



KAPITEL 3 / CHAPTER 3³

PROPER STORAGE PRACTICES FOR FOOD AND NON-FOOD ITEMS IN RESTAURANTS: ADHERING TO HACCP PRINCIPLES

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Introduction

Food service establishments play a crucial role as primary sources of various foodborne illnesses [1, 2]. The prevalence of such diseases in developing countries is attributed to factors such as inadequate handling practices, limited surveillance, fragmented control policies, and the absence of reliable data on food safety issues [3].

Currently, there are five primary risk factors contributing to foodborne illnesses. These factors include obtaining food from unsafe sources, poor personal hygiene, inadequate cooking practices, improper food holding, and contamination of food surfaces and equipment. Therefore, effective food safety programs must actively address these risks through measures such as time/temperature control, promoting good personal hygiene, controlling cross-contamination (Figure 1), and implementing efficient cleaning and sanitization programs [4, 5].

From the consumers' safety perspective, proper storage and transportation are key factors in maintaining adequate conditions for both food and non-food products. Quality control and adherence to standards play a crucial role in the safety of food and non-food products, preventing reputational and financial losses for suppliers.

The storage of both food and non-food products is crucial for establishments in the restaurant industry. The quality of received products and their shelf life depend on these processes being carried out under appropriate conditions.

For fresh-food products, supply chain management, especially during the distribution phase, plays a fundamental role in determining the final quality perceived by the consumer. Food supply chains differ from other chains due to continuous changes in quality from the time raw materials leave the grower until the product

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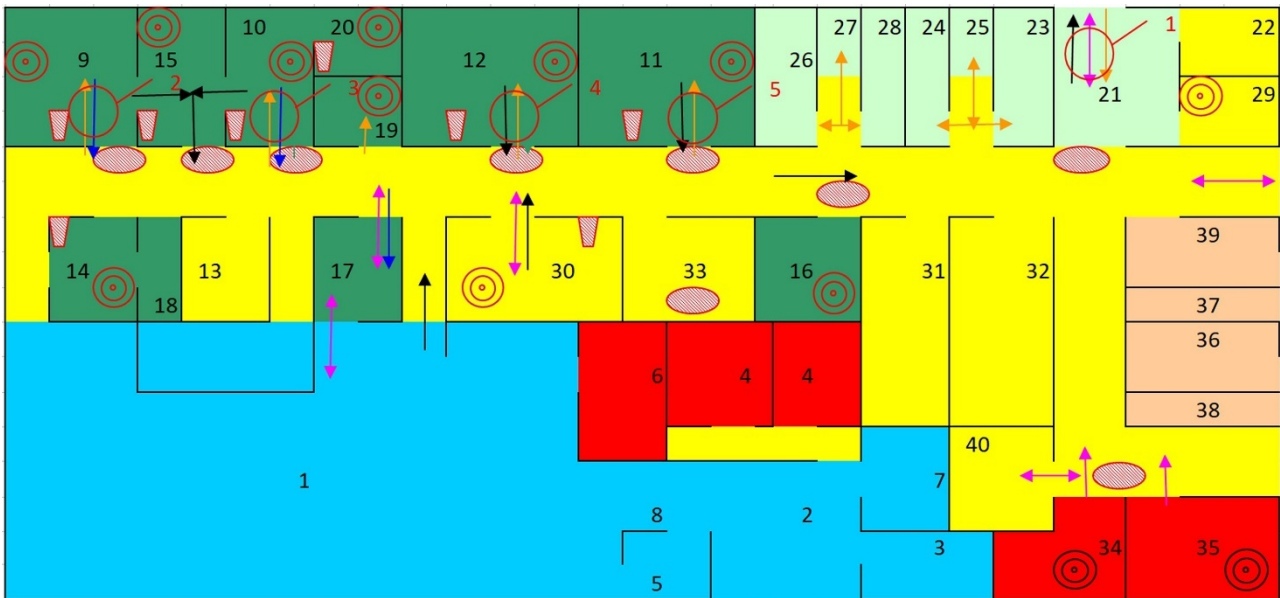


Figure 1 – Scheme of the restaurant:

visitor rooms (1 – dining hall with bar; 2 – lobby; 3 – cloakroom; 4 – toilet; 5 – smoking room; 6 – restrooms for persons with disabilities; 7 – vestibule; 8 – stage with inventory); production rooms (9 – hot kitchen; 10 – cold kitchen; 11 – vegetable kitchen; 12 – meat and fish kitchen; 14 – dishwashing room; 15 – utensil washing room; 16 – utensil and container room; 17 – serving room; 18 – service room; 19 – egg processing room; 20 – bread cutting room); storage rooms (21 – loading room; 23 – dry products chamber; 24 – vegetable chamber; 25 – alcohol products chamber; 26 – refrigerated meat and fish chamber; 27 – refrigerated chamber for dairy and fat products and gastronomy; 28 – refrigerated chamber for green fruits and vegetables); administrative and household rooms (13 – production manager's room; 22 – storekeeper's room; 29 – material and technical supply warehouses; 30 – laundry; 31 – director's office; 32 – accounting office; 33 – staff room; 34 – women's cloakroom and dressing room; 35 – men's cloakroom and dressing room; 40 – cleaning inventory room); technical rooms (36 – heating substation; 37 – exhaust ventilation chamber; 38 – inflow ventilation chamber; 39 – electrical panel room)

reaches the consumer. The presence of biological variability in products and uncertainties in the delivery process adds complexity to managing this phase [6].

The continuous deterioration of food product quality over time, influenced by storage temperature, necessitates low-temperature storage to prolong shelf life, albeit at increased storage costs [7].

Therefore, the presented research on the storage of food and non-food products in restaurants based on HACCP principles is relevant, aligning with the current needs and



requirements of restaurant establishments.

General provisions

All food and non-food products are supplied to restaurants from approved and authorized suppliers. Incoming control of food products, auxiliary materials for food processing, items and materials in contact with food products, and other non-food products in restaurants are carried out in accordance with the procedures defined in prerequisite programs (PP) «Incoming control of raw materials and packaging materials».

Material receiving must occur in a protected and clean area. The enterprise should designate a receiving area where it is necessary to ensure the ability to manage sanitary-hygienic conditions for all received goods [8].

To ensure the continuous cold chain, incoming control of perishable food products involves mandatory temperature monitoring of such products. Non-compliance with incoming control procedures may affect the safety of already existing food products due to cross-contamination.

Market operators create appropriate conditions for storing finished food products, raw or partially processed food products, auxiliary materials for food processing, items and materials in contact with food products, and other non-food products [9].

Thus, for the temporary storage of food products and other sanitary items on restaurant premises, there are appropriate facilities and cold-generating equipment available. Natural lighting in the temporary storage areas is absent, as light acts as a catalyst for oxidative processes occurring in products during storage. Therefore, products are stored in darkness, without access to natural light.

The sanitary and technical condition of special storage areas, rooms for storing raw materials and semi-finished products, and cold-generation equipment in restaurants is monitored in accordance with the prerequisite program defined in PP «Storage and transportation of food and non-food items». Food raw materials, food



ingredients, and packaging materials should be stored above floor level (e.g., on carts, pallets) and with space between them and the walls for inspection and pest control [4]. In this case, products in trays should be arranged in one or two rows (depending on the requirements of the standards). The minimum height for installing trays in the bottom row of the rack is 30 cm from the floor.

The premises should be spacious and equipped to provide storage conditions, as well as to adhere to the principle of using batches of products with shorter storage periods first. The necessary equipment for storing food products should maintain storage conditions with full occupancy of the premises, with control of temperature and humidity regime [9].

When storing food products, auxiliary materials for food processing, items and materials in contact with food products, and other non-food items in the premises, recommended parameters established by the manufacturer are observed. The storage conditions are determined by the optimal temperature or temperature regime, the appropriateness of ventilation and air exchange, or the ventilation regime, and adherence to established sanitary conditions or the sanitary regime.

Microclimate parameters are crucial for determining the storage conditions of food products. The main parameter of storage is the temperature regime. Products are stored according to accepted classifications by type: dry grocery items (flour, sugar, cereals, pasta, etc.); bread; meat and fish; dairy and fatty products; gastronomic; vegetables, and fruits.

Food products (by types) are stored in separate refrigerators or in one refrigerator while maintaining conditions of product adjacency (on separate shelves), with raw materials stored on the lower shelves and finished products on the upper shelves.

Products with specific odors (spices, herring, cheese, smoked products, etc.) are stored separately from products capable of absorbing foreign odors (butter, sour cream, cream, tea, salt, sugar, creams, etc.) or in the same refrigerated room, in sealed containers or packaging.

Raw materials and ingredients that need to be removed from their original packaging must remain protected and retain their labeling. If this is not possible, the



information contained on the label should be transferred to another label, or any other effective method ensuring product traceability should be utilized [8].

Products are stored in the manufacturer's packaging or, if necessary, transferred to clean, appropriately labeled production (in-house) containers, such as containers with lids for food products, trays, jars, boxes, or other containers covered with lids and/or food film of the most convenient (square or rectangular) shape, allowing the products to be packed as tightly as possible.

Employees involved in production processes must label unpackaged food raw materials and partially processed food products according to established procedures. Damaged or suspiciously unsafe products are stored separately and appropriately labeled as «Damaged».

The responsibility for training restaurant staff engaged in food storage, basic knowledge of storage, and adherence to principles (FIFO, FEFO) is placed on the restaurant manager.

3.1. Storage of raw materials and ingredients

The premises designated for storing raw, partially processed, or processed food products, items, and materials that come into contact with food should be designed to prevent contamination during storage, cleaning, washing, and, if necessary, disinfection, and to prevent pest entry [9].

The storage conditions of goods should align with the properties specified in standards and technical specifications.

To inhibit the growth of harmful bacteria, perishable food products requiring a controlled temperature regime are stored in facilities equipped with clearly defined refrigeration-generating equipment.

Refrigeration equipment should include devices for measuring and monitoring air or product temperature, which should undergo periodic calibration. Maintaining records of temperature monitoring is essential [8].



Upon arrival at the restaurant, grocery items in various packaging should be stacked for storage in stacks of boxes, bags, or crates (with the stack height of boxes not exceeding 8 rows) or on the shelves of racks in unpacked form or in crates.

Dry products must be stored under appropriate temperature and humidity conditions. Packaging materials for food products and materials in contact with food products should be safeguarded from dust and any form of contamination.

Supplies of grains, pasta, and salt should be stored in dry, clean, cool premises, free from barn pests, and separated from stocks of goods with strong odors.

Food concentrates and semi-finished flour products in production should be stored in boxes stacked in piles no wider or higher than 8 boxes (temperature-humidity regime according to the standard).

Spices should be stored in clean, dry rooms at a temperature of 5-15 °C and relative humidity of 65-70 %, following the requirements of product adjacency. These products not only easily absorb foreign odors but also transmit their own.

Tea storage should be conducted in enclosed wall cabinets in clean, dry, ventilated rooms with a relative humidity not exceeding 70 %. Due to the high hygroscopicity of tea, ventilation of such a room in damp weather is prohibited. Storing tea near spices, soap, coffee, and other goods capable of imparting odors is also prohibited.

Sugar should be stored in clean rooms with a relative humidity not exceeding 70%, near the surface of the bottom in the stack of bags (for refined sugar – not exceeding 80 %). To prevent moisture, bags in stacks need to be checked at least twice a month, and in case of detecting wet spots, the sugar should be transferred to other bags.

Sunflower oil is stored in boxes in enclosed rooms at a temperature not exceeding 18 °C. Mayonnaise should be stored in factory packaging in darkened premises with a relative humidity not exceeding 75 % and air temperature ranging from 3 to 18 °C.

Chicken eggs for consumption should be stored separately from odorous and open (unwrapped, unpackaged, non-airtight) items that easily absorb odors and may become contaminated with pathogenic microorganisms. Dietary eggs should be stored for no more than 7 days at temperatures ranging from 0 to 20 °C; table eggs – no more than



25 days at the same temperature range, and at temperatures from 0 to $-2\text{ }^{\circ}\text{C}$ – for up to 120 days.

Raw meat products should not be stored together with sausages and culinary products. Chill stored raw foods of animal origin between 1 and $4\text{ }^{\circ}\text{C}$. Other raw foods that require refrigeration, such as certain vegetables, should be stored at as low a temperature as quality permits [10].

For the storage of gastronomic goods, refrigerated cabinets are utilized. Chilled meat, all types of sausage products, sardines, and sausages are stored in refrigerated cabinets at the appropriate temperature regimes. The temperature inside refrigerated cabinets for the quality storage of these products should not exceed $6\text{ }^{\circ}\text{C}$. The relative humidity of the air in refrigerated cabinets during the storage of chilled meat should be within 85-90 %, frozen meat – 95-98 %, chilled poultry meat – 80-85 %, and frozen poultry meat – 85-90 %.

Dairy products such as milk, cream, butter, and cheese, along with animal fats, margarine, and mayonnaise, are stored in refrigerators on shelves. Cheeses are stored considering their dimensions and the type of packaging they arrived in – in boxes, barrels, or drums. Large cheeses without packaging are stored on wooden slats, with plywood placed between the cheese rounds. Barrels containing brine-soaked cheeses should be overturned every 5 days of storage.

Confectionery products with limited storage periods, such as cakes, muffins, and pastries, are placed on shelves in refrigerators and stored for 6 to 36 hours at a temperature of 2 to $6\text{ }^{\circ}\text{C}$.

Fresh fruits and vegetables should be stored in separate refrigerated, ventilated rooms without natural light. Imported fruits or vegetables in crates or trays should be placed on pallets, observing a maximum stacking height of 1.5-2.0 meters.

Non-alcoholic beverages, fruit drinks, and kvass are stored in premises for storing goods at a temperature of 2- $12\text{ }^{\circ}\text{C}$; beer is stored at $12\text{ }^{\circ}\text{C}$; wines are stored at temperatures of 8- $16\text{ }^{\circ}\text{C}$.

Raw products and ingredients stored within the factory premises must be kept under conditions that prevent spoilage, contamination, and minimize damage. Regular



supply of raw materials and ingredients is essential to prevent prolonged storage of excess supplies [10]. To prevent food spoilage, members of the HACCP team conduct checks on existing stocks during reprocessing.

Risk assessment and ensuring the storage of food products, auxiliary materials for food processing, items, and materials in contact with food, as well as other non-food products, should be carried out to prevent their mutual negative impact [9]. Raw materials and ingredients must be inspected and sampled before processing, and if necessary, laboratory testing should be conducted to establish their suitability for use. Only suitable, high-quality raw materials and ingredients should be used for preparation [8].

3.2. Storage of frozen products

Upon the arrival of frozen products at the restaurant, it is necessary to promptly place them in a low-temperature refrigeration cabinet. Frozen products that are not immediately used should be stored at temperatures below -18 °C. Food service establishments must be equipped with refrigeration and/or freezing equipment of sufficient capacity to store food products at the proper temperature in accordance with requirements [8].

Freezing and refrigeration chambers or equipment for storing finished products during freezing and cooling must have a total volume that exceeds twice the maximum possible output of product in one working day. All freezing rooms must be equipped with temperature measuring devices, and it is recommended to use temperature recording devices. These devices should be clearly visible and positioned to accurately record the maximum temperature in the room. If possible, freezing and refrigeration chambers should be equipped with alarms to prevent exceeding the permissible temperature.

Frozen products are stored at low temperatures (-18 °C and below) and are preferably packaged in airtight packaging to prevent excessive drying during storage.



Proper product rotation should be implemented by placing new items behind those already in the refrigerator.

Products should only undergo freezing once; during thawing, bacteria present in the product can begin to grow. As a result, upon refreezing such a product, the quantity of bacteria it contains may exceed the acceptable level.

3.3. Storage of chilled products

Cooling should be carried out immediately after preparation and as quickly and efficiently as possible. The temperature inside the product should be reduced to 10 °C within 2 hours; then the product should be promptly placed in storage at a temperature of 4 °C. The temperature should not exceed 4 °C in any part of the product and should be maintained until use.

Constant monitoring of storage conditions is necessary [10]. The storage period between the completion of preparation of the chilled product and consumption should not exceed 5 days, including the day of preparation and the day of consumption.

3.4. Storage of finished products

All products that have undergone proper heat treatment and are intended for further storage or for further preparation of portioned dishes undergo rapid cooling to 8 °C within 90 minutes. Hot products are kept hot with an internal product temperature not lower than 63 °C for no more than three hours [8].

Prepared products that are not stored at a temperature higher than 63 °C must be sold within two hours of preparation. Products can only be reheated once after cooling. When reheating, the internal temperature of the product should not be lower than 82 °C. Mixing leftovers with different dates or times of preparation is strictly prohibited.

Additionally, it is prohibited to leave for sale the next day the following items:



salads, vinaigrettes, pâtés, jelly dishes, and other perishable cold dishes; pureed soups; minced meat and poultry products; sauces; mashed potatoes; and boiled pasta.

Conclusions

Ensuring the safe and efficient storage of food and non-food items in a restaurant is critically important for food safety and compliance with HACCP principles. Key aspects include temperature control, avoiding cross-contamination of food flows, proper packaging and labeling, maintaining cleanliness and sanitation, and staff training.

Restaurants should have appropriate refrigeration and freezing equipment, subject to periodic verification, and keep records of temperature monitoring. Separation of raw and prepared food, inventory control, adherence to sanitary standards, and prevention of cross-contamination of products with different levels of processing are mandatory practices to maintain the safety of food products.

Regular checks of storage conditions, staff training, and documentation are crucial steps in implementing the HACCP system in the restaurant business. These measures contribute to avoiding potential health risks for consumers and ensure a high standard of quality for products served in the foodservice establishment.