PREVENTING FOOD-BORNE ILLNESS FROM FARM TO PLATE HIGHLIGHTS OF BEST PRACTICE

Food Processing, Preventing Food-borne Illness and Improving Quality

The fundamental purpose of food processing remains unchanged - to make food available and safe when and where it is needed. With rapid and continuing lifestyle changes such as more women working outside the home, the continuing shift of people from rural to urban environments, demand for food processed to extend shelf-life, variety, nutritional value, or convenience, continues to grow.

Almost all the foods that we eat are processed in some form. Food processing is an international industry, bringing increased food choices to the consumer, and major export opportunities to Asia.

Typical methods of food processing

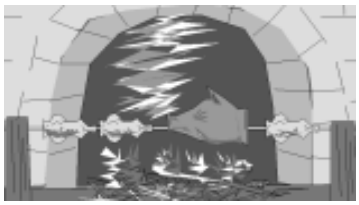
- **Heating:** ***Pasteurisation*** involves heating to temperatures of at least the equivalent of at least 72° C for 15 seconds to kill most food-borne pathogens and then quickly cooling to a maximum temperature of 5° C. However, food is not totally sterilised; refrigeration is required and shelf life is limited.

Sterilisation involves heating to temperatures of at least 120° C or more for a prescribed period of time to kill microbes and or inactivate spoilage enzymes; followed by rapid cooling. Sterilisation significantly increases shelf life and eliminates the need for refrigeration as long as the package remains unopened.

- **Cooling**: Refrigeration and freezing maintain food at controlled, low temperatures to keep enzymes inactive and inhibit the growth of microbes. To remain effective, cooling and freezing must be maintained consistently through transport, retail sale and storage at home. Cooling and freezing is not therefore a reliable method of food preservation in significantly under-developed and rural areas of Asia, where a constant power supply cannot be guaranteed. Total temperature control is critical because many foods spoil rapidly and irreversibly.

- **Drying:** This is one of the most traditional methods of preserving foods, and is still widely used in Asia. Drying produces stable foods by reducing their water content, which, in turn, denies microbes the environment needed for reproduction. Food products where this technique is used are fish and seafood, meat, dates, beans, noodles, rice and cereals and powdered milks. The addition of salt and sugar to foodstuffs also controls microbial food poisoning by effectively making water present in the foodstuff unavailable for microbial growth. For this reason, high sugar foods are usually relatively safe to eat.

- **Smoking:** These methods both dry the food and add extra flavour eg meat, fish and seafood, and edible insects.



- **Fermentation:** Fermentation is the process by which microbes produce alcohol or acid, which act as preserving agents. Fermentation of foods has a long tradition in Asia -tofu, tempeh, idlis, kimchi, fish sauce, oyster sauce, beer, wine, and some dairy products such as yoghurt are typical examples.

- **Food additives:** Food additives also play a key role in food processing. For example, some additives make food acidic and thereby protect it against spoilage; anti-oxidants prevent fats and oils from becoming rancid; emulsifiers and stabilisers help produce stable mixtures of ingredients which would otherwise separate, for example oil and water.

- **Atmosphere** Special atmospheric conditions are used less frequently than temperature control for food preservation, but in certain cases, atmosphere control has a major impact on the quality of products in storage and transport. The best example is fruit that is packed and preserved in special nitrogen-rich atmospheres for six months or more. This is achieved by sucking out ambient oxygen-rich air from the storage facility and replacing it with "reconstituted" air which is low in oxygen and high in both nitrogen and carbon dioxide.

- **Irradiation** Food Irradiation involves treating foods with ionizing energy or radiation. Radiation processing of food strengthens food conservation, improves food hygiene and helps food exports overcome quarantine barriers. It facilitates packing, storage, transport and distribution of foods by extending shelf-life of food products (by killing spoilage-causing micro-organisms). Irradiation also destroys insect pests in stored products and fruits, and parasitic organisms such as tapeworms which are a particular risk to those consumers (in Japan and China for example), who consume fish, shellfish and meat raw or part-cooked. The World Health Organisation and the Codex Alimentarius Commission have both approved irradiation as a safe and effective method of food preservation, and over 42 countries in the world including developing countries like Bangladesh, India, Indonesia, and Thailand have given clearance for radiation processing of food.

Benefits of food processing

Preservation: Preserving the taste, smell, look and feel of food and preventing spoilage is an important function of food processing. Preservation inactivates natural processes in food which cause its deterioration.

- Enzyme action - all food contains natural enzymes that break down proteins, fats and carbohydrates. Once an animal has been killed or a plant harvested, these enzymes, if left uncontrolled,

continue to work, break down the food and cause spoilage.

- Microbial action - all food can be attacked by bacteria and fungi that cause food to rot or become mouldy. If permitted to multiply, these microbes can cause spoilage.
- Oxidation - many food components can be attacked by oxygen in the air, making them rancid or resulting in an unpleasant taste. This too can be controlled, for example through canning, vacuum packing and with the use of antioxidant additives such as vitamin C and beta-carotene.

Nutrition: Processing techniques may preserve, enhance or destroy natural nutrients: For example, high temperatures required for sterilization may destroy some of the heat sensitive vitamin C in canned fruit, but cooking and processing of some foods, such as carrots and spinach, actually increases the bioavailability of the carotenoids (which the body converts into vitamin A) they contain.

Processing makes some food and availability stuffs more digestible, thus increasing both their appeal of important nutrients. The simple process of cooking for example increases digestibility and absorption rates of starch, an important complex carbohydrate.

The increased variety and choice in a consumers' diet facilitated by processed foods, further enhances the nutritional quality. As a general rule, the more varied the diet, the more nutritionally balanced it is likely to be.

Convenience: With urbanisation, changing roles of women and more women working outside of the home, providing food products that are convenient and can be easily prepared at home, is an increasingly important function of processed food products. Products include ready prepared ingredients and sauces for curry and stir-fry dishes; chopped or frozen vegetable, meat & fish; instant noodle soups; chilled ready to cook spring rolls and chapatis; and also complete meals for almost instant serving from freezer via microwave or conventional oven, to table.

Variety: As a result of modern food processing, today's consumer has unparalleled choice: teas from Assam, coffee from Columbia, fish from the North Atlantic, imported canned fruit from the US and so on.

Consumption of a wide variety of food also reduces the cumulative risk of some specific food-borne chemicals. For example, mycotoxins (produced by certain fungi in/on foods and feeds) have been associated with a range of disorders from gastroenteritis to cancer in populations whose diet have little variety and are heavily reliant on food crops susceptible to infection by these toxin-producing fungi.

Affordability: The food processing industry plays a major role in ensuring that varied and nutritious products available today are affordable to an increasingly larger proportion of the population.

Ensuring Quality and Safety in Processing

Food processors rely on modern quality management systems to ensure the quality and safety of the products they produce.

Key systems in use are:

- **Quality Assurance Standards.** Adherence to standards such as the International Standards Organisation ISO 9000, Codex Alimentarius and standards set by national government food and drug regulatory authorities, helps ensure that food processing, catering and other food-related industries conform to prescribed, documented procedures, which are regularly assessed by independent experts.

- **Good Manufacturing Practices (GMP).** The Codex Alimentarius Commission developed a Code of GMP in 1997 to help all sector of the food industry in the food hygiene implementation. GMP provides food manufacturing and catering establishments with the means to assure a basic standard of food safety. Food industry and public health authorities however, recognise that GMP alone is not sufficient safeguard against food-borne health risks.

- **Good Hygiene Practice (GHP).** The use of appropriate cleaning and sanitising techniques, including the use of approved and effective cleaning chemicals, use of protective clothing and strict observation of personal hygiene by personnel and provision of the necessary facilities for this purpose, as well as time-temperature controls, are fundamental principles of GHP.

- **Hazard Analysis Critical Control Points (HACCP).** The concept and practice of HACCP provides a greater standard of food safety protection than GMP or GHP. HACCP is a proactive technique used in the food industry, which focuses on preventing defects in the production process itself, by identifying them in advance of a problem occurring.

In preparation for World Trade Organization (WTO) entry and to meet its own market development needs, a number of strategies have been mapped out by the food industry in different parts of Asia. In Thailand for example, many food companies are implementing inspection, monitoring and verification procedures to strengthen their HACCP schemes, quality assurance and laboratory inspection systems with a view to ensuring compliance to International Organisation for Standardisation (ISO) Guidelines.

China too is stepping up efforts to establish a set of technical standards for food products. Both imported food and food items produced on the mainland for sale in the domestic market will be required to strictly comply with food quality assurance systems, including food safety assurance tools, such as GMP and HACCP. Unification of food standards and quality certification systems such as ISO 9000 will be promoted and implemented.

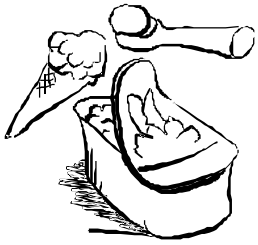
Before and after processing

The quality of food products is dependent on the quality of raw materials and on the quality of transport, storage and sale to the consumer. Increasingly therefore, quality management systems of food processors (e.g. ISO 9000 systems) also involve working with the suppliers (individual farmers and raw material wholesalers), transporters, product wholesalers and retailers to ensure quality assurance procedures at each level.

On a regular basis, processors brief suppliers on the specific requirements for raw materials and provide technical assistance to help ensure that raw material production meets specifications. In addition, quality audits and inspections of raw materials at the point of delivery help ensure that specifications are met. Processors also provide technical assistance to, and conduct audits of, transporters, wholesalers and retailers to ensure that specifications for temperature, moisture and other conditions are met and that sell-by dates are observed.

Protecting Food through Packaging

Food packaging is an important part of food preservation and safety. It ensures that food reaches the consumer in peak condition. Food grade packaging materials such as cans, bottles, vacuum-wrapped plastic do this by:



- Maximising shelf life by acting as a barrier against water vapour, air, and microbes. Packaging may also retain moisture and gases, which preserve product freshness and safety.
- Carrying information on the label (use-by dates, ingredients, refrigeration or cooking instructions, recipes suggestions etc) to help the consumer store and use products safely at home.
- Providing evidence that the product is intact and has not been tampered with.
- Preventing loss of aroma and protecting against odours from external sources.
- Including bar codes for identifying the date and location of manufacture which enables processors, transporters and retailers to keep track of products for both inventory control and identification of potential hazards.

Loyalty Based on Trust

The success of each food processing company is dependent on the loyalty of the consumer to each individual brand and product. In turn, loyalty relies on the consumer's trust in the quality and safety of products. Hence, food companies have a strong incentive to provide safe, good quality food to consumers.

The principle of shared responsibility is fundamental both in the processing and in the preparation of food to ensuring that food is both nutritious and free of the contaminants that cause food-borne diseases.

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