
PHR 150
FOOD PRESERVATION

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Hunter-gatherer lifestyle

- Feast or famine
- Occasional surpluses
 - > How long dare we stay?
 - > How much can we carry?
 - > How long will it be OK?
- How to preserve?

Agriculture invented

- Harvests are seasonal
- Some animal products are also seasonal
- Animals can convert grass, etc., to food
- Animals can (usually) walk
- Preservation of animal foods

Preservation against competitors:

- bacteria and fungi
- insects, rodents, and birds
- animals larger than people
- other people
- the internal combustion engine
- (+ delay deterioration)

Preservation methods

- Physical processes
- Chemical treatments
- Biological processes

Physical processes:

- Heating
- Cooling
- Drying
- Irradiation
- High hydrostatic pressure

Physical — heating:

- **Cooking:** boiling water, direct flame, oil cooking
- **Baking:** oven vs. food temps.
- **Below boiling:**
 - > blanching
 - > pasteurization

Physical — heating:

- **Heat processes, prediction**
 - > *D* value
 - > *z* value
- **Retorting**

Physical — cooling:

- **Refrigeration (mechanical):** retards biological processes
- **Freezing:** water in solid state, microbial processes stop, some enzymatic deterioration possible

Physical — drying:

- (Grains often dry)
- **Dehydration:** evaporation or sublimation vs microbes, enzymes (examples: chuño, viande séché)
- **Addition of solute:** binds water (examples: honey, salt pork)

Physical — irradiation:

- **Microwave:** processing, home
- **Ultraviolet:** surface treatments, disinfection of water
- **Ionizing radiation — sources**
⁶⁰Co, electrons, x-rays

Ionizing radiation:

- <1 kGy — sprouting control, insects, *Trichinella*, protozoa?
- 1–10 kGy — pasteurization
- >10 kGy — commercial sterilization, astronaut food

High hydrostatic pressure

- 600–700 MPa applied to food
- Kills bacteria & viruses
- Processing applications still under development

Chemical treatments:

- Acidification
- Enzyme treatments
- Antimicrobial additives

Chemical treatments

— acidification:

- Organic acids (e.g., acetic, lactic, propionic): strong antibacterial effects
- Mineral acids: prevention of botulism

—enzymes

Chemical treatments — antimicrobial additives:

- Broad-spectrum: sulfites for wine preservation, etc.
- Targeted: nitrite for preventing botulism; nisin

Biological processes:

- Controlled, spontaneous microbiological processes (e.g., sauerkraut) vs uncontrolled
- Microbiological processes — defined inocula

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- Starter cultures: cheese and sausage
- Mold inoculation: blue cheese, surface-ripened cheese

Summary

- Preservation includes any means to keep food safe and fit to eat, has been practiced for a very long time.

Summary (2)

- Physical processes, especially drying and heating, are probably the oldest.
- Pre-cooking, chemical preservation, HHP, and irradiation coming?

Summary (3)

- Controlled, defined biological processes – parts of the “art” of food science, possible safety hazards if no science base.