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Temperature Abuse in Frozen Food and Conforming of Health and Hazards

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FROZEN FOODS

Food means raw, cooked, or processed edible substance, ice, beverage, chewing gum, or ingredient used or intended for use or for sale in whole or in part for human consumption.

Frozen foods: foods which are maintained at temperatures below $-18\text{ }^{\circ}\text{C}$ to retain their quality, shelf life, wholesomeness and safety.

Examples: Meat, Fish, Vegetables, Fruits, Desserts, Bakery products

HIGH RISK FOODS

Food that has to be kept at certain temperatures to minimize the growth of any pathogenic microorganisms that may be present in the food or to prevent the formation of toxins in the food

Common foods that are considered to be potentially hazardous are:

- Meat
- Poultry
- Milk
- Eggs
- Rice
- Fish
- Gravies
- Soups
- Custards
- Pork roll

FROZEN FOODS' QUALITY COMPLIANCE

- High intrinsic quality of raw materials used in the product.
- Proper personal hygiene, cleaning and sanitizing
- Correct processing and packaging of the product
- Rotation of inventory throughout the "Cold Chain,"
- Follow Food safety to prevent cross contamination
- Maintenance of uniform, sufficiently cold temperatures

SHELF LIFE OF FROZEN FOODS

Approximate storage periods for general classes of frozen foods at 0 °F (-18 °C) without any commercially significant quality loss	
Packaged Chicken Heat Treated Citrus Concentrates Sugared Fruits Pies, including Fruit Pies	Over 12 months
Most Fruits & Vegetables, Fruit Juices Bakery Products, Confections Beef, Veal, Lamb, Turkey, Meat Pies	10-12 months
Lean fish Shellfish Some Fatty Fish	8-10 months
Fried foods Pork Most Dairy Products Fatty Fish	6 months or less

HEALTH HAZARDS OF FROZEN FOODS

1. Biological Hazards

By far, biological hazards pose the greatest threat to food safety. Biological hazards include certain bacteria, viruses, parasites, and fungi, as well as certain plants, mushrooms, and fish that carry harmful toxins. Disease-causing micro-organisms are responsible for the majority of food borne-illness outbreaks. Food contaminated by bacteria may look completely normal. It cannot be tasted, smelt or seen. However, the consequences will be felt.

2. Physical Hazards

A physical hazard is an item you can physically see in the food. It may enter the food at any stage of the production, but most commonly found in the manufacturing or preparation stage.

Physical hazards include items: such as hair, fingernails, metal staples, and broken glass, as, well as naturally occurring objects, such as bones in fillets.

3. Chemical Hazards

Chemical contamination occurs as a result of food coming into contact with chemicals.

Chemical hazards include pesticides, food additives, preservatives, cleaning supplies, and toxic metals that leach from cookware and equipment. Chemical contamination can come from solvents, detergents & sanitizers.

FROZEN FOOD TEMPERATURE REQUIREMENTS

Pathogens can survive and multiply rapidly under favorable conditions. Hence, it is recommended for food products to be stored at the correct temperatures:

The most common Temperature Standards are:

- Banana (13 °C)
- Chill (2 °C)
- Frozen (-18 °C)
- Deep Frozen (-29 °C)

TEMPERATURE ABUSE

Time-temperature abuse refers to the storage and holding of food in the temperature danger zone (5°C – 60°C) for an extended time period. Prolonged exposure of food to the temperature danger zone will accelerate the rate of bacterial growth and quicken the food spoilage process.

Food has been time-temperature abused any time it has been allowed to remain too long at temperatures favorable to the growth of food borne micro-organisms. For example:

- Not held or stored at required temperatures
- Not cooked or reheated to temperatures that kill micro-organisms
- Improperly cooled
- High risk foods left at room temperature for long periods of time are most likely to result in food poisoning when eaten.

SYMBOLS OF TEMPERATURE ABUSE

Physical changes may indicate how the product was handled unrooted. For example, frozen products may show ice formation which indicates that temperature fluctuations in refrigerated storage have occurred, causing water to sublime from the product and then to recondense inside the packet. This leads to dehydration of the product, known as freezer burn.

Severe temperature abuse may be evident through signs of thawing and refreezing, seen when, for example, individually quick-frozen items stick together.

For fruit the parameters are size, ripeness and fullness. For salmon fillets, visible features such as the pinkness of the flesh, the absence of blood spots, the texture and the absence of gapping in the flesh are important,

TEMPERATURE ABUSE HEALTH HAZARDS

The temperature range in which food-borne bacteria can grow is known as the danger zone i.e. roughly as 5 to 60 °C (41 to 140 °F). Food-borne bacteria, in large enough numbers, may cause:

Food poisoning, symptoms similar to gastroenteritis or "stomach flu".

Some of the symptoms include stomach cramps, nausea, vomiting, diarrhea, and fever.

Food-borne illness becomes more dangerous in certain populations, such as people with weakened immune systems, young children, the elderly, and pregnant women

2 HOUR/4 HOURS TEMPERATURE ABUSE RULE

The 2 hour/4 hour rule below explains how long PHF's can be kept safely at temperatures within the 'Temperature Danger Zone'.

If a PHF has been held within the temperature danger zone:

- For less than 2 hours – refrigerate or use immediately
- Between 2 hours and 4 hours – use immediately
- For more than 4 hours – throw out.

COLD CHAIN OF FROZEN FOODS

The sequence of temperature controlled events from raw material supply, through production, manufacture or slaughter, to the presentation of the product for final consumption.

Cold Chain Management (CCM), is the process to ensure that temperature sensitive food products are maintained at correct temperatures from farm to fork,

It is used to preserve, extend and ensure the shelf life of products, such as fresh agricultural produce, seafood, frozen food, photo film, chemicals, and drugs.

TIME-TEMPERATURE ABUSE CONCEPT

Time-temperature abuse refers to the storage and holding of food in the temperature danger zone (5°C – 60°C) for an extended period of time.

It is important to ensure stringent time-temperature control along the supply chain so as to preserve the quality of the food and ensure food safety.

Prolonged exposure of food to the temperature danger zone will accelerate the rate of bacterial growth and quicken the food spoilage process.

TIME -TEMPERATURE CONTROL MANAGEMENT

(WITHIN ESTABLISHMENT)

Throughout the flow of food, time & temperature remain constant threats to the safety of food.

The best way to avoid time-temperature abuse is to establish procedures to be followed by everyone. Some suggestions include:

- Decide the best way to monitor time and temperature in your establishment.
- Determine which foods should be monitored, how often, and who should check them
- Make sure the establishment has the right kind of thermometers available in the right places. Regularly record temperatures and the times they are taken.
- Incorporate time and temperature controls into standard operating procedures.

TIME-TEMPERATURE MANAGEMENT

(THROUGHOUT THE COLD CHAIN)

1. Receiving of Raw Materials

- Schedule delivery time with your suppliers so that no food products or ingredients are left unattended upon delivery
- When receiving food products, load/unload the chilled and frozen food products as quickly as possible to minimize fluctuation in temperature of the products
- Use insulated containers with ice if cold items cannot be stored in chillers/freezer immediately
- An appointed kitchen staff could be tasked to receive the food products (i.e. raw ingredients, meat, poultry etc.) and ensure that food products are received in sealed packaging and at the right temperatures.

2. Food Preparation & Holding

- Ensure that cooked food is not left at temperature danger zone for prolonged period of time.
- Keep food meant to be consumed hot above 60°C, and food meant to be consumed cold at below 5°C.
- Controlling time and temperature helps prevent harmful bacteria from multiplying to unsafe levels.

3. Freezing & Packing of Food

- Freezing should be performed with appropriate equipment in such a way as to minimize physical and biochemical changes. With most products this is best achieved by ensuring that the product passes through the temperature range of maximum crystallization [for most products +30°F to +23°F (-1°C to -5°C)] quickly.
- On exit from the freezing apparatus, the product should be minimally exposed to humidity and warm temperatures, be moved into a cold warehouse as quickly as practical and then allowed an adequate dwell time for temperature equilibration.
- Product should leave the warehouse at 0°F (-18°C) or lower promptly, and retain that temperature upon reaching the primary warehouse.
- Phrases such as "Store at 0°F (-18°C) or colder" should appear on outer cases.

4. Food Transportation

Trucks, trailers or containers, railcars, ships and aircrafts, should be:

- Constructed, insulated and equipped with adequate refrigeration capacity and air delivery system to continuously maintain product temperature of 0°F (-18°C) or colder.
- Equipped with tight fitting doors and suitable closures for drain holes to prevent air leakage;
- Pre-cooled to 0°F prior to loading. The object of pre-cooling is to establish a gradient across the insulation
- Equipped with an appropriate temperature monitoring device
- Proper airflow or air circulation must be maintained on all six sides of the load.

5. Retail Storage of Food

- Frozen food storage facilities should maintain a steady product temperature of 0°F (- 18°C) or colder
- Frozen food storage facilities should have sufficient circulation of refrigerated air.
- Frozen food storage facilities should be equipped with an adequate number of accurate and calibrated thermometer(s) and temperature recording devices
- Refrigeration equipment installation include an audible or visual alarm system

6. Delivery of Food

- Frozen food should be delivered in a frozen condition, preferably at 0°F (-18°C) or colder
- Once unloaded, frozen food should be moved immediately into cold storage or into the retail display case
- Rotate inventory on a "first-in - first-out" (FIFO) basis
- The thawing of frozen food for sale at refrigerator temperature should only be done in a refrigerator at a temperature not warmer than 41°F (5°C).

THE MAJOR COLD CHAIN TECHNOLOGIES

- **Dry Ice:** Solid carbon dioxide, is about -80°C and is capable of keeping a shipment frozen for an extended period of time. Dry ice does not melt, instead it sublimates when it comes in contact with air.
- **Gel Packs:** Gel packs contain phase changing substances that can go from solid to liquid and vice versa to control an environment at a temperature range between 2°C and 8°C .
- **Eutectic plates:** The principle is similar to gel packs. Instead, plates are filled with a liquid and can be reused many times.

The major cold chain technologies (continue...)

- **Liquid Nitrogen:** Liquid nitrogen is an especially cold substance, of about -196°C . It is used to keep packages frozen over a long period of time.
- **Quilts:** These are insulated pieces that are placed over or around freight to act as buffer in temperature variations and to maintain the temperature relatively constant. Its used to keep Freight frozen for a longer time period.
- **Reefers:** It's a Generic name for a temperature controlled container, which can be a van, small truck, a semi or a standard ISO container.

CONSUMER AWARENESS

A qualitative survey was conducted to gain an insight into the ways consumers purchase, transport and storage fresh and frozen food:

- Respondents heard the term cold chain but not its significance: 54.2%
 - Consumers knew the term but associated it with several meanings: 25%
 - Respondents, did not knew the term: 20.8%
- (Italian Journal of Food Safety, Dec-2014)

ROLE OF CONSUMER IN COLD CHAIN

There are some simple steps that the consumer can take to ensure that chilled and frozen foods are as safe, high quality and nutritious as possible. These include:

- When shopping: try to purchase chilled and frozen foods at the end of a shopping run and pack chilled and frozen foods in separate bags (preferably insulated) to keep them cool or frozen.
- On returning home: unpack the chilled and frozen foods away first – ensure they are put in the chiller/freezer as soon as possible “don’t wait – refrigerate!”
- At home: purchase and use a refrigerator and freezer thermometer. Check the operating temperature of the refrigerator and freezer. Are they operating below +4°C (refrigerator) or below -18°C (freezer)?

THANK YOU