##  Sengamala Thayaar Educational Trust Women’s College

## (Affiliated to Bharathidasan University)

**(Accredited with ‘A’ Grade {3.45/4.00} By NAAC) (An ISO 9001: 2015 Certified Institution)**

 **Sundarakkottai, Mannargudi-614 016.**

**Thiruvarur (Dt.), Tamil Nadu, India.**

**BASIC FOOD PROCESSING AND PRESERVATION**

## G.K.GOMATHI

## ASSISTANT PROFESSOR AND HEAD

**DEPARTMENT OF NUTRITION AND DIETETICS**

**II B.SC NUTRITION AND DIETETICS**

**BASIC FOOD PROCESSING AND PRESERVATION**

**Food Spoilage & Food Preservation**

Foods undergo deterioration or spoilage from the time they are harvested, slaughtered or manufactured. Foods undergo physiological, chemical and biological changes & make them unfit for human consumption. Numbers of causes are responsible for food deterioration. These include:
i. Micro-organisms
ii. Activities of enzymes present in food
iii. Insects
iv. parasites
v. rodents
vi. temperature
vii.moisture
viii.Oxygen, light and time.

These factors are not isolated In nature. At any one time, many forms of spoilage may take place depending upon the food and environmental conditions.
**i. Micro-organism:** bacteria, yeasts & molds spoil food after harvesting, during handling, processing & storage. The microorganisms are found everywhere & are always present to invade the flesh of animals & plants. When there is a cut in their skin or if the skin is weakened by disease or death.

**ii. Food enzymes:** enzymes present in plant & animal foods continue to be present and are even intensified after harvest & slaughter. Enzymes are responsible for facilitating many changes during storage such as changes in colour, texture and flavor e.g. ripening of tomatoes, tenderizing of meat on ageing are desirable, but if proceeded too far can result in food spoilage if not halted at the appropriate time. The enzymes need to be inactivated by suitable method at appropriate time to prevent food spoilage.

**iii. Insects, parasites & rodents:** insects are destructive to cereals grains, fruits & vegetables. The loss of food due to insects
destruction varies from 5-50% depending upon the care taken in the field & storage. Insects are generally controlled by fumigation with ethylene oxide & propylene oxide. Parasitic food spoilage occurs in some foods. Pigs eat
uncooked food waste, the parasitic nematode penetrates the pig’s intestine & finds its way into pork. The live worms can infect man if the pork is not thoroughly cooked.
Entamoeba histolytica is responsible for amoebic dysentery. This organization contaminates food when raw human excreta is used as fertilizers for crops. Infected water and poor hygiene also spread the parasites. Cooking kills most of these parasites. Rodents contribute substantially to food spoilage rats cockroaches rodents urine and drippings harbor several kinds of disease producing bacteria and rats spreads such human disease as typhus fever, plague, typhoid fever etc.

**iv. Temperature :** – Heat and cold contribute to food spoilage if not controlled. The rate of chemical reaction doubles itself for every 10o C rise in temperature. Excessive heat brings about protein denaturation, destroy vitamins, break emulsions and dries out food by removing moisture. Freezing and thawing of fruits and vegetables destroy their structure.

**v. Moisture : –** Foods with high % water spoil fast. Perishable foods have a high water content. Control of moisture in foods is thus very important. From the point of view of their preservation.

vi. Oxygen, Light and Time : – air and oxygen bring about a number of changes in food components such as destruction of food
colour, flavor vitamin A & C and other food constituents. Oxygen is to be excluded from in the course of processing while deareation, vacuum packing or flushing containers with nitrogen or carbon dioxide. Light destroys vitamin B2, A and C. it also deteriorates many food colours. Foods may be protected from light by impervious packing or keeping them in containers that screen out specific wavelengths. Foods spoilage is time dependent. The larger the time, the greater the destructive influences.

**vii. Food Safety In The Home : –** in order to avoid food spoilage in the home, standards of hygiene should be maintained.Personal hygiene & kitchen sanitation practice should be maintained.

Table of Contents

**Spoilage of Cereals and Cereal Products**

The exterior of harvested grains retain some of the natural flora plus contamination from soil, insects & other sources e.g.
 Of bacteria that infestaie pseudonuenadaceae, micrococcaceae, lactobacillaceae.
 Washing & milling reduces microorganisms.
 Blending & conditioning increases contamination.

**Cereal products**

 Wheat flour – bacteria – bacillus, sarcina, micrococeus, molds – aspergillus, penicillium.
 Corn meal – molds – fusarum, penicillum.
 Bread – a freshly baked loaf is practically free of viable microorganisms, but mold spores contaminate during cooking & before wrapping slicing by knives also contaminates.

**MILK AND MILK PRODUCTS**

· Milk contains few bacteria when it leaves the udder of healthy cow. Contamination starts from the animal especially the exterior of the adjacent areas. Bacteria found in manure, soil & water may entre from this source. Microorganisms from milking machine, when milking by hand. Contamination from dairy utensils & milk contact surfaces like milk oil or milking machines, bulk milk cooler. Hands & arms of the milker, flies, the air around milk parlor.  Other sources tanker-truck, transfer pipes, sampling utensils separators, homogenizers, coolers, glass bottles.

**MILK PRODUCTS**

**· BUTTER: –** microorganisms from churner, from water used in its washing, old cream & packaging material.
· **Dry milk, evaporated milk & sweetened condensed milk** may be contaminated from special equipments used in their preparation.
**· Cheese –** it is contaminated from air, brine, tanks, shelves & packaging material.
**· Ice cream –** organisms may be added to ice cream in the ingredients.

**MEAT**

The healthy inner flesh meat contains few or no microorganisms although they have been found in lymph nodes, bone marrow & even flesh. Normal slaughtering practices would remove the lymph nodes from edible parts. Contamination comes from external sources during bleeding, handling and processing. During bleeding, skinning and cutting the main sources of
microbes is the exterior of the animals (hide, hoofs and hair) and the intestinal tract.

· Knives, clothes, air, hands and clothing of the workers can serve as intermediate source of containments.
· During handling contamination comes from cart, boxes, and contaminated meat, from air and from personals.
· Grinders, sausages stuffers, slicing, casing and ingredients are the sources.
· In home refrigerators, containers used previously to store meats act as a source.
**E.G. molds –** cladosporium, geotrichium, panicillium.
**Bacteria –** pseudomonas, bacillus, clostridium.
**EGGS: –** Most freshly laid eggs are sterile but the shells of some become contaminated by faecal material from the hen, by the lining of the nest, by wash water, by handling the materials in which eggs are packed.

**FRUITS AND VEGETABLES**

· Spoilage occur during storage, transportation while waiting to be processed, washing, mechanical damage, processes such as trimming, peeling, cutting, coring add to contamination.

**CANNED PRODUCT**
Spoilage occurs by chemical, biological or both. CHEMICAL: – by hydrogen swell resulting from the pressure of
hydrogen gas released by action of acid of goods on the iron of the cane, time, temperature of storage, tinning imperfection, poor exhaust etc.

**BIOLOGICAL: –** by microorganisms, survival of organisms after administration of the heat treatment, leakage of the container after the process permitting the entrance of microorganisms.

**FOOD PRESERVATION**

**Methods of food preservations**
1. Asepsis or keeping out microorganisms.
2. Removal of microorganisms.
3. Maintenance of anaerobic conditions.
4. Use of high temperature.
5. Use of low temperature.
6. Drying
7. Use of chemical preservatives
8. Irradiation
9. Mechanical destruction of microorganisms by grinding or high pressure.
10.Combination of two or more of above methods.

**Principle of food preservation**

In accomplishing the preservation of foods by the various methods the following principles are involved: –
**1. Prevention or delay of microbial decomposition.**
a. By keeping out microorganisms.
b. By removal of microorganisms.
c. By hindering growth & activities of microorganisms.
d. By killing of microorganisms i.e. by heat or radiation.
**2. Prevention or delay of self decomposition of the food: –**
a. By destruction or inactivation of food enzymes e.g. by blanching
b. By prevention or delay of chemical reactions
**3. Prevention of damage because of insects animals and mechanical causes: –**
The methods used to control the activities of microbes usually are effective against enzymatic activities. A summary of the major preservation factor and their mode of action and achievement presented in the graph.

**METHOD OF PRESERVATION**

**1) ASEPSIS: –** keeping out the microorganisms by adopting good hygienic practices and sanitized environment.

**2) REMOVAL OF MICROOGANISMS: –** Can be done by filtration, centrifugation (sedimentation or clarification) washing or
trimming.

**3) MAINTENANCE OF ANEROBIC CONDITION: –** a complete fill, evacuation of unfilled space or replacement of air by
carbon dioxide and by inert gas nitrogen.

**4) PRESERVATION BY USE OF HIGH TEMPERATURES: –** high temperatures denature proteins and inactivate enzymes required for metabolisms of the microorganisms. That treatment varies with microorganisms. Depending on the heat
treatment employed some of the vegetative cells, most of the cells are part of bacterial spores, or all of them may be killed.
Yeast and yeast spores: ascospores are killed at 600C for 10 to 15 minutes Yeast and yeast spores: 62.8 0 C for 30 minutes , 71.70C for 15 seconds. Mold & mold spores: Are killed at 600C in 5 to 10 minutes e.g. aspergillus. Bacteria: salmonella typhe – 600C for 4 minute E.coli – 57.30C for 20 to 30 minutes, streptococcus thermophiles – 700C to 750C for 15 minutes,
clostridium botulinium – 1000C for 100 to 330 minutes.

**5) PRESERVATION BY USE OF LOW TEMPERATURE:**– low temperatures are used to retard chemical reactions and action of food enzymes and to slow down or stop the growth and activity of microorganisms in foods. The lower the temperature the slower the chemical reaction, enzyme action and microbial growth, a low enough temperature will prevent the growth of any microorganisms. Commercial refrigeration temperatures i.e. lower than 50C to 70C effectively retard growth of many borne pathogens. Cold storage: – most commercial storage freezers are at or below – 18\*C.
Common or cellar storage lower than 150C (for root crops, potatoes, cabbage, apples)
CHILLING STORAGE: – it involves cooling by ice or by mechanical refrigeration. Most perishable foods including eggs, dairy products, meat, sea food, vegetables & fruits are kept at chilling storage. Temperature varies
from – o.50C to 100C.
**FROZEN STORAGE: –**
· Sharp freezing: – -150C to 290C & may take 3 – 72 hours.
· **Quick freezing: –**
a) Direct immersion of the food or the package food in a refrigerant as in the freezing of fish in brine.
b) Indirect contact with the refrigerant at -17.80C to -45.60C.
c) Air blast freezing where air at -17.80C to -34.40C is blown across the materials being frozen.

**6) PRESEVATION BY DRYING: –** drying usually is accomplished by the removal of water but any method that reduces
the amount of available moisture in a food is a form of drying, method of drying includes · Solar drying ( raisins, figs, pears, fish, rice) · Mechanical dryers – it involves passage of heated air with controlled relative humidity over the food to be dried or the passage of the food through such air. E.g. evaporator or kiln, drum dry, spray drying, freeze dryers & vacuum dryers.

**7) PRESERVATION BY FOOD ADDITIVES: –** A food additive is a substance or mixture of substances, other than the basic
food stuff, which is present in food as a result of any aspect of production, processing, storage or packaging. Those food additives which are specifically added to prevent the deterioration or decomposition of a food are referred as chemical preservatives, their enzymes activity or their genetic mechanisms. E.g. propeonic acid, sodium or calcium propionates, sorbic acid, nitrite & nitrates, salt, sugar, wood smoke, spices, spices like cinnamon & cloves.

**8) PRESERVATIO BY RADIATION: –**Use of U.V radiation, ionizing radiation which include x rays, gamma rays, beta rays and
cathod rays and microwave heating which have electromagnetic waves between infrared and radio waves.