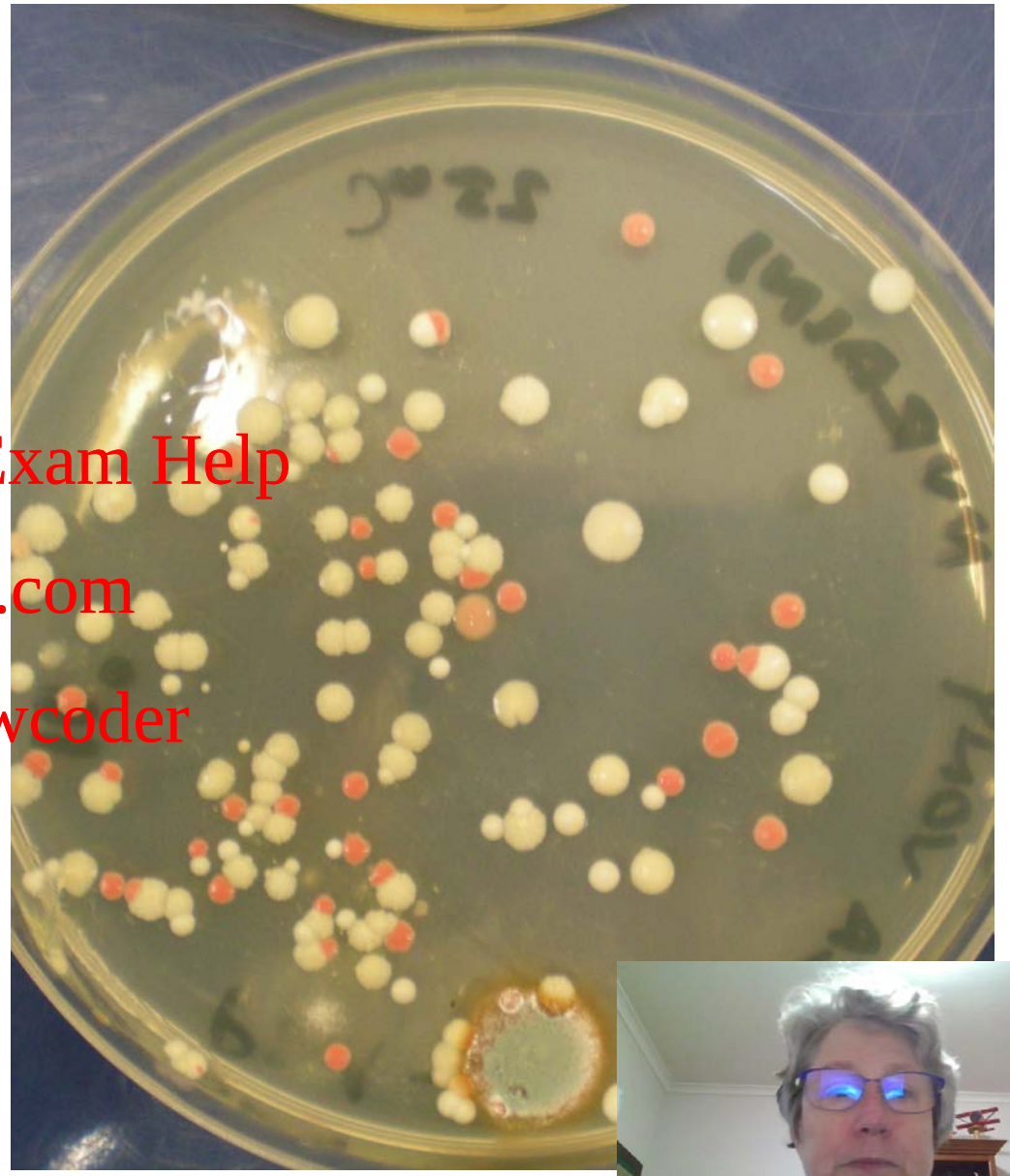
Fruit juices, spoilage by acid resistant and spore forming species

Vegetable juices, spoilage by mould, yeast and lactic acid bacteria

Juices may be heat-treated through pasteurisation or canning to prolong their shelf life.



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