Food Microbiology

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Primary sources of MO in Foods

(1) soil

Ousually high in numbers

O greater near the soil surface than at deeper levels

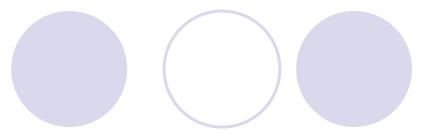
microbial growth is limited to areas of organic material

Ogenerally not a good medium for microbial growth

Sporeforming bacteria quite common

Acinetobacter, Alcalegenes, Arthrobacter,
 Corynebacterium, Flavobacterium, Micrococcus,
 Pesudomonas

Soil (continued)



Mold spores can be found (*Aspergillus, Rhizopus, Penicillium, Fusarium* etc.)

- Yeasts (Saccharomyces, Hanseniaspores) prevalent in soil of orchards and vineyards
- \bigcirc 10⁴ to 10⁹/g in marine sediments

Aeromonas, Bacillus, Chromobacterium, Citrobacter,
 Escherichia, Pseudomonas, Vibrio included

(2) Water

- Rain from air, run off from soil, sewages in water
- Pseudomonas, Micrococcus, Bacillus, Flavobacterium, Streptococcus, Escherichia etc.
- Altermonas specific in marine

(3) plant and plant products

- contaminated by air, water, sewage, animals, soil, human
- Corynebacterium, Pseudomonas, Xanthomonas, Lactic acid bacteria & yeast

(4) Animals

- Surface flora, respiratory, intestinal, etc.
- Carry potential human pathogens such as *Salmonella*,
 Shigella, *Vibrio*, *Escherichia* by fly
- Dominant MO in intestinal flora are obligate anaerobes, such as *Bacteriodes*, *Peptostreptococcus*, which may rich to 10^{10} to $10^{11}/g$
- Facultative anaerobe (food related)may reach levels of 10⁷
 to 10⁹ including coliforms, enterococci and lactobacilli



- Skin, respiratory, intestinal
- Skin is never free of MO and contains normal microflora
 (S. aureus on head and face, arms and hands had
 Sarcina, Bacillus etc.)
- Carelessness of human hygiene and sanitation can results in contaminated food

(6) air

- contaminated by respiratory MO, MO in dust
- not contain a normal flora
- mold spores normally the most prevalent
- MO in air depend on several factors (a) sunshine; (b) humidity; (c) location; (d) air movement
- MO can not multiply in air



- many parts and surfaces
- types of surfaces (wood vs. stainless steel)
- clean and sanitation
- type & amount of food processed, care of equipment, storage of equipment, air flow, dust
- MO adhere to surfaces (sanitation concern)

(8) sewage

- use of animal wastes to fertilize crops (organic), contaminated water, inadequate sewage disposal system
- Salmonella are quite prevalent in raw sewage
- Enteric virus survive sewage treatment process and may remain infective

(9) Animal feeds and hides

- Salmonella to poultry and other farm animals (How to prepare Salmonella-free egg?)
- Lister monocytogenes to dairy and meat products
- MOs from udder and hide can contaminate the environment, milk containers, and hands of handlers