Hazard analysis and critical control point generic models for some traditional foods

A manual for the Eastern Mediterranean Region

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Preface

Food safety is of paramount importance. The World Health Organization (WHO), recognizing that unsafe food has great health and economic consequences, has from its inception promoted food safety. The conventional approach to ensuring food quality and safety, which depends on inspection and testing of end products, has proved to be inadequate in controlling food-borne disease outbreaks. This may be particularly so in the case of traditional foods, because of their diversity and the great number of personnel involved in their production. A new approach seems to be needed. The Hazard Analysis and Critical Control Point (HACCP) system, which is based on training, developing systems for food hygiene and safety, and monitoring/auditing to confirm proper implementation, has evolved into the system of choice internationally to ensure food safety. The HACCP system identifies, evaluates and controls hazards that are significant for food safety, is logical, practical and preventive in nature, and may be implemented at all stages of the food production process.

In countries of the WHO Eastern Mediterranean Region, traditional foods constitute a major part of everyday meals. These foods are generally simple in preparation, and their ingredients are widely available. From a hygienic point of view, however, traditional foods are characterized by being intensively handled by workers, often in premises that do not adhere to hygiene standards and lack control measures that may help reduce and/or eliminate microbial hazards prior to consumption. Although it is the role of governments to uphold the safety and security of food, it is the responsibility of producers to ensure the safety of their products. Thus it should be mandatory for producers to adopt and apply the HACCP system to ensure food safety.

This manual is intended to help producers, regulators, trainers and others concerned with the safety of traditional foods in the Region, and may be used as material for training in food hygiene and the HACCP system, as well as the basis for the development of food safety programmes. It is expected that most producers of the foods covered in this manual will have little or no knowledge of the HACCP system, so to expect them to implement the relevant models alone would not be realistic. Rather, governmental or nongovernmental agencies engaged in health, food control, or safety of the environment will need to help groups of producers in implementing the models in their plants.

Finally, this manual covers just a few of the many traditional foods of the Region. It is hoped that this represents just the first edition of the manual, and that countries will develop and share generic HACCP models for other traditional foods in the Region so that a second edition can follow.

Acknowledgements

WHO acknowledges, with thanks, the financial support of the Arab Gulf Programme for United Nations Development Organizations (AGFUND) in the development of this publication. WHO would also like to thank Professor Mohammed Isam Yamani, PhD, Professor of Food Microbiology and Hygiene at the Department of Nutrition and Food Technology, Faculty of Agriculture, University of Jordan, Amman, who was the author of the original draft of this manual and who was a main contributor throughout the process of review and finalization. Mrs Leena Abdel Salam drafted some of the HACCP models and Mr Jihad Abuzahedeh helped in preparation and finalizing of the draft. Professor Alan Reilly, Deputy Chief Executive of the Food Safety Authority of Ireland, and Professor Saad M. Saad, Food Safety and HACCP expert, Egypt, reviewed the manuscript. The final draft was reviewed in a consultation organized by the WHO Regional Office for the Eastern Mediterranean and held in Cairo 6–8 November 2006 by the following experts: Mrs Sawsan Osman Abdel Razig (Sudan), Dr Ahmed Al-Hosni (Oman), Dr Siham Daoud (Syrian Arab Republic), Dr Sanaa Gammo (Jordan), Dr Abbas Hadjiakhoondi (Islamic Republic of Iran), Dr Haitham S. Ibrahim (Iraq), Dr Tomader Saed Kordi (Saudi Arabia), Dr Yousef El-Sanusi El-Mabsouth (Libyan Arab Jamahiriya), M Driss Machraa (Morocco), Dr Mabrouk Nedhif (Tunisia), and Mr Mohammed Fahmi Saddik (Egypt). Dr M.Z. Ali Khan and Mr Raki Zghondi, WHO Regional Centre for Environmental Health Activities (CEHA), and Dr Mohamed Elmi, Food and Chemical Safety, WHO Regional Office for the Eastern Mediterranean, oversaw the project from inception to publication. A substantial part of the knowledge of traditional foods in Jordan is based on research work conducted at the Department of Nutrition and Food Technology, Faculty of Agriculture, University of Jordan.

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The HACCP system

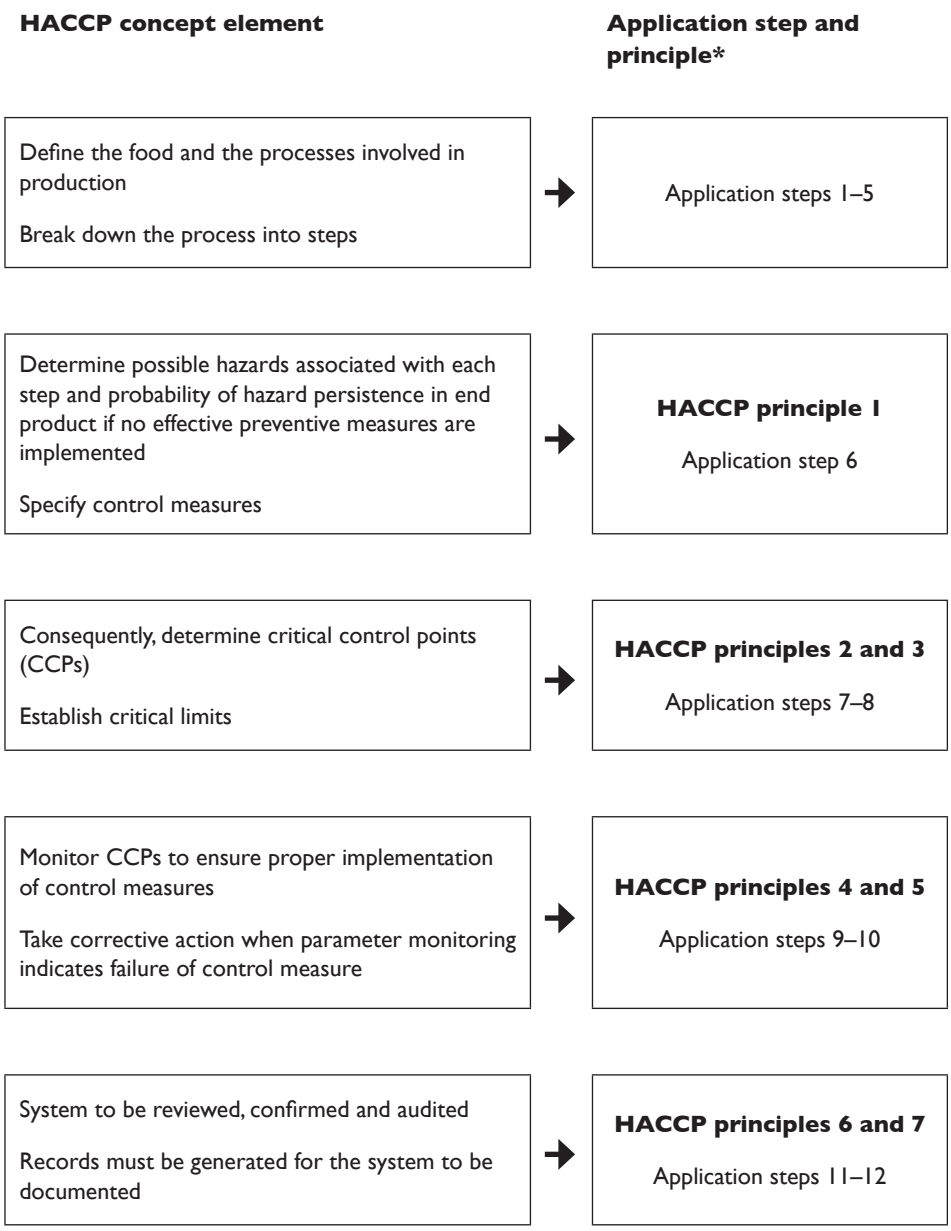
Overview

In order for food to be acceptable it has to be suitable and safe. While suitability usually refers to the sensory, nutritional and convenience aspects of foods, safety is "the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use" [1]. Control measures and conditions have been developed and implemented to ensure food safety and suitability at all stages of the food chain. These form the basis of the hygiene and safety programmes in food establishments.

Established methods of food safety, which usually constitute a major part of product control activities in food establishments, rely on inspection and testing, especially of end products. Production and maintenance personnel are not directly involved in safety assurance, although food safety is directly affected by their activities. Worldwide increases in the number of food-borne epidemics, the increasing health and economic consequences of food-borne illnesses and the inherent limitations of traditional systems are a clear indication that conventional methods are not functioning as planned.

The Hazard Analysis and Critical Control Point (HACCP) system, because of its logical and practical approach to food safety, has evolved as an alternative, scientifically-based and internationally recognized food safety system (Figure 1).

The Joint FAO/WHO Food Standards Programme (Codex Alimentarius Commission, 1997) was one of the first international bodies to adopt the HACCP system and promote its application. Nowadays HACCP is internationally acknowledged as the



*HACCP principles are outlined in Figure 2; application steps in Figure 7

Figure 1. Evolution of the concept of hazard analysis and the identification and monitoring of critical control points in a system to ensure food safety

The HACCP system consists of the following seven principles:

Principle 1
Conduct a hazard analysis.

Principle 2
Determine the Critical Control Points (CCPs).

Principle 3
Establish critical limit(s).

Principle 4
Establish a system to monitor control of the CCP.

Principle 5
Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.

Principle 6
Establish procedures for verification to confirm that the HACCP system is working effectively.

Principle 7
Establish documentation concerning all procedures and records appropriate to these principles and their application.

Figure 2. Principles of the HACCP system [1]

system of choice to ensure food safety because it is logical and practical, preventive in nature and places the responsibility of ensuring food safety in the hands of all parties concerned: production, quality control and testing, and maintenance [2].

The guidelines for the application of HACCP systems, as described by the Codex Alimentarius Commission [1], have been accepted internationally as a reference for HACCP application. The National Advisory Committee on Microbiological Criteria for Foods (NACMCF) in the United States has developed similar guidelines [3]. This logical approach to food safety has been summarized in the seven principles of the HACCP system (see Figure 2). Among the prerequisites necessary for HACCP system application, training in and implementing Codex general principles of food hygiene [1] or Food and Drug Administration (FDA) good manufacturing practices (GMPs) [4] are considered essential.

Prerequisites for the application of HACCP

Food hygiene requirements and measures

The prerequisite for the proper development and implementation of an effective HACCP system is a solid foundation of hygiene measures, conditions and requirements. This is usually accomplished through the application of a permanent food hygiene programme, which should be designed, implemented, monitored, and reviewed effectively. Such a programme provides the basic environmental and operating conditions that are necessary for the production of safe and suitable food. Hygiene and sanitation requirements outlined in the following references may be used in developing the prerequisite programme:

- Codex Alimentarius Commission, *Recommended international code of practice – general principles of food hygiene* (CAC/RCP 1-1969, Rev. 4 (2003)) [1];
- United States Food and Drug Administration, *Current good manufacturing practice in manufacturing, packing, or holding human food,* 21 CFR Part 110 [4];
- national corresponding standards, especially those based on CAC/RCP 1-1969, Rev.4 (2003) [1], such as those developed in Jordan, Syria and member countries of the Gulf Cooperation Council.

The following measures and conditions of a typical and generally accepted prerequisites programme are largely based on the Codex Alimentarius Commission's *Recommended international code of practice – general principles of food hygiene* [1].

Management and supervision

The type of control and supervision needed depends on the size of the business, the nature of its activities and the types of food involved. It is vital that managers and supervisors, who are responsible in the first place to ensure the quality and safety of food products, have enough knowledge of food hygiene principles and practices to be able to judge potential risks, take appropriate preventive and corrective action, and ensure that effective monitoring and supervision takes place.

Facilities

Effective hazard control requires attention to good hygienic design and construction, appropriate location, and the provision of adequate facilities. Depending on the nature of the operations and the risks associated with them, premises, equipment and facilities should be located, designed and constructed to ensure that:

- the establishment is located, constructed and maintained in accordance with sanitary design principles;

- there is a linear (one way) product flow and traffic control to minimize direct or indirect cross-contamination from raw to cooked materials;
- other forms of contamination are minimized;
- design and layout permit appropriate maintenance, cleaning and disinfection and minimize airborne contamination;
- surfaces and materials, in particular those in contact with food, are non-toxic and, where necessary, suitably durable and easy to maintain and clean;
- where appropriate, suitable facilities are available for temperature, humidity and other controls;
- effective pest control measures are in place.

Supplier control

An establishment should identify and specify quality and safety requirements of incoming materials used directly in production, such as raw materials, ingredients and materials used in cleaning, disinfection and packaging, and should not accept any material if it contains hazards, or decomposed or extraneous substances. Where appropriate, supplier evaluation should be carried out and approved suppliers identified.

Raw materials or ingredients should be inspected and sorted before processing. Where necessary, laboratory tests should be carried out to establish fitness for use. Only sound, suitable raw materials or ingredients should be used. Stocks of raw materials and ingredients should be subject to effective store and stock control. Proper supplier control requires documentation of specifications for ingredients and packaging materials, and the development of a supplier approval system that culminates in the preparation of an approved supplier list.

Production equipment

Equipment and containers coming into contact with food should have the following characteristics:

- they should be designed and constructed to ensure that they can be adequately cleaned, disinfected and maintained to avoid the contamination of food;
- they should be manufactured from non-toxic materials;
- they should be durable and portable or capable of being disassembled to allow for maintenance, cleaning, disinfection, monitoring and other reasons, for example to facilitate inspection for pests;
- they should be located so that they:
  - permit adequate maintenance and cleaning;
  - function in accordance with their intended use;
  - facilitate good hygiene practices, including monitoring.

Maintenance, cleaning and sanitation

Adequate facilities, suitably designated, should be provided for cleaning food, utensils and equipment. Such facilities should have an adequate supply of hot and cold potable water where appropriate. Establishments and equipment should be kept in an appropriate state of repair and condition in order to:

- facilitate all sanitation procedures;
- function in accordance with their intended use, particularly at critical steps;
- prevent physical contamination of food, e.g., from metal shards, flaking plaster, debris or chemicals.

Cleaning should remove food residues and dirt, which may be a source of contamination. The necessary cleaning methods and materials will depend on the nature of the food business. Disinfection of utensils and equipment may be necessary after cleaning. Chemicals used in cleaning should be handled and used carefully and in accordance with manufacturers' instructions, and stored separately from food in clearly identified containers to avoid the risk of contaminating food. Physical methods such as heat, scrubbing, turbulent flow, or vacuum cleaning, and chemical methods using detergents, alkalis or acids may be used separately or in combination. Cleaning procedures should involve, where appropriate:

- removing debris from surfaces;
- application of a detergent solution to loosen soil and bacterial film;
- rinsing with water that complies with local or international standards for drinking water [5];
- dry cleaning or other appropriate methods for removing and collecting residues and debris;
- disinfection (where necessary).

Cleaning and disinfection programmes should ensure that all parts of the establishment are appropriately clean, including the cleaning of equipment used for cleaning. They should be continually and effectively monitored for their suitability and effectiveness and should be documented to specify:

- areas, items of equipment and utensils to be cleaned;
- responsibility for particular tasks;
- method and frequency of cleaning;
- monitoring arrangements.

Pest control

Effective pest control should be in operation at all times, because pests pose a major threat to the safety and suitability of food. Pest infestations can occur where there are

breeding sites and a supply of food, so good hygiene practices should be employed to avoid creating an environment conducive to pests. Good sanitation, inspection of incoming materials, and good monitoring can minimize the likelihood of infestation and thereby limit the need for pesticides. A comprehensive pest control programme should cover:

- *Access prevention*
  Buildings should be kept in good repair and condition. Holes, drains and other places where pests are likely to gain access should be kept sealed. Wire mesh screens, for example on open windows, doors and ventilators, can reduce the problem of pest entry. Animals should be excluded from the grounds of factories and food processing plants.

- *Harbourage and infestation*
  The presence of food and water encourages pest harbourage and infestation. Food sources should be stored in pest-proof containers and/or stacked above the ground and away from walls. Food premises should be kept clean, inside and out. Where appropriate, refuse should be contained in covered, pest-proof receptacles.

- *Monitoring and detection*
  Establishments and surrounding areas should be regularly examined for evidence of infestation.

- *Eradication of pests*
  Infestations should be dealt with immediately and without adversely affecting food safety or suitability. Treatment with chemical, physical or biological agents should be carried out without posing a threat to the safety or suitability of the food.

Waste management

Adequate drainage and waste disposal systems and facilities should be provided. They should be designed and constructed in such a way that the risk of contaminating food or the potable water supply is eliminated. Suitable provision must be made for the removal and storage of waste. Waste must not be allowed to accumulate in food handling, food storage, and other working areas and the adjoining environment. Waste stores must be kept appropriately clean.

Personal hygiene

Individuals who do not maintain an appropriate degree of personal cleanliness, who have certain illnesses or conditions, or who behave inappropriately can contaminate

food and transmit illness to consumers. To ensure that those who come directly or indirectly into contact with food are not likely to contaminate it personal hygiene must be practised by:

- maintaining an appropriate degree of personal cleanliness;
- behaving and operating in an appropriate manner, e.g., by avoiding jesting and joking.

Hygiene facilities should be available to ensure that an appropriate degree of personal hygiene can be maintained. Where appropriate, facilities should include:

- wash basins and a supply of hot and cold or suitably temperature-controlled water;
- soap and paper towels;
- lavatories of appropriate hygienic design;
- adequate changing facilities for personnel.

Such facilities should be suitably located and designated. All employees and other persons who enter the manufacturing plant should follow the requirements for personal hygiene.

Food handlers should maintain a high degree of personal cleanliness and wear suitable protective clothing, head covering, and footwear. Cuts and wounds should be covered by a visible waterproof dressing. Personnel should always wash their hands when personal cleanliness may affect food safety, for example:

- at the start of food handling activities;
- immediately after using the lavatory;
- after handling raw food or any contaminated material.

Avoid handling ready-to-eat food, where appropriate.

Health status

People known or suspected to be suffering from, or to be a carrier of, a disease or illness likely to be transmitted through food should not be allowed to enter any food handling area if there is a likelihood of them contaminating the food. Any person so affected should immediately report illness or symptoms of illness to the management. A medical examination of a food handler should be carried out if a food handler shows any clinical or epidemiological symptoms. Conditions that should be reported to management so that any need for medical examination and/or possible exclusion from food handling can be considered include:

- jaundice;
- diarrhoea;
- vomiting;
- fever;

- sore throat with fever;
- visibly infected skin lesions (boils, cuts, etc.);
- discharges from the ear, eye or nose.

Personal behaviour

People engaged in food handling activities should refrain from behaviour that could result in contamination of food, for example:

- smoking;
- spitting;
- chewing or eating;
- sneezing or coughing over unprotected food.

Personal effects such as jewellery, watches, pins or other items should not be worn or brought into food handling areas if they pose a threat to the safety and suitability of food.

Visitors

Visitors to food manufacturing, processing, or handling areas should, where appropriate, wear protective clothing and adhere to the other personal hygiene provisions in this section.

Chemical control

Documented procedures must be in place to ensure the segregation and proper use of non-food chemicals in the plant. These include cleaning chemicals, fumigants, and pesticides or baits used in or around the plant.

Receiving, storage and shipping

All raw materials and products should be stored under sanitary conditions and the proper environmental conditions (such as correct temperature and humidity) to ensure their safety and wholesomeness.

Cross-contamination

Pathogens can be transferred from one food to another, either by direct contact or by food handlers, contact surfaces, or the air. Raw, unprocessed food should be effectively separated, either physically or in time, from ready-to-eat foods, with effective intermediate cleaning and, where appropriate, disinfection. Access to processing areas may need to be restricted or controlled. Where risks are particularly high, access to processing areas should be exclusively via a changing facility. Personnel and visitors may need to put on clean protective clothing including footwear and wash their hands before entering.

Surfaces, utensils, equipment, fixtures, and fittings should be thoroughly cleaned and, where necessary, disinfected after raw food, particularly meat and poultry, has been handled or processed.

Packaging

Packaging design and materials should provide adequate protection for products to minimize contamination, prevent damage, and accommodate proper labelling. Non-toxic packaging materials (or gases) must be used so that they do not pose a threat to the safety and suitability of food under the specified conditions of storage and use. Where appropriate, reusable packaging should be suitably durable and easy to clean and, if necessary, disinfect.

Training

Training is fundamentally important to any food hygiene system. Any persons engaged in food operations that come directly or indirectly into contact with food should be trained and/or instructed in food hygiene to a level appropriate to the operations they are to perform. Inadequate hygiene training, instruction or supervision can pose a potential threat to the safety of food and its suitability for consumption.

Awareness and responsibilities

All personnel should be aware of their roles and responsibilities in protecting food from contamination or deterioration. Food handlers should have the necessary knowledge and skills to enable them to handle food hygienically. Those who handle strong cleaning chemicals or other potentially hazardous chemicals should be instructed in safe handling techniques.

Training programmes

Factors to take into account in assessing the level of training required include:

- the nature of the food, in particular its ability to sustain growth of pathogenic or spoilage microorganisms;
- the manner in which the food is handled and packed, including the probability of contamination;
- the extent and nature of processing or further preparation before final consumption;
- the conditions under which the food will be stored and the expected length of time before consumption.

Instruction and supervision

Periodic assessments of the effectiveness of training and instruction programmes should be made, as well as routine supervision and checks to ensure that procedures are being carried out effectively. Managers and supervisors of food processes should have the necessary knowledge of food hygiene principles and practices to be able to judge potential risks and take the necessary action to remedy deficiencies.

Refresher training

Training programmes should routinely be reviewed and updated where necessary. Systems should be in place to ensure that food handlers remain aware of all procedures necessary to maintain the safety and suitability of food. All employees should receive documented training in personal hygiene, principles of food hygiene (GMP), cleaning and sanitation procedures, personal safety, and their role in the HACCP programme.

Traceability and recall

Effective procedures should be in place to deal with any food safety hazard and to enable the complete rapid recall of any implicated lot of the finished food from the market. These systems and plans must be periodically tested to ensure that they are comprehensive and serve to remove an unsafe product from consumers and/or the distribution chain. However, food businesses should expand their recall and traceability systems to encompass product issues not involving food safety.[1]

Where a product has been withdrawn because of an immediate health hazard, other products that are produced under similar conditions and that may present a similar hazard to public health should be evaluated for safety and may need to be withdrawn. The need for public warnings should be considered. Recalled products should be held under supervision until they are either destroyed, used for purposes other than human consumption, determined to be safe for human consumption, or reprocessed in a manner to ensure their safety.

All raw materials and products should be lot-coded and a recall system should be in place so that rapid and complete traces and recalls can be performed when product retrieval is necessary. Prepackaged foods should be labelled with clear information about the product and lot identification.

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[1] This section is largely based on Food Safety Authority of Ireland, *Guidance note no. 10: product recall and traceability* [6], and is reproduced with kind permission of the Food Safety Authority, Ireland.

Table 1. Guide to the scope of a traceability system

Business engagement	Traceability system required
Catering and supply of food direct to the consumer	Supplier, process
Catering and supply of food to other catering business	Supplier, process, customer
Retail supply of food to consumers	Supplier
Wholesale supply of local or imported food to other food business	Supplier, process, customer
Processing and supply of food to other food business	Supplier, process, customer

Traceability

A reliable traceability system is the means by which a food company can track and trace any foodstuff that is unsafe. The objective of a food traceability system is to identify a unique batch of product and the raw materials used in its production and then follow that batch and each individual unit from the batch through the production and distribution process to the immediate customer.

When creating a traceability system, its scope should first be defined. Suppliers, processes or customers may be traced. Table 1 shows examples for various types of food business.

Documenting the traceability system

Every traceability system developed by a food business should be documented. Documents should include the scope of the system, details of the system, and any associated operational documentation and review arrangements. Figure 3 outlines the key elements of traceability systems.

Ensuring **supplier traceability** is the first step in the development of a traceability system.

- *Supplier traceability for processing and catering businesses*
  Each processor or caterer should be able to ensure that foodstuffs and packaging entering the premises are traceable to the supplier.

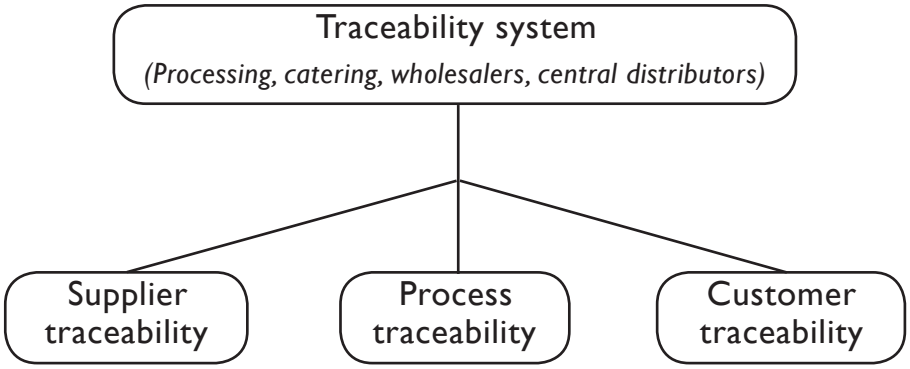

Figure 3. Steps needed to establish a traceability system

- *Supplier traceability for wholesalers, central distribution centres and retail food businesses*
  Each wholesaler, central distribution centre, or retailer should at least be able to ensure that foodstuffs in their control are traceable to the supplier.

Process traceability is the second step in the development of a traceability system.

- *Process traceability for processing and catering businesses*
  Each processing or catering food business should be able to ensure that foodstuffs produced on site can be traced back to the ingredients and primary packaging used in their manufacture. Processors involved in re-wrapping products for the local market should ensure that traceability to the original supplier is maintained.

- *Process traceability for wholesale, central distribution centres and retail food businesses*
  Each wholesale, central distribution centre, or retail food business should at least be able to ensure that foodstuffs handled on site are traceable to the supplier at all times.

Customer traceability is the third step in the development of a traceability system.

- *Customer traceability for all processors and those caterers involved in business-to-business trade*
  Each processor or catering food business involved in business-to-business trade should be able to ensure that foodstuffs leaving the control of the business are traceable to the immediate customer.

- *Customer traceability for wholesalers and central distribution centres*
  Each wholesaler or central distribution centre food business should be able to ensure that foodstuffs leaving the control of the business are traceable to the immediate customer.

Reviewing the traceability system

A system that is being operated by a food business should be reviewed at least yearly to ensure that it is delivering the required level of traceability.

Recall

The objective of product recall is to protect public health by informing consumers (where necessary) of the presence on the market of a potentially hazardous foodstuff and by facilitating the efficient, rapid identification and removal of unsafe foodstuffs from the distribution chain, to ensure that the unsafe foodstuffs are either destroyed or rendered safe.

Classification of the level of product recall

Where food safety is concerned there are only two levels of product recall. These are:

Recall – the removal of unsafe food from the distribution chain that extends to food sold to consumers, and therefore involves communication with consumers.

Withdrawal – the removal of an unsafe foodstuff from the distribution chain that does not extend to food sold to the consumer.

> If a food business becomes aware or is notified of a potential food safety incident, all necessary action must be taken to protect public health.

The objective of a product recall procedure is to facilitate the efficient and effective removal of unsafe foodstuffs from the market. There are seven steps to a product recall procedure.

1. *Development of a product recall policy*
   A product recall policy demonstrates the company's commitment to protect public health. It should clearly state the objective of the product recall plan and the senior management's commitment to providing the necessary resources to ensure successful removal of unsafe foodstuffs from the market.

2. *Development of a product recall plan*
   A product recall plan is a documented procedure designed to ensure the professional, efficient and effective removal of unsafe food from the market. A multi-disciplinary recall team should develop the product recall plan. Examples of elements that may be incorporated into a plan are:
   - reference to the product recall policy;
   - list of members of the recall team;
   - definition of roles and responsibilities for product recall (Figure 4);
   - contact names and details including home telephone or mobile phone numbers;
   - definitions of the two classifications of a product recall (recall and withdrawal);
   - a product recall decision tree;[2]
   - mechanisms of notification of a product recall;
   - reference to the company's traceability system;
   - guidelines for media contact;
   - sample press releases;
   - sample product recall notices;
   - a product recall review procedure.

3. *Testing of a product recall plan.*

4. *Notification and initiation of a product recall.*

5. *Management of a product recall.*

6. *Closing a product recall.*

7. *Review of a product recall and amendment of the product recall plan.*

Notification of a product recall

If the decision is taken to initiate a withdrawal then three levels of notification are advised:

- within the company
- distribution chain – distributors, wholesalers, retailers, caterers
- regulatory authorities.

[2] The decision tree should be designed to clarify the thought processes leading to a final decision on the necessity of product recall and the appropriate type of product recall. Figure 5 shows an example of a typical decision tree. however, food businesses should draw up a decision tree applicable to their own business and management structure.

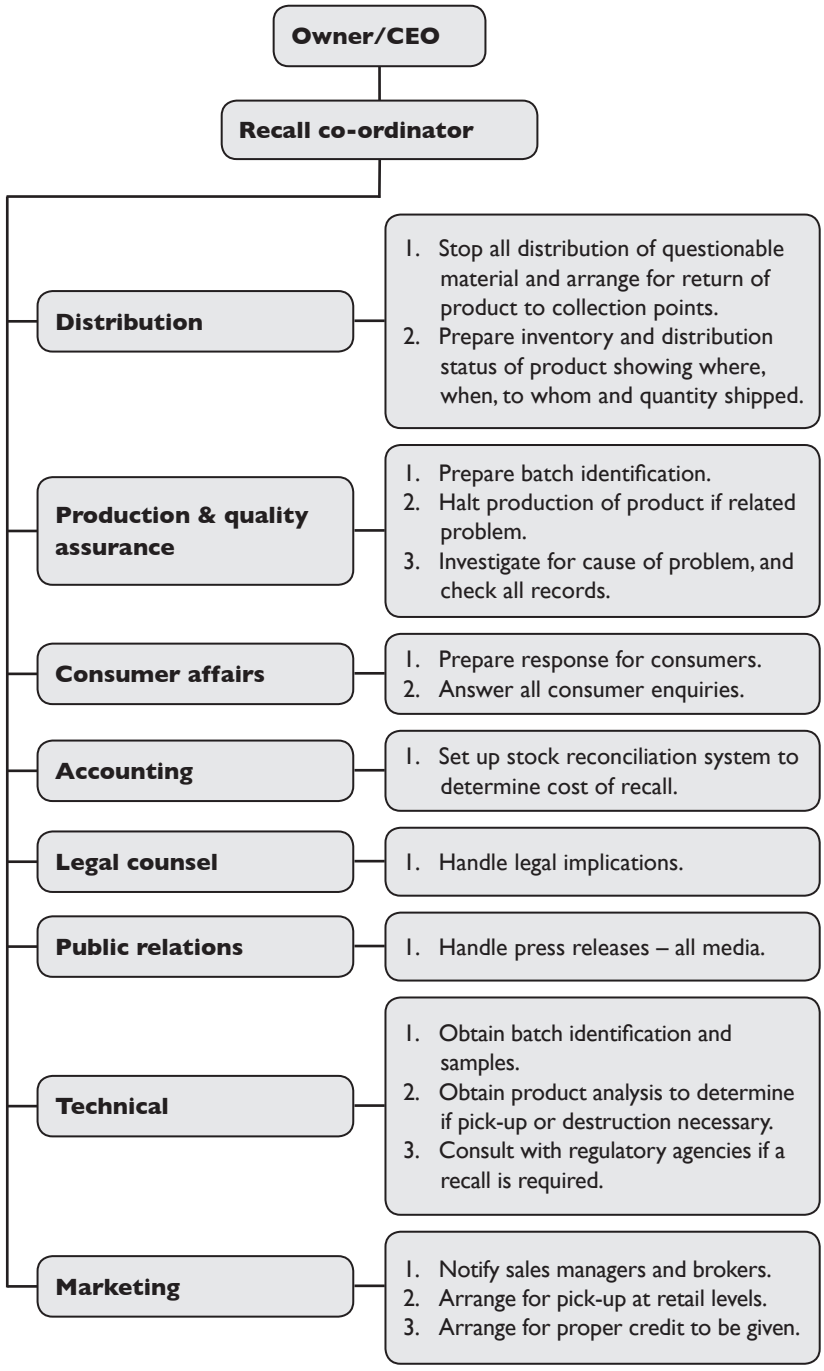

Figure 4. Example of a role and responsibility chart [6]

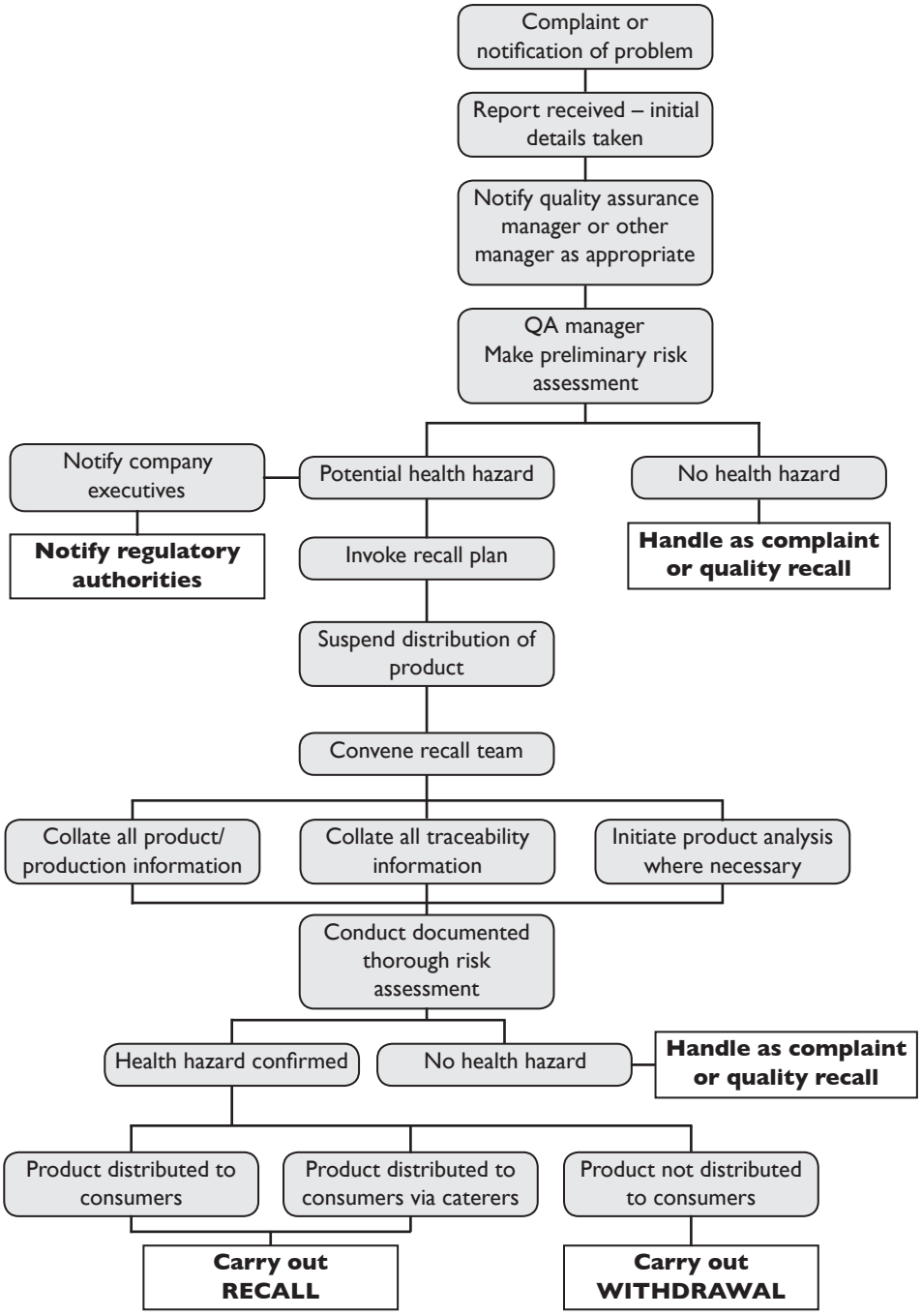

Figure 5. Example of a product recall decision tree [6]

If the decision is taken to initiate a recall then four levels of notification are advised:
- within the company
- distribution chain – distributors, wholesalers, retailers, caterers
- regulatory authorities
- consumers.

Companies should notify the regulatory agencies prior to commencing the product recall, and supply them with the following information:
- name of the company and contact details, plus alternative contacts
- name of the product
- batch identification codes
- product details including packaging size and type
- 'use by' date or 'best before' date
- amount of unsafe product on the market
- distribution details (e.g., is the product exported?)
- name of companies/outlets selling to the consumer
- nature of the food safety risk
- results of any investigations or tests
- the level of product recall being considered (i.e., recall or withdrawal)
- plans for public communications
- timings for product recall and communication.

Communicating a product recall

- *Trade communication (applicable during a recall or a withdrawal)*
  Initial notification to the trade should be via telephone but this should be followed up by written communication preferably sent by fax or e-mail.

- *Paid advertisements (applicable during a recall or a withdrawal)*
  Paid advertisements are necessary in the case of a recall or in the case of a withdrawal when a company cannot identify all its business customers in the distribution chain.

- *Press release (applicable during recall only)*
  To ensure that information is disseminated as widely as possible, food businesses engaged in a recall, as defined above, should consider a press release in addition to paid advertisements. Press releases have the advantage of reaching the print media and electronic media fast and do not suffer from delays that could accompany a paid advertisement.

Testing and reviewing the product recall plan

The product recall plan should specify the periods for review and the names of the people responsible for the review. The plan should be examined for errors, particularly in the contact lists or in light of any changes in the company product recall policy or trading status. It is recommended that the product recall plan is reviewed at least twice a year following a documented procedure that is part of the product recall plan itself.

Managing a product recall

The management of a product recall should be driven by the product recall plan. The plan should carry all the details necessary for the product recall coordinators to manage a product recall successfully.

- *Sources of information*
  To prevent the miscommunication that often hampers efficient product recall, the product recall team should always get their facts first hand. The information that is gleaned concerning the food safety hazard, the product details, the likely distribution, and the extent of the problem is vital to good decision-making. Training of staff will be necessary to ensure that such information is handled appropriately.

- *Risk assessment*
  Product recall is a risk management decision that requires food businesses to be able to identify a potentially unsafe foodstuff. In addition a business must be able to decide if the unsafe foodstuff can cause a potential risk to public health and if so, determine the level of adverse health effect and the affected population profile and size. This requires a food business to carry out an assessment of the potential risks resulting from the problem with the foodstuff. This is called a risk assessment (see Figure 6). Risk assessments should only be carried out by competent technical people. If in doubt, food businesses are advised to seek suitably competent technical advice and/or the appropriate regulatory authority.

- *Documenting the product recall process*
  All information gathered by product recall team should be documented along with the date, time, and provider of the information.

- *Regaining control of affected stock*
  A food business that has initiated a product recall may regain control of the potentially unsafe product but must account for all missing stock.

- *Closing the product recall*
  A product recall must be formally closed so that it is clear to all parties that the incident has ended. Food businesses should also notify the regulatory authorities in writing when a product recall is closed.

Reviewing the lessons learned

Every product recall should be viewed as an opportunity to learn and improve the systems used in the food business.

Reviewing the product recall process

Food businesses involved in product recall should review the product recall process and evaluate its effectiveness, and amend the product recall plan if necessary. This should be followed by a final report and recommendations.

The production problem

The pH of an acid-preserved foodstuff is too high. The product is distributed at ambient temperature, has a shelf life of one year, does not require re-heating, and has been on sale for one month.

Hazard identification

The bacterium *Clostridium botulinum* could grow during product distribution. *C. botulinum* causes botulism, a condition where a person who eats food in which *C. botulinum* has grown and produced toxin may die.

Exposure assessment

The product conditions and shelf life are suitable for *C. botulinum* to grow and produce toxin. There is no re-heating to degrade the toxin. The consumer is likely to have bought the product. The chances of exposure to *C. botulinum* toxin are high.

Hazard characterization

C. botulinum toxin is one of the most potent neurotoxins known. If the toxin is ingested the chances are high that the consumer will develop severe breathing difficulties and may die.

Risk characterization

The chances of exposure are high and the consequences of exposure potentially lethal. A severe adverse public health effect is likely. It is not possible to quantify the risk or the uncertainties associated with the risk.

Risk management decision

Recall of product from the affected batches with immediate effect.

Figure 6. Example of a risk assessment problem

Guidelines for HACCP system application[3]

Prior to the application of HACCP, the food establishment should be operating according to:

- the Codex *General principles of food hygiene* [1]
- the appropriate Codex codes of practice
- appropriate food safety legislation.

Management commitment is necessary for implementation of an effective HACCP system. During hazard identification, evaluation, and subsequent operations in designing and applying HACCP systems, consideration must be given to the impact of raw materials, ingredients, food manufacturing practices, role of manufacturing processes to control hazards, likely end-use of the product, categories of consumers of concern, and epidemiological evidence relative to safety. HACCP should be applied to each specific operation separately. The application of HACCP principles consists of the tasks identified in the Logic Sequence for Application of HACCP (Figure 7) prepared by the Codex Alimentarius Commission [1].

1 Assemble HACCP team

The appropriate product specific knowledge and expertise should be available for the development of an effective HACCP plan. This is best achieved by assembling a multidisciplinary team. Where such expertise is not available on site, expert advice should be obtained from other sources. The scope of the HACCP plan should he identified.

2 Describe product

A full description of the product should be drawn up, including relevant safety information such as: composition, physical/chemical data (including a_w, pH, etc.), microbial/static treatments (heat-treatment, freezing, brining, smoking, etc.), packaging, durability and storage conditions and method of distribution.

3 Identify intended use

The intended use should be based on the expected uses of the product by the end user or consumer. In specific cases, e.g., institutional feeding, vulnerable groups of the population may have to be given special consideration.

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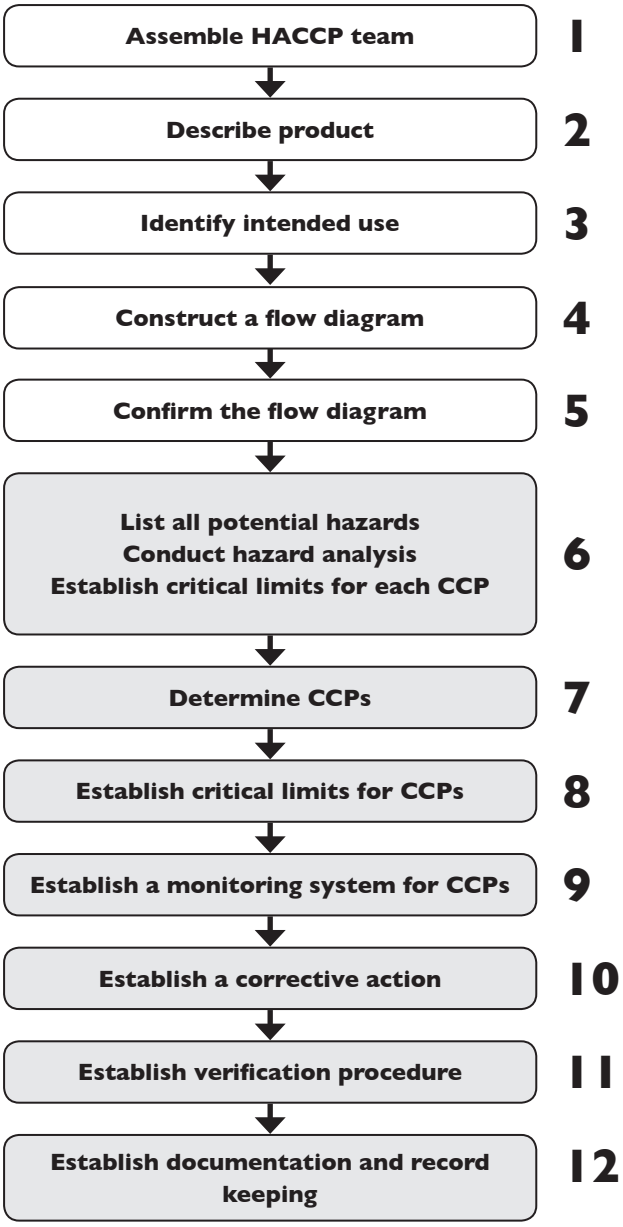
[3] This section is largely based on the Codex Alimentarius Commission's (1997) *Guidelines for the application of the Hazard Analysis and Critical Control Point (HACCP) system* [1].



Note: Steps 6–12 are the application of the seven principles of the HACCP system

Figure 7. Logic sequence for application of HACCP [1]

4 Construct flow diagram

A flow diagram covering all steps in a given operation should be constructed by the HACCP team.

5 On-site confirmation of flow diagram

The HACCP team should confirm the processing operation against the flow diagram during all stages and hours of operation and amend the flow diagram where appropriate.

6 List all potential hazards associated with each step, conduct a hazard analysis, and consider any measures to control identified hazards (HACCP Principle 1)

Hazard is defined as a chemical, biological, or physical agent in, or a condition of, food with the potential to cause an adverse health effect, while hazard analysis is the process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety and should therefore be addressed in the HACCP plan. Chemical hazards include residues of pesticides and veterinary drugs, certain non-GRAS (generally recognized as safe) additives and preservatives, toxic metals, and chemicals from cleaning (Table 2). Biological hazards include disease-causing microorganisms such as bacteria, viruses, parasites and fungi, and also certain plants and fish that carry toxins. Table 3 shows the most significant food-borne biological hazards that may occur in food, while Appendix 1 gives more detailed information about their growth limits. Physical hazards include dirt, hair, broken glass and crockery, nails, staples, metal fragments or bits of packaging materials that accidentally enter food (Table 4).

The HACCP team should list all of the hazards that may be reasonably expected to occur at each step of the process and then conduct a hazard analysis to identify for the HACCP plan which hazards are of such a nature that their elimination or reduction to acceptable levels is essential to the production of a safe food. The team must then consider what control measures, if any, exist that can be applied for each hazard.

Table 2. Chemicals used in food processing

Point of use	Type of chemical
Growing crops	Pesticides, herbicides, defoliants
Raising livestock	Growth hormones, antibiotics
Production	Food additives, processing aids
Plant maintenance	Lubricants, paints, solvents
Plant sanitation	Cleaners, sanitizing agents, pesticides

Table 3. Some food-borne biological hazards

Bacteria	**Parasites**	**Seafood toxins**
Aeromonas hydrophila	*Anisakis* spp.	Ciguatera fish poisoning
Bacillus cereus	*Ascaris lumbricoides*	Gempylotoxin
Brucella spp.	*Cyclospora cayetanensis*	Tetrodotoxin
Campylobacter jejuni	*Cryptosporidium parvum*	Scombrotoxin (histamine)
Clostridium botulinum	*Diphyllobothrium* spp.	Paralytic, neurotoxic and diarrhetic shellfish poisoning
Clostridium perfringens	*Entamoeba histolytica*	
Listeria monocytogenes	*Giardia lamblia*	
Pathogenic *Escherichia coli*	*Taenia* spp.	**Viruses**
Plesiomonas shigelloides		Hepatitis A virus
Salmonella spp.	**Mycotoxigenic moulds**	Polioviruses
Shigella spp.	*Aspergillus* spp.	Norwalk virus group
Staphylococcus aureus	*Fusarium* spp.	
Streptococcus pyogenes	*Penicillium* spp.	
Vibrio cholerae		
V. parahaemolyticus		
V. vulnificus		
Yersinia enterocolitica		

Table 4. Examples of physical hazards and their sources

Physical hazard	**Source**
Metal	Bolts, nuts, screws, screens/sieves, steel wool
Glass	Light bulbs, watch crystals, thermometers, etc.
Wood splinters	Pallets, equipment bracing, overhead structure
Insects	Environment, electrocution traps, incoming ingredients
Hair	Meat ingredients, employees, clothing, rodents
Mould	Poor sanitation, inadequate cleaning of equipment
Rodents/droppings	Inadequate rodent controls, incoming ingredients
Dirt, rocks	Raw materials, poor employee practices
Paint flakes	Equipment, overhead structure
Band-aid	Poor employee practices
Pen caps	Poor employee practices
Carcass ID tags	Slaughterhouse
Hypodermic needles	Veterinarian
Bullets/shot/BBs	Animals shot while in fields
Feathers	Poor sanitation, inadequate pest (bird) controls
Gasket material	Inadequate preventive maintenance of equipment
Grease	Poor equipment maintenance programme

7 *Determine Critical Control Points (CCPs)* (HACCP principle 2)

A Critical Control Point (CCP) is a step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level. If a hazard has been identified at a step where control is necessary for safety, and no control measure exists at that step, or any other, then the product or process should be modified at that step, or at any earlier or later stage, to include a control measure. The determination of a CCP in the HACCP system can be facilitated using a decision tree (Figures 8 and 9).

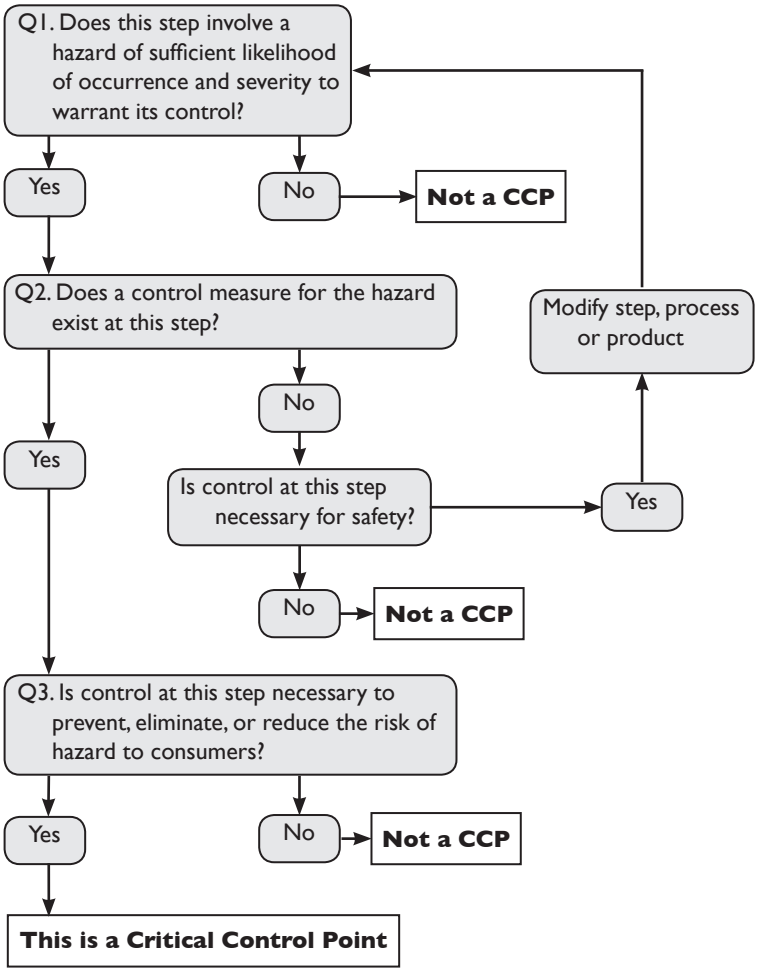


Figure 8. Example 1 of HACCP decision tree [3]

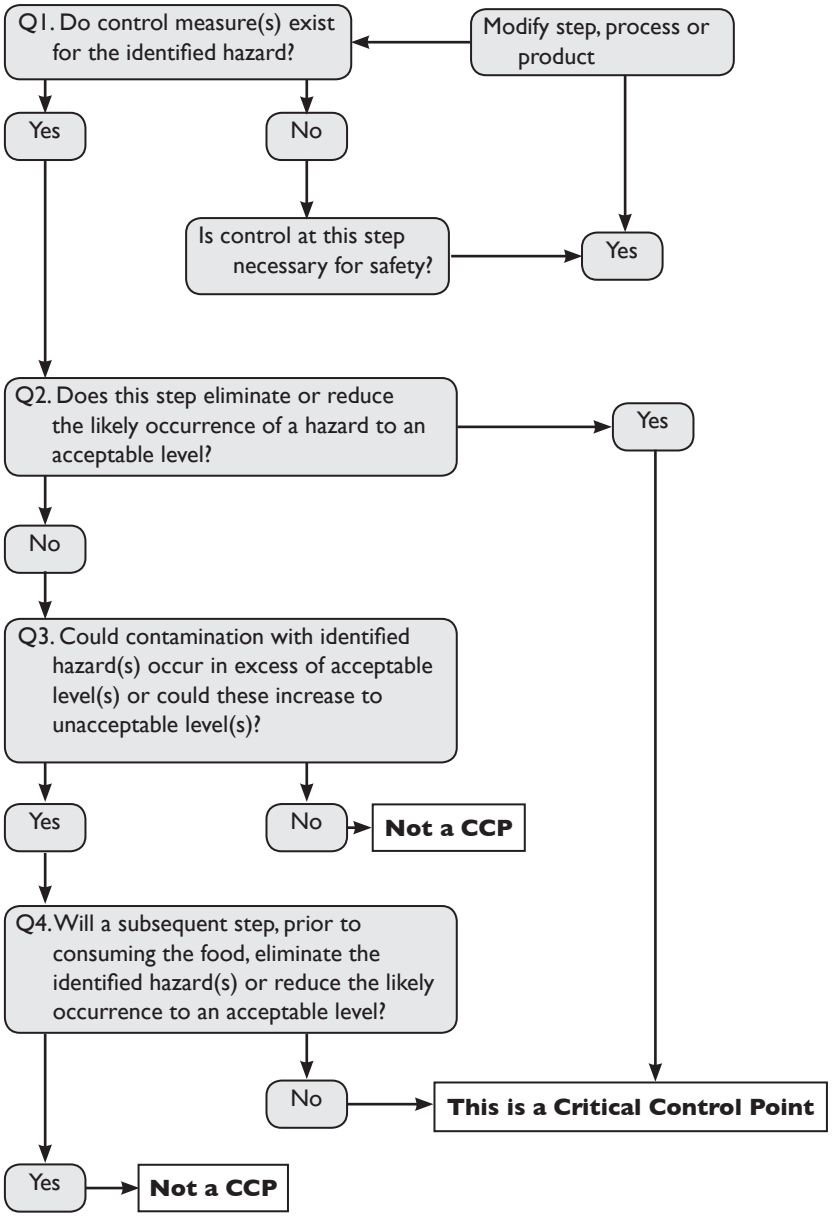


Figure 9. Example 2 of HACCP decision tree [1]

8 Establish critical limits for each CCP (HACCP principle 3)

The critical limit is the criterion that separates acceptability from unacceptability. Critical limits must be specified and validated if possible for each critical control point. In some cases more than one critical limit will be elaborated at a particular step. Criteria often used include measurements of temperature, time, moisture level, pH, a_w, available chlorine, and sensory parameters such as visual appearance and texture.

9 Establish a monitoring system for each CCP (HACCP principle 4)

Monitoring is the act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control. Monitoring procedures must be able to detect loss of control at the CCP. Further, monitoring should ideally provide this information in time to make adjustments to ensure control of the process to prevent violating the critical limits. The task or test, the frequency of testing and the persons responsible for carrying out the task should be detailed in the monitoring procedure. Most monitoring procedures for CCPs will need to be done rapidly because they relate to on-line processes and there will not be time for lengthy analytical testing. Physical and chemical measurements are often preferred because they may be done rapidly.

10 Establish corrective actions (HACCP principle 5)

Specific corrective actions must be developed for each CCP in the HACCP system in order to deal with deviations when they occur. The actions must ensure that the CCP has been brought under control. Actions taken must also include proper disposal of the affected product.

11 Establish verification procedures (HACCP principle 6)

Verification activities that can be used to determine if the HACCP system is working correctly include:

1. Review of the HACCP system and its records.
2. Review of deviations and product dispositions.
3. Confirmation that CCPs are kept under control.
4. Auditing methods, procedures and tests.
5. Random sampling and analysis.
6. System validation (ensuring development of a documented system that meets all Codex requirements, and updating the system when changes are made in processes, steps or materials used in production).

12 Establish documentation and record keeping (HACCP principle 7)

Efficient and accurate record keeping is essential to the application of a HACCP system. HACCP procedures should be documented. Documentation and record keeping should be appropriate to the nature and size of the operation. Documentation examples are:

- hazard analysis
- CCP determination
- critical limit determination.

Record examples are:

- CCP monitoring activities
- deviations and associated corrective actions
- modifications to the HACCP system.

Generic HACCP models

Merits and advantages

A principal characteristic of the HACCP system is that it is applied to each process of food production individually. This makes it possible to prepare generic HACCP models that can be applied to the production process of a particular food.

The idea of developing generic HACCP models is that these models, after being adopted by a regulatory or private agency engaged with food safety, can be used as templates for all relevant food sectors. In this way establishments concerned with the implementation are spared the time, effort and cost of developing the system themselves. Furthermore, implementing generic models has the advantage of creating a high level of uniformity among those who apply the system.

Generic models can be used as a part of the material for training in the HACCP system, and as a reference for inspection. Experience gained in the first implementations of generic models, including avenues for improvement, can be incorporated into later applications of the model.

As with most generic systems, HACCP models have the disadvantage of not being tailored to the individual establishments planning to apply the HACCP system. So the generic models should be reviewed and refined, and applied only after making adjustments to meet the needs and peculiarities of the establishment applying the system.

Development of generic HACCP models

The concept of developing generic HACCP system models by governmental agencies responsible for control of food safety has been internationally acknowledged. The USA, Canada, and New Zealand are among the countries in which generic HACCP models have been developed. The first generic HACCP models to be developed were the American and the Canadian models for high risk foods (mostly of animal origin). These products are often for export, and are more frequently associated with food-borne illness outbreaks.

The Food Safety and Inspection Service (FSIS), the agency within the United States Department of Agriculture responsible for ensuring the safety, wholesomeness, and accurate labelling of meat, poultry and egg products, issued its landmark rule, *Pathogen reduction; hazard analysis and critical control point (HACCP) systems; final rule* [8] on July 25, 1996. The rule requires all meat and poultry plants to develop and implement a system of preventive controls (HACCP), and to assist in this process FSIS developed its own generic HACCP models. *A Guidebook for the preparation of HACCP plans* [9] and other materials to help in the implementation and maintenance of the system have been published, and are available online or as hard copy. Table 5 lists the generic HACCP models developed in the USA by the FSIS. Details of these models can be found at the FSIS website: http://www.fsis.usda.gov/Science/HACCP_Models/index.asp (accessed 28 March 2007).

In Canada, the Food Safety Enhancement Program (FSEP) of the Canadian Food Inspection Agency (CFIA) developed generic HACCP models that cover all federally registered establishments of the meat, dairy, honey, maple syrup, processed fruit and vegetable, shell egg, processed egg and poultry hatchery sectors. Table 6 lists the generic models developed in Canada by the FSEP.

Details of these models can be found at the following website: http://www.inspection.gc.ca/english/fssa/polstrat/haccp/haccpe.shtml (accessed 28 March 2007). Generic HACCP plans for many other foods, especially seafoods, have subsequently been developed and may be located easily on the internet. However, generic HACCP models for the traditional foods of many countries are still scarce. This manual has been developed for the countries of the Eastern Mediterranean Region in order to alleviate this shortfall.

Table 5. Generic HACCP models developed in the USA by the Food Safety and Inspection Service/U.S. Department of Agriculture

1. Raw, ground meat and poultry products
2. Raw, not ground meat and poultry products
3. Poultry slaughter
4. Mechanically separated (species)/ mechanically deboned poultry
5. Thermally processed, commercially sterile meat and poultry products
6. Irradiated, raw meat and poultry products
7. Meat and poultry products with secondary inhibitors, not shelf-stable
8. Heat treated, shelf-stable meat and poultry products
9. Heat treated but not fully cooked, not shelf-stable meat and poultry products
10. Cooked, not shelf-stable meat and poultry products
11. Beef slaughter
12. Pork slaughter
13. Not heat treated, shelf-stable meat and poultry products

Table 6. Generic HACCP models developed in Canada by the Food Safety Enhancement Program/Canadian Food Inspection Agency

Meat and poultry products
1. Beef slaughter – slaughter operations for all red meat species (except hog)
2. Boneless beef – red meat boning operations
3. Cooked sausage – cooked, cured, ready-to-eat meat products e.g., wieners, bologna
4. Meat spread (cretons) – cooked, pasteurized meat products requiring refrigeration for preservation e.g., head cheese, cretons
5. Fermented smoked sausage – dry fermented meat products, sausages e.g., salami, and some types of pepperoni
6. Assembled meat product (pizza) – multi commodity food products with or without meat e.g. pizza, submarines, sandwiches
7. Dried meat (beef jerky) – non-fermented dried cured meat products e.g., beef jerky
8. Cooked/sliced ham – cooked, sliced meat packaged after heat treatment e.g., luncheon meats
9. Ready to eat poultry products: (fully cooked chicken wings) – cooked, ready-to-eat poultry products e.g., chicken wings, drumsticks
10. Ready to cook poultry products: (chicken breast fillets) – raw or partially cooked, may be cured e.g., seasoned or breaded breasts, fingers
11. Chinese style dried sausage – cured/dried sausages (not ready to eat)
12. Mechanically separated meat (chicken) – mechanically separated or deboned meat products
13. Poultry slaughter (chilled ready to cook whole chicken) – poultry slaughter operations e.g., turkey, Cornish hens, fowl
14. Hog slaughter – hog slaughter operations
15. Ready to cook poultry products (seasoned, formed, breaded chicken burger) – poultry products such as burgers, nuggets
16. Prosciutto (salted ham) – cured hind leg of pork, prepared in accordance with a variety of traditions
17. Fresh/frozen stored products (meat, non-meat, food, non-food)
Processed products (fruits, vegetables, honey, maple)
18. Low acid canned food – canned vegetables, meats and milk products
19. Acidified low acid – includes pickles, pork tongue in vinegar
20. Frozen vegetables – frozen fruits and vegetables
21. Aseptic fruit juice – aseptically packaged fruit and most vegetable juices
22. Pasteurized honey – honey operations that pasteurize and package
23. Maple syrup – maple product operations that heat treat and package
Dairy products
24. Unsalted butter – butter products e.g., salted, unsalted, light, dairy spreads and blends
25. Ice cream – frozen dairy products e.g., light ice cream, ice milk, frozen yogurt
26. Soft-serve ice cream – frozen dairy product mixes e.g. includes soft-serve yogurt, milk shake mix
27. UHT milk – ultra-high temperature-treated milk products which are aseptically packaged and do not require refrigeration for preservation e.g., UHT cream, UHT milk shakes

Appendix 1. Growth limits for some biological food-borne hazards

Microorganism / hazard	Temp. °C			pH		
	Min.	Opt.	Max.	Min.	Opt.	Max.
Aeromonas spp.	>0, <4	28–35	>42, <45	<4.5	7.5	–
Bacillus cereus	4	30–40	55	5	6.0–7.0	8.8
Brucella spp.	6	37	42	4.5–5.1	7.3–7.5	8.2–8.8
Campylobacter spp.	32	42–43	45	4.9	6.5–7.5	~9
Clostridium perfringens	12	43–47	50	5.5–5.8	7.2	8.0–9.0
Intestinally pathogenic *E. coli*	~7–8	35–40	~44–46	4.4	6–7	9
Listeria monocytogenes	-0.4	37	45	4.39	7	9.4
Salmonellae spp.	5.2	35–43	46.2	3.8	7–7.5	9.5
Shigella sonnei	6.1	–	47.1	4.9	–	9.34
S. flexneri	7.9	–	45.2	5	–	9.19
Staphylococcus aureus growth	7	37	48	4	6–7	10
S. aureus toxin production	10	40–45	48	4.5	7–8	9.6
Streptococcus pyogenes	10–15	37	>40, <45	4.8	7	<9.3
Aspergillus flavus growth	10–12	33	43	2	5–8	>11
A. flavus aflatoxin production	13	16–31	31–37			
A. parasiticus growth	12	32	42	2	5–8	>11
A. parasiticus aflatoxin production	12	25	40	2	6	>8
A. ochraceus growth	8	24–31	37	2.2	3–8	13
A. ochraceus ochratoxin production	12	31	37			
A. ochraceus penicillic acid production	10	16	31			
A. versicolor growth	9	25	35–40	3.1	4–8	0
A. versicolor Sterigmatocystin production	nk	nk	nk			
Fusarium equiseti growth	nk	nk	nk	<3.3	5.0–8.0	>10.4
F. graminearum growth	nk	24–26	nk	<2.4	6.0–8.0	>10.2
F. moniliforme growth	2.5–5	22.5–27.5	32–37	<2.5	5.5–7.5	>10.6
Penicillium citreonigrum growth	<5	20–24	37–>37	<2.2	5.0–6.5	>10
P. citreonigrum citreoviridin production	10	20	37	nk	nk	nk
P. citrinum growth	5–7	26–30	37–40	<2.2	5.0–7.0	>9.7
P. citrinum citrinin production	<15	30	37	nk	nk	nk
P. verrucosum growth	0	20	31	<2.1	6.0–7.0	>10.0
P. verrucosum ochratoxin A production	0	20	31	nk	nk	nk
P. verrucosum citrinin production	<12	–	>25	nk	nk	nk
Vibrio cholerae	10	37	43	5	7.6	9.6
V. parahaemolyticus	5	37	43	4.8	7.8–8.6	11
V. vulnificus	8	37	43	5	7.8	10
Yersinia enterocolitica	-1.3	25–37	42	4.2	7.2	Growth at 9.6, no growth at 10

Compiled from data in *Microorganisms in foods 5: Microbiological specifications of food pathogens* [7]

nk = not known

a_w			Salt (NaCl)%			Oxidation/reduction potential
Min.	Opt.	Max.	Min.	Opt.	Max.	
			–	1–2	>5, <6	
			0.93	–	–	
			–	–	<4	
>0.987	0.997	–	–	0.5	1.5	5% O_2 + 10% CO_2
0.97	0.95–0.96			To 5.0, strain variation up to 8%		
0.95	0.995	–				
0.92	–	–				
0.94	0.99	>0.99				
			–	–	5.18	
			–	–	3.78	
0.83 Anaerobic 0.90	0.98	>0.99				<–200mv–>+200mv (optimally +200mv) Anaerobic–aerobic (optimally aerobic)
0.87 Anaerobic 0.92	0.98	>0.99				Anaerobic–aerobic (optimally aerobic 5–20% dissolved O_2)
			–	–	>4, <6.5	
0.8	0.98	>0.99				
0.82	0.95–0.99	>0.99				
0.80–0.83	0.99	>0.99				
0.86	0.95	>0.99				
0.77–0.80	0.95–0.99	>0.99				
0.83	0.95–0.99	>0.99				
0.81	0.9	>0.99				
0.76–0.80	0.93–0.97	>0.99				
nk	nk	nk				
0.92	>0.99	>0.99				
0.9	>0.99	>0.99				
0.87	>0.99	>0.99				
nk	nk	>0.99				
nk	nk	nk				
0.80–0.84	0.98–0.99	>0.99				
nk	nk	nk				
0.86–0.87	0.95–0.99	>0.99				
<0.93	–	>0.99				
0.97	0.984	0.998	0.1	0.5	4	Anaerobic–aerobic (optimally aerobic)
0.94	0.981	0.966	0.5	3	10	Anaerobic–aerobic (optimally aerobic)
0.96	0.98	0.997	0.5	2.5	5	Facultative (optimally aerobic)
			–	–	Growth at 5, no growth at 7	

2

Traditional foods

of the Eastern Mediterranean Region

Food safety of some traditional foods

Over the years, a number of traditional foods have been developed in countries of the Eastern Mediterranean to accommodate the needs and conditions prevailing in the Region. Traditional foods most probably evolved in the home through trial and error, after which some came to be commercially produced. Nowadays, traditional foods are produced both at home and at the commercial level, in small and large amounts. Improvements in the processing, preservation and packaging of many traditional products have been achieved, but generally their processing is determined by its simplicity (including equipment), lower energy demand, and the availability of resources.

Although some traditional foods have relatively long shelf lives and were originally developed as a means of preservation, others have limited shelf lives. Most traditional foods were developed when the scientific basis of control of microorganisms by heat treatment and/or lowering of temperature had not been established. During their preparation there is intensive handling by workers, since many steps are still manual. In the preparation of most traditional foods there are no control measures to destroy unwanted microorganisms prior to consumption, and in some of these foods raw materials are incorporated at the end of the process. Research has been carried out and published that covers nutritional, technological, chemical, microbiological and safety aspects of a selection of the most common traditional products. The following overview of the microbiology and safety of some of the foods dealt with in this manual was based on this research.

The studies highlight the need for improvements in the manufacture of traditional foods and drinks in the Eastern Mediterranean Region, particularly in the case of small producers. It is intended that the generic HACCP models for some of the most widespread traditional foods in the Region will be of significant help in fulfilling this need.

Hummus

Many traditional foods in the Region, of which *fuul* or *medammis, falafel* and *hummus* are the most popular, are based on legumes. Today, *hummus* (*hoummos, houmous, humous,* occasionally *humus*) is prepared using specially designed, locally produced mechanical choppers, where 3 kg to 5 kg bulk amounts of the basic mix are prepared and kept in plastic or stainless steel pots, from which hummus is dispensed after adding a dressing and oil.

Sixty samples of fresh hummus taken from 15 restaurants in winter and summer were examined to find out numbers and types of microorganisms present [12]. Five reference samples, produced under hygienic conditions by the investigators, were examined for comparison. The microbial load of commercial hummus was high and spherical lactic acid bacteria (LAB) belonging to *Lactococcus*, *Enterococcus* and *Leuconostoc* spp. were the predominating microorganisms.

The means of the aerobic plate count (APC), LAB, and coliform counts (1.9×10^8 cfu/g, 1.6×10^8 cfu/g and 2.9×10^5 cfu/g, respectively) in summer samples were significantly higher ($p < 0.05$) than in winter samples (2.7×10^7 cfu/g, 1.6×10^7 cfu/g and 2.2×10^3 cfu/g, respectively). The average yeast counts in summer and winter were 4.2×10^4 cfu/g and 1.5×10^4 cfu/g respectively.

In reference samples of hummus, APC and LAB counts were $< 10^3$ cfu/g, while the coliform and yeast counts were < 10 cfu/g and 10^2 cfu/g, respectively. In comparing these results with those of the test samples, one can suspect a lack of hygienic practices during the production of commercial hummus. *Salmonella* was not detected in any sample, and *Escherichia coli* and *Staphylococcus aureus* counts were < 10 cfu/g in all samples. The relatively low pH of hummus (the average pH of all samples was 5.1), the rapid growth of LAB and the possible accompanying production of inhibitory substances may explain the predominance of these bacteria, and could have contributed to the absence of the pathogens examined.

Labaneh

Labaneh (*labna, labneh*; from the Arabic word *laban*, milk) is the name used in Jordan and other Arab countries for a semisolid dairy product made from set yogurt, with the whey partially removed. *Labaneh* is widely consumed with olive oil at breakfast, supper or as a snack, usually as a sandwich spreader [13,14,15]. In Jordan and other countries in the Region a large proportion of *labaneh* is still produced by a traditional method, which involves straining set yogurt in cloth bags. When packaged for sale, the total solids and fat content of this dairy product are 23–25% and 8–11% respectively; the acidity (expressed as percentage of lactic acid) is 1.4–2.8%, and the pH ranges between 3.6 and 4.

Packaged *labaneh* samples were taken from 18 producers in Amman, Jordan [12]. All the samples were from cow's milk and made by the traditional method of straining set yogurt in cloth bags directly before packaging. The samples were purchased on the day of packaging and brought to the laboratory within one hour of purchase. Packaged *labaneh*, as a product with a high concentration of lactic acid and limited access to air during refrigerated storage, is thought to be suitable for the growth of yeasts. When the traditional production method is used, especially when general good manufacturing practices (GMPs) are not followed, yeast contamination of *labaneh* cannot be prevented.

The mean values of psychrotrophic and mesophilic yeast counts for all 18 samples were 2.6×10^6 cfu/g and 4.4×10^6 cfu/g respectively. By the end of the shelf life (14 days at 7°C), these mean values had increased to 1.1×10^7 cfu/g and 1.4×10^7 cfu/g respectively. Psychrotrophic yeast counts of $> 10^6$ cfu/g were measured in 50% of the samples directly after packaging and 78% after 14 days storage at 7°C, while mesophilic yeast counts of $> 10^6$ cfu/g were measured in 56% and 83% of samples respectively.

Saccharomyces cerevisiae, which can be grouped into seven biovariants, was present in all the samples. *Trichosporon brassicae, Cryptococcus curvatus* and *Kluyveromyces marxianus* were found in 33%, 28% and 17% of *labaneh* samples respectively. *Trichosporon cutaneum, Debaryomyces hansenii, Pichia farinosa, Geotrichum candidum* and *Candida blankii* were all present in 6% of the samples. All *labaneh* samples showed characteristic signs of yeast spoilage after 14 days at 7°C; thus, psychrotrophic yeasts are the main cause of spoilage of traditionally produced, packaged labaneh kept under refrigeration.

Using alternative methods of production, instead of the traditional in-bag straining, may help avoid the adverse effects of yeast growth. The use of yeast-free yogurt starter cultures, and application of strict hygienic measures during processing and packaging of *labaneh* could help control yeasts. Shortening of the shelf life of *labaneh* to 7–10 days, instead of 14 days, may also be useful.

Kunafa

Kunafa (*kunafeh, knafeh*) is a sweet dish eaten in many countries of the Region. There are several recipes for *kunafa*, which is basically prepared from flour batter finished in the form of fine threads (vermicelli) and relatively thick sugar syrup. In a *kunafa* variant found in Jordan and neighbouring countries, a white cheese of the Nabulsi type is used as a major ingredient; thus this food is called *kunafa nabulsieh* or simply *nabulsieh* (referring to the Palestinian town of Nablus in the West Bank of Jordan). *Kunafa* is prepared mainly in patisserie shops that specialize in producing Arab sweets and in many restaurants. It is served or sold either in individual portions or by the whole pan, and is usually consumed warm to hot, with syrup added as desired. *Kunafa* is served mainly as a dessert after the main meal, especially at occasions such as weddings and big receptions.

Restaurants serving *kunafa* in the six major cities of Jordan were visited, and methods of *kunafa* production in each restaurant were observed, discussed with the producer and recorded. Thirty-five samples of *kunafa* displayed for sale in patisserie shops and restaurants were taken and analysed microbiologically [16].

The averages of the APCs, coliform counts and *Escherichia coli* counts of the commercial samples of *kunafa* were 4.5×10^5 cfu/g, 4.6×10^2 cfu/g and 7 cfu/g respectively. White cheese, the most sensitive ingredient of *kunafa*, had the highest counts (1.2×10^6 cfu/g, 4×10^2 cfu/g and 1.7×10 cfu/g, respectively).

Tahini

Tahini (*tehena, tehineh, tahina*) and *halawa* are among the most important traditional foods in Jordan and neighbouring countries. *Tahini*, obtained by milling cleaned, de-hulled and roasted sesame seeds, is manufactured in specialized plants. Some of these are equipped with modern machines, whereas others still use a traditional method of manufacturing. In the traditional method, or so-called wet method, large amounts of water are used, and sometimes a large millstone is used for milling.

The relatively high cost of water leads some plants to re-use the water for cleaning and soaking. The problem is aggravated by the use of brine to separate the hulls, since in order to eliminate the salty after-taste in the seeds large amounts of water may be needed. These difficulties are not encountered in the improved method, which uses less water and does not use brine for the separation of the hulls.

The main drawback to using large millstones is that this part of the process is not covered, allowing contamination of the product at this step. This is not the case in the improved method where milling is done with small disks in a closed unit.

Tahini is mainly composed of oil and protein. The proximate analysis of *tahini* gives 58.9% fat, 24.7% protein, 2.3% crude fibre, < 1.0% moisture and 3.0% ash. *Tahini* is not usually consumed straight; it is used, commercially and at household level, in the preparation of traditional dishes such as hummus *mottabal al-bathinjan* (a dip made by the blending of roasted eggplant, lemon juice, garlic and *tahini*) or tomato and *tahini* salad. Sometimes *tahini* is mixed with date molasses and eaten with bread at breakfast. *Tahini* is a major component of *halawa* [17].

Tahini samples were taken immediately after production from 14 plants located in Amman, Jordan. The samples were examined microbiologically for APC, LAB count, coliforms count, *Staphylococcus aureus* count, mesophilic aerobic spore-former count, and yeast and mould counts. Screening for *Salmonella* and *Escherichia coli* was also done.

The APC immediately after production ranged between 10.0×10^2 cfu/g and 4.0×10^4 cfu/g, with an average of 5.2×10^3 cfu/g [18]. The averages of APC after two and four months of storage at room temperature were 3.4×10^3 cfu/g and 1.7×10^3 cfu/g respectively. The LAB count immediately after production ranged between < 10.0 cfu/g and 5.5×10^4 cfu/g, with an average of 4.7×10^3 cfu/g. The average LAB counts after two and four months of storage at room temperature were 2.2×10^3 cfu/g and 1.5×10^3 cfu/g respectively. The coliform count directly after production ranged between < 10 cfu/g and 7.5×10^3 cfu/g, with an average of 6.0×10^2 cfu/g. The averages of coliform count after two and four months of storage at room temperature were 3.27×10^2 cfu/g and 2.43×10^2 cfu/g respectively. *Staphylococcus aureus* count immediately after production ranged between < 10.0 cfu/g. The averages of *Staphylococcus aureus* count after two and four months of storage at room temperature were 5.4×10 cfu/g and 3.5×10 cfu/g respectively. The mesophilic aerobic spore-former counts immediately after production were between 10.0 cfu/g and 1.5×10^3 cfu/g, with an average of 2.0×10^2 cfu/g. The average spore-former counts after two and four months of storage at room temperature were 1.29×10^2 cfu/g and 9.4×10 cfu/g respectively. Yeast and mould counts immediately after production ranged between < 10 cfu/g and 1×10^2 cfu/g, with an average of 2.1×10 cfu/g. The average counts of yeasts and moulds after two and four months of storage at room temperature were 9 cfu/g and 3 cfu/g respectively.

Salmonella and *Escherichia coli* were not isolated from any of the examined samples. Significant differences were found in microbial counts of *tahini* samples from different establishments.

Generally, microbial counts were higher in samples taken from establishments that followed traditional methods than those of more modern establishments. Therefore, microbial counts of *tahini* could be a good indicator of prevailing conditions during processing.

The pH values of *tahini* ranged between 5.65 and 6.0, with an average of 5.9, while the water activity (a_w) ranged between 0.12 and 0.18, with an average of 0.16.

It is clear that the low a_w in *tahini* would not permit the growth of any known food-borne microorganisms. However, most of these microorganisms could still survive and become significant when *tahini* is used in the preparation of other dishes that are intrinsically suitable for microbial growth. Therefore, *tahini* should be free from pathogenic bacteria, while having the minimum possible number of other microorganisms. This can be achieved by implementing the safety and sanitation requirements laid out in the GMP specifications, especially those relevant to cleanliness, personnel hygiene, and pest control. Changing from the traditional method of production to a more modern one may contribute to improving quality and safety of the product.

Halawa

Halawa (*halwa, halawah, halva*) is a low-moisture food consisting of *tahini*, sugar, citric acid and *Saponaria officinalis* (soapwort) root extract. According to Jordanian Standard 65:1995, *halawa* should have the following composition: > 45% *tahini*, > 25% fat (sesame oil), 45–55% sugar, < 2.5% moisture and < 2% ash. *Halawa* is consumed as such, usually with bread at breakfast and dinner. *Tahini* and *halawa* have a long shelf life (usually one year) when kept at ambient temperature, because of their low moisture content.

Halawa samples were taken immediately after production from 14 plants located in Amman, Jordan, and examined microbiologically, chemically, and physically.

The water activity (a_w) ranged from 0.17 to 0.23, with an average of 0.16. This very low a_w does not permit the growth of any type of food-borne microorganisms (in any food, microbial growth does not occur when $a_w < 0.60$) [7]. The pH of *halawa* samples ranged from 4.8 to 5.9, with an average of 5.5. The APC ranged from 3.0×10 cfu/g to 3.8×10^4 cfu/g, with an average of 6.34×10^3 cfu/g. APC was $> 1.0 \times 10^4$ cfu/g in only two of the ten *halawa* samples (20%). LAB count ranged from 9.0×10 cfu/g to 5.0×10^3 cfu/g, with an average of 1.7×10^3 cfu/g. In five of the 10 *halawa* samples (40%) APC was $< 1.0 \times 10^3$ cfu/g.

Only one *halawa* sample proved to contain coliform bacteria; the count was low (40 cfu/g). Counts of *S. aureus* were < 10 cfu/g. Yeast and mould counts were low. Five samples proved to contain yeasts and moulds, in which the count ranged from 10 to 8.0×10^2 cfu/g. Salmonella was not isolated from any of *halawa* samples tested.

Traditional beverages

A study was conducted to evaluate the microbiological quality of traditional drinks most commonly consumed in Jordan [20]. The study included 21 samples of *sous* or *'irqsus* (a drink extracted from the dried roots of *Glycyrrhiza glabra*), 44 samples of tamarind, *tamr hindi*, (a drink prepared by infusing of *Tamarindus indica* dried pulp) and 31 samples of *laban* drink (a drink prepared by dilution of yoghurt with water). Samples were collected from the local markets in Amman, Jordan.

Water is the major component of the three drinks, thus water activity (a_w) of the drinks was anticipated to be high. Tamarind and *laban* drinks are characterized by being acidic (the average pH of their samples were 2.8 and 3.3, respectively), while *sous* drink has an alkaline pH (average pH was 8.6). None of these drinks is processed for safety before serving, and some vendors did not properly refrigerate the drinks.

The averages of the aerobic plate count (APC) and LAB and yeast counts in *sous* drink samples were 7.9×10^5 cfu/ml, 1.0×10^5 cfu/ml and 6.3×10^3 cfu/ml respectively. In tamarind drink samples, the respective counts were 1.0×10^4 cfu/ml, < 10 cfu/ml and 5.9×10^5 cfu/ml respectively, while in *laban* drink samples, the counts were 1.7×10^6 cfu/ml, 3.1×10^7 cfu/ml and 9.3×10^5 cfu/ml respectively. Some species of *Enterobacteriaceae* were detected in two *sous* drink samples, two tamarind drink samples and one *laban* drink sample. *Salmonella* was detected in one *sous* and one tamarind drink sample. *Pseudomonas aeruginosa* was detected in only one *sous* drink sample. This was probably due to contamination from the environment, handlers or as a result of cross-contamination. *Escherichia coli* O157:H7 was not detected in any drink sample.

Generic HACCP models for some traditional foods

The generic HACCP models listed in Part 3 were developed in order to fill the gap in the regional food processing sector with regard to small-scale production of traditional foods. They cover a variety of traditional foods from many countries of the Region. Most of these foods are still produced in restaurants or small plants, as well as in large-scale food processing plants; some, such as the drinks, are produced at the home level for sale outside the home. The Codex Alimentarius Commission's *HACCP Guidelines* [1] were followed during the development of the generic models.

Information about each food was collected during a number of visits to the producers of the food. A questionnaire (see Appendix 2) was used to collect information about

Table 7. Traditional food groups

Group	Food
1	*Hummus, fuul, falafel* and salads
2	*Shawarma* and salads
3	Meat pastries and salads
4	*Tahini* and *halawa*
5	*Kunafa* (incl. Nabulsi)
6	Tamarind, *sous* and *laban* drink
7	*Labaneh*

raw materials, processing details, preservation methods and shelf life. Steps 1–5 of the HACCP system application outlined in Figure 7 were applied to each product using the collected data. As with generic HACCP models developed elsewhere products were categorized in groups according to their nature (Table 7). A tabulated HACCP chart showing the application of the seven principles of the HACCP system (steps 6–12 in Figure 7) to the particular process was then constructed and a generic HACCP plan developed for each food.

Application guidelines

The flow diagrams have been designed with the assumption that good manufacturing practices are already being followed at all steps. Currently, not enough attention is attached to personal hygiene in traditional food preparation.

The generic models are not intended for direct use in all plants, but should instead be adapted to reflect the conditions specific to each process and plant. The process of application and review is outlined in Figure 10. Differences in production steps, capabilities and resources between establishments will lead to differences in HACCP plans development and implementation for the same foods. This is evident, for example, when dealing with raw materials. Bigger establishments can specify their requirements for raw materials (for example sugar, flour, milk powder, cereals, etc.), which are usually reflected as critical limits. To ensure compliance, such plants usually require suppliers to provide them with certificates and test results, and carry out their own analyses and quality systems audits at the supplier's premises. However most traditional food

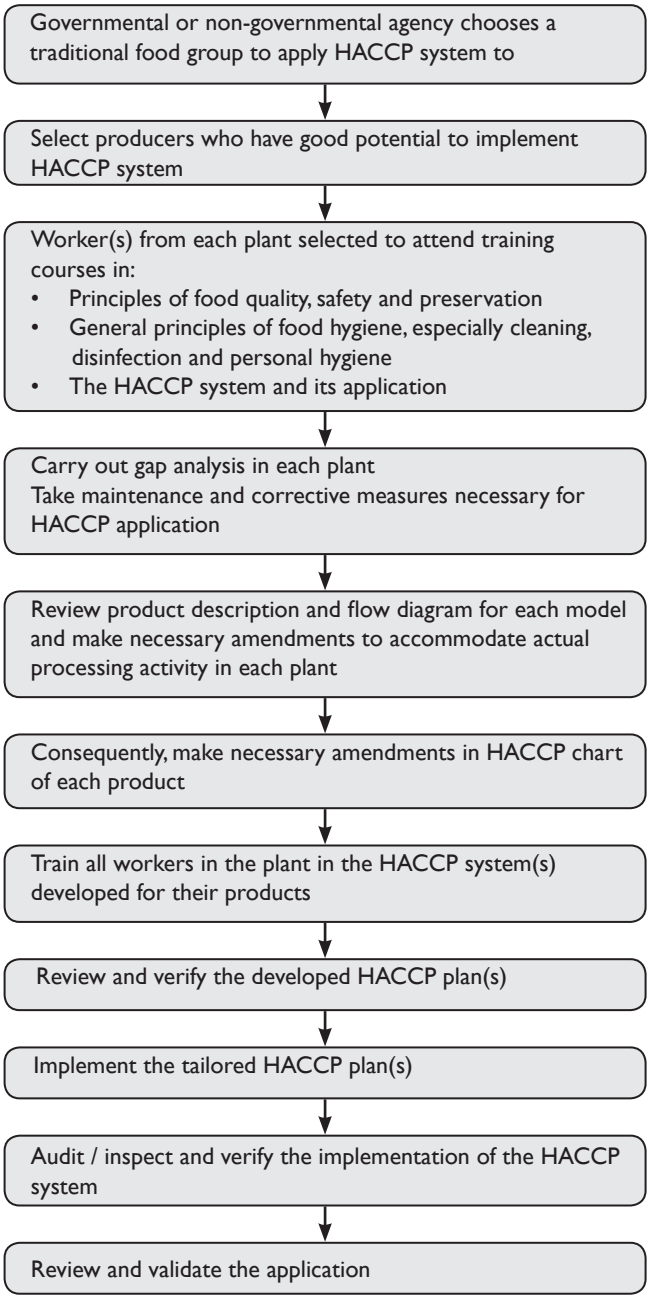


Figure 10. Application steps for the generic HACCP models

producers are small producers and do not have such capabilities. In the generic models, the procurement of raw materials is not assumed to be a CCP but merely a control point (CP). For the small producer, awareness of hazards and critical limits, buying from reputable suppliers, visual inspection, and proper storage of raw materials are acceptable means of control at the procurement of raw materials CP. The proper selection of incoming materials and the avoidance of mishandling products after release should reflect the producer's position in the food chain. Recognition of this position, and proper communication throughout the chain are essential to support any HACCP system implementation.

Documentation (HACCP principle 7) is also a potential issue. It is neither realistic nor practical to expect a high level of documentation in small restaurants and small plants. Nevertheless it is imperative that all establishments, both large and small, have properly documented HACCP plans for their products, along with the necessary documentation to demonstrate proper implementation of the system.

Producers should be made aware that maintenance and continual improvement of the system are an integral part of its implementation. An effective way of verifying the proper implementation and maintenance of the system is to review HACCP plans and perform internal and third party audits and inspections of the system, especially regarding monitoring of the CCPs and implementation of GMPs, at short and regular intervals.

Appendix 2

Hazard analysis questionnaire

GENERAL INFORMATION

Premises name _____
Product _____
Production space (area) _____ Number of shifts per day_____
Production planning and control activities: ☐ Yes ☐ No
Products, daily (or weekly) production and capacity _____

PRODUCT INGREDIENTS AND FORMULA

Ingredients:

Ingredients	Supplier	Specification	Storage facility type	Storage conditions

Product formula and production steps

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Which ingredients are used as preservatives? _____
Are any acid ingredients used? If yes, what kind of acid?
☐ Yes ☐ No _____
What is the source of water used?
_____
Are non-consumed foods or leftovers re-processed? If yes, at which stage?
☐ Yes ☐ No _____ .
Do the processing steps include heating? If yes, to what temperature?
☐ Yes ☐ No _____

RAW MATERIALS

Does a fixed supplier supply the raw materials? If no, what measures are applied for controlling the quality of raw materials?
☐ Yes ☐ No _____
_____
_____
Is there any storage for raw materials? If yes, describe storage conditions
☐ Yes ☐ No _____
_____
_____
Does the layout of the facility provide an adequate separation of raw materials from ready-to-eat foods?
☐ Yes ☐ No

PACKAGING

Do you package the product? If yes, what kind of packaging materials are used and what method of packaging?
☐ Yes ☐ No _____
_____
_____

EQUIPMENT AND FACILITIES

What alternative procedures are used in case of breakdown of equipment?
_____..
Is there any programme – even simple – for periodic cleaning and sanitation of equipment? If yes, please give details.
☐ Yes ☐ No _____
_____

INSPECTION AND CONTROL

Are there any quality control inspection procedures (inspecting raw materials and product, etc.) applied? If yes, please give details.
_____
_____
_____
_____

What product safety devices are used to enhance consumer safety?

- ☐ Foreign bodies detectors
- ☐ Magnets
- ☐ Sifters
- ☐ Filters
- ☐ Screens
- ☐ Thermometers
- ☐ Deboners

HYGIENE AND EMPLOYEE AWARENESS

Are employees aware of safe procedures of food preparation?

☐ Yes ☐ No

Do employees wear special dress/uniform during preparation to prevent contamination?

☐ Yes ☐ No

Do employees follow personal hygiene rules?

☐ Yes ☐ No

READY-TO-EAT FOOD DELIVERY

What procedures are used prior to food delivery to consumers?

_____
_____
_____
_____
_____

OBSERVATIONS BY THE SURVEYOR UPON LEAVING THE PREMISES

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3

Generic HACCP models

حمص

Generic HACCP model for

hummus

1. Product description

Product name(s)	*Hummus (houmous, humous, humus)*
Important product characteristics	Average composition of *hummus* per 100 g of edible portion is 49.5 g water, 9.6 g protein and 19.7 g fat pH is 5.1 No preservatives are used
Intended use	*Hummus* is prepared for immediate consumption It is served as a snack or as a sandwich using Arabic bread Consumed by general public
Packaging	Served and dispensed on plates or bowls Sold as takeaway in plastic containers (100 g – 300 g)
Shelf life	24 h in the refrigerator (below 5°C*)
Prepared / sold in	Restaurants, hotels, homes
Labelling instructions	Keep refrigerated (below 5°C*)
Special distribution control	Transport, store, and display refrigerated (below 5°C) under hygienic conditions

[12,20]

* As recommended by applicable Codex Alimentarius standards for refrigerated foods [10].

2. Ingredients of *hummus*

Chickpeas	***Tahini***	**Sodium bicarbonate**
As per CODEX STAN 171-1989 [10]	*Packaged in plastic or metallic containers* No Codex standard available[a]	Powder No Codex standard available[b]
Salt	**Citric acid**	**Lemon juice**
As per CODEX STAN 150-1985 [10][c]	*Dried white* Food Chemicals Codex[d]	Fresh (sometimes used instead of citric acid) No Codex standard available[e]
	Water	
	As per WHO Guidelines for drinking-water quality [5]	

[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 1124:2003 [11]

[b] Related national standard, e.g., JISM 987:1994 [11]

[c] Related national standard, e.g., JISM 32:1995 [11]

[d] Related national standard, e.g., JISM 649:2000 [11]

[e] Related national standard, e.g., JISM 627:2001 [11]

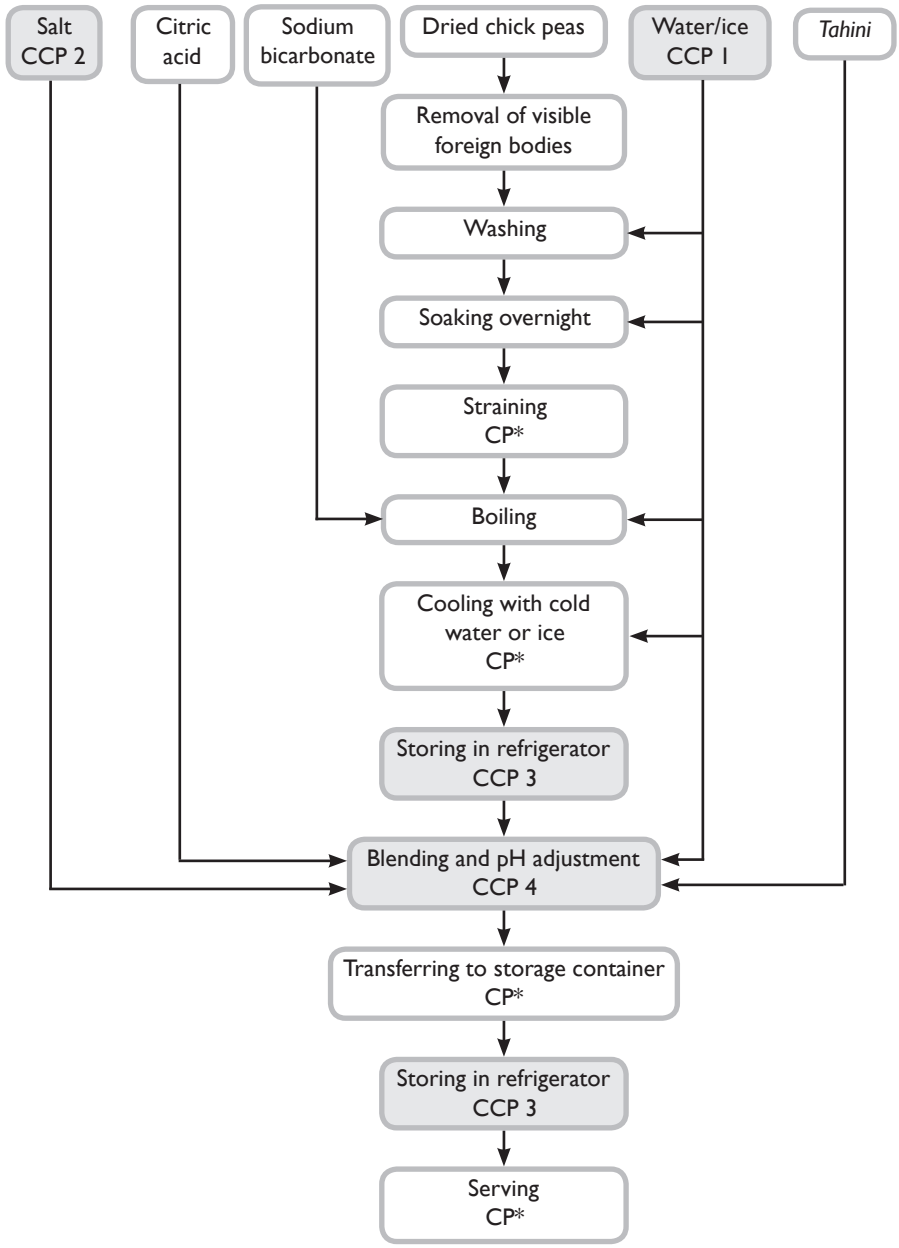
3. Preparation of *hummus*

Hummus is a traditional food in the Eastern Mediterranean Region and is often eaten as an appetizer. It is prepared at the household level, or in restaurants, and can be served as a snack or as a sandwich using Arabic bread.

Hummus is prepared from chickpeas (*Cicer arietinum*), which are soaked overnight and then boiled with sodium bicarbonate. Once cooled, the cooked chickpeas are then blended with lemon juice or citric acid, *tahini*, and salt to give the basic *hummus* mix.

To serve, *hummus* is transferred onto a plate or dish. Salt, lemon juice, and a dressing consisting of crushed garlic and green hot pepper in lemon juice are often added. The dish is then topped with olive oil. [12,20]

4. Process flow chart for *hummus* production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP). [4]

5. HACCP chart for *hummus* production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filters, tanks and hydrants	1	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Salt	*Physical:* Foreign matter	Sieving	2	Mesh size of sieve	Visual examination	Each batch	Re-sieve salt
Storing in refrigerator	*Biological:* Growth of disease-causing microorganisms	• Control refrigeration (below 5°C for 24 h) • Date code of batches	3	• Temperature: < 5°C • Time: 24 h • Date code	• Temperature check on product • Date code	Continuous	• Discard non-conforming product • Investigate root cause, and eliminate
Blending and pH adjustment	*Biological:* Growth of disease-causing microorganisms	Adjust pH to below 5	4	pH < 5	Check pH using a calibrated pH meter	Each batch	• Readjust the pH • Investigate root cause, and eliminate

* WHO *Guidelines for drinking-water quality* [5]

Generic HACCP model for

fuul (fava beans)

فول

1. Product description

Product name(s)	*Fuul (ful, foul, medammis)*
Important product characteristics	None This product should be considered ready to eat
Intended use	Eaten after cooking with oil on its surface, or can be eaten as sandwiches Consumed by general public
Packaging	Plastic containers or bowls
Shelf life	Not specified, usually directly consumed
Prepared / sold in	Restaurants, hotels, street vendors, homes
Labelling instructions	Not applicable
Special distribution control	Not applicable

2. Ingredients for *fuul*

Fava beans	Skinless fava beans	Salt
(Vicia faba L. minor)[a] As per CODEX STAN 171-1989 [10]	Dried As per CODEX STAN 171-1989 [10]	As per CODEX STAN 150-1985 [10][b]

Water	Lemon juice
As per WHO *Guidelines for drinking-water quality* [5]	Fresh (sometimes used instead of citric acid) No Codex standard available[c]

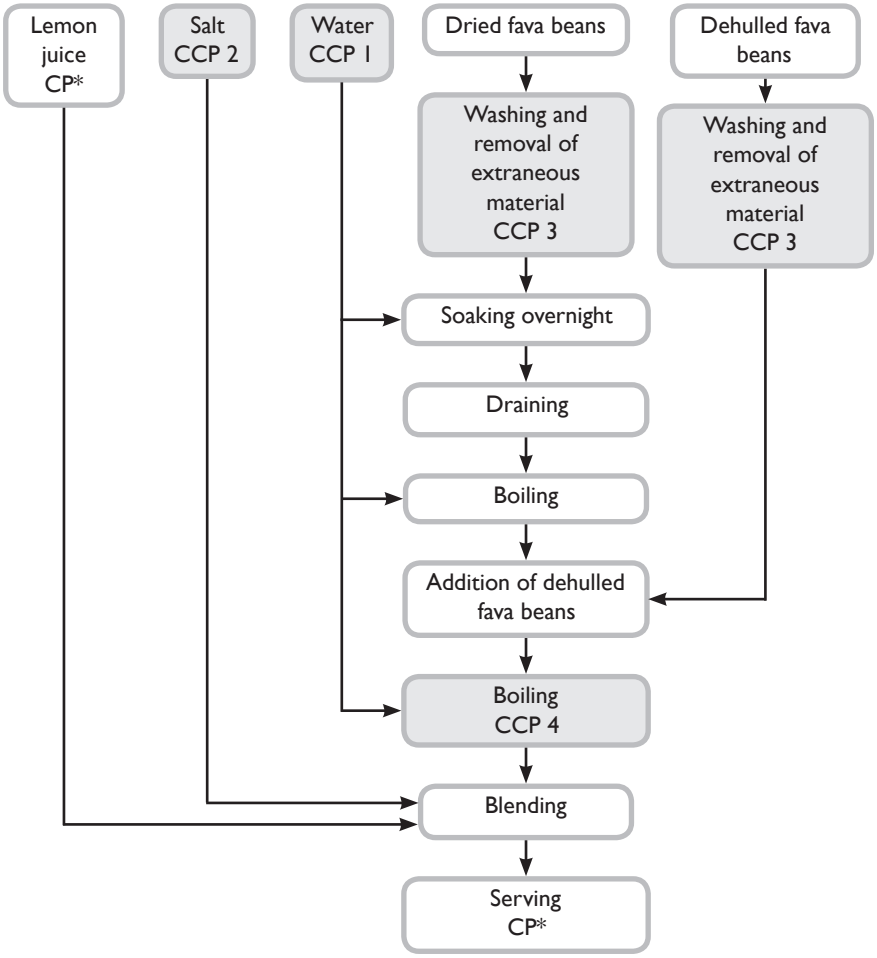
[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 763:2005 [11]
[b] Related national standard, e.g., JISM 32:1995 [11]
[c] Related national standard, e.g., JISM 627:2001 [11]

3. Preparation of *fuul*

Fava beans are soaked overnight and boiled till tender. Skinless fava beans may be soaked and added to the boiled fava beans. The mix is held hot in a special metal container.

For serving *fuul* is transferred into a bowl. Salt, lemon juice, and a dressing, usually consisting of crushed garlic and green hot pepper in lemon juice, are added. The dish is then topped with olive oil, or other edible vegetable oil. [20]

4. Process flow diagram for *fuul* production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP). [4]

5. HACCP chart for *fuul* production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filters, tanks and hydrants	1	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Salt	*Physical:* Foreign matter	Sieving	2	Mesh size of sieve	Visual examination	Each batch	Re-sieve salt
Cleaning of extraneous material from fava beans	*Physical:* Foreign matter	Removing foreign materials	3	Absence of foreign materials	Visual examination	Each batch	Re-clean
Boiling	*Biological:* Disease-causing microorganisms	Time / temperature	4	Beans are tender	Testing beans for tenderness	Each batch	Re-boil

* WHO *Guidelines for drinking-water quality* [5]

فلافل

Generic HACCP model for falafel

1. Product description

Product name	*Falafel (ta'miya*)*
Important product characteristics	Deep-fried flattened patties prepared from a mixture of previously soaked ground chickpeas (and/or fava beans), garlic, onion, parsley and a blend of herbs
Intended use	Fried and served as a snack or as a sandwich using Arabic bread Consumed by general public
Packaging	Paper bags
Shelf life	Not specified, usually consumed directly after frying
Prepared / sold in	Restaurants, hotels, homes
Labelling instructions	None
Special distribution control	None

* A variant found in Egypt and Sudan.

2. Ingredients of *falafel*

Chickpeas

As per CODEX STAN 171-1989 [10]

Fava beans

As per CODEX STAN 171-1989 [10]

Sodium bicarbonate

Dry white powder (baking soda)
No Codex standard available[a]

Garlic

Crushed garlic cloves
No Codex standard available[b]

Parsley

Fresh and finely chopped
No Codex standard available[c]

Onion

Fresh and finely chopped (used sometimes)
No Codex standard available[d]

Salt

As per CODEX STAN 150-1985 [10]

Green pepper

Fresh
No Codex standard available[e]

Spices

Packaged spices
No Codex standard available[f]

Oil

Vegetable oils
As per CODEX STAN 210-2003 and 33-1981, Rev. 1-1989 [10]

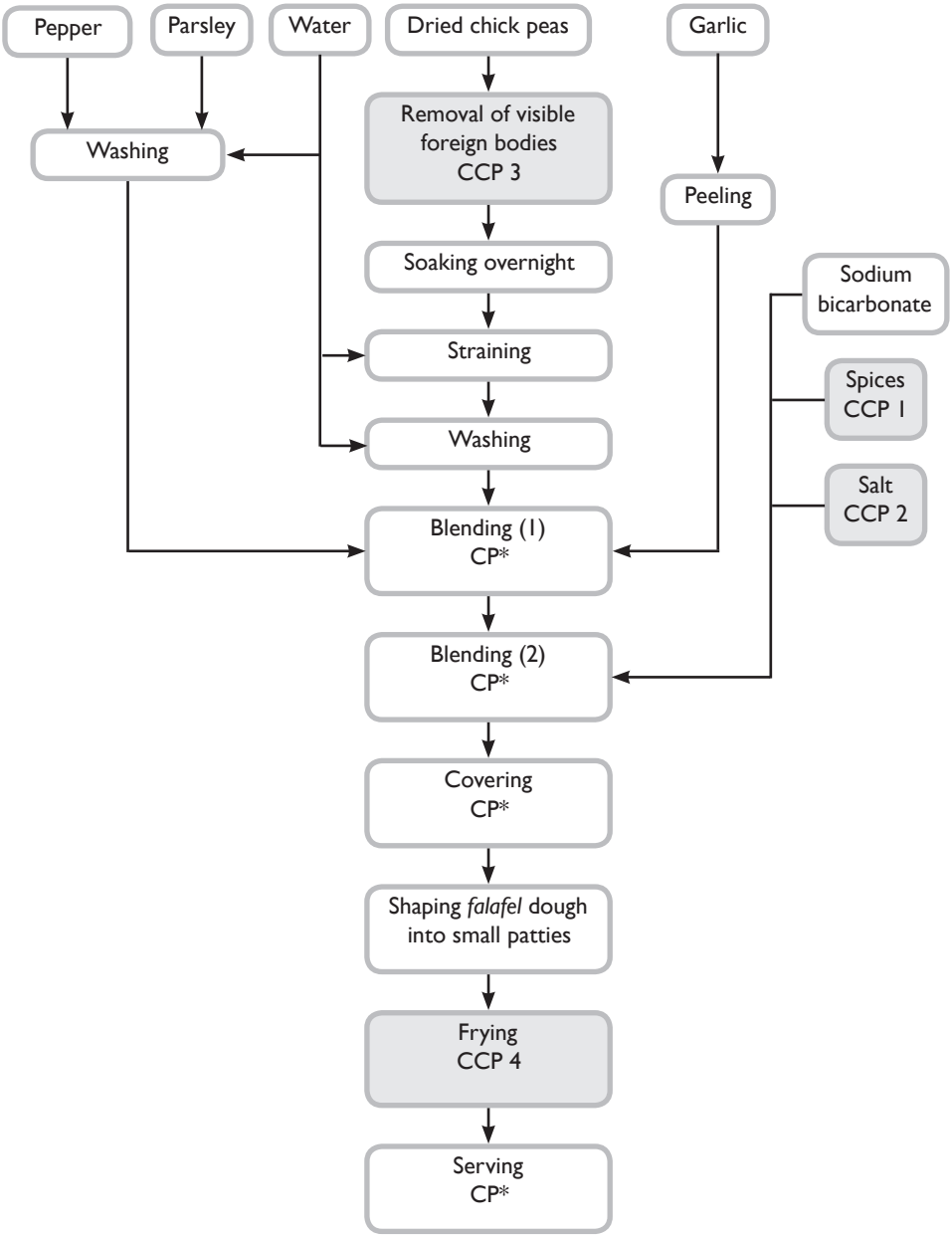
[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 987:1994 [11]
[b] Related national standard, e.g., JISM 985:2001 705:1990 [11]
[c] Related national standard, e.g., JISM 20:2004 [11]
[d] Related national standard, e.g., JISM 50:1997 [11]
[e] Related national standard, e.g., JISM 20:2004 [11]
[f] Related national standard, e.g., JISM 411:2001 [11]

3. Preparation of *falafel*

Falafel, a deep fried flattened patty, is prepared from a mixture of previously soaked ground chickpeas (and/or fava beans), garlic, onion, parsley and a blend of herbs, which is shaped into small patties and fried in oil in a deep pan or fryer.

Falafel is served hot as a snack or as a sandwich in Arabic bread, often with *tahini* and tomato salad and pickles.

4. Process flow chart for *falafel* production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP). [4]

5. HACCP chart for *falafel* production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Spices	*Biological:* Moulds *Physical:* Foreign matter	• Visual examination • Sieving	1	• No mould growth, no foreign bodies • Sieve mesh aperture < 1 mm	Visual examination	Each batch	Reject non-conforming product
Salt	*Physical:* Foreign matter	• Sieving • Visual test	2	• No foreign bodies • Sieve mesh aperture < 1 mm	Visual examination	Each batch	Re-sieve salt
Removal of visible foreign bodies from chickpeas	*Physical:* Stones and pieces of wood, metal, etc.	Cleaning / removal of foreign bodies Use of magnet	3	Absence of foreign bodies	Visual test	Each batch	Re-clean non-conforming product
Frying	*Biological:* Pathogens *Chemical:* Polymers, nonvolatile compounds and free radicals	• Proper frying (frying temperature should be 160–180°C) • Periodic change of frying oil	4	• Oil temp. 160–180°C • Oil should not be dark brown colour • No increase in oil smoking • Absence of large foam • No increase in oil viscosity	• Visual test • Rapid tests using an oil test kit	• Every day • Kit testing as specified by kit manufacturer	• Reject non-conforming product • Change non-conforming oil

سلطات

Generic HACCP model for

green salads

1. Product description

Product name(s)	Green salads
Important product characteristics	Mix of various vegetables, mainly raw, components varied from customer to customer No preservatives added
Intended use	Served fresh Consumed by general public
Packaging	Plates / bowls / plastic containers
Shelf life	6 h at below 5°C
Prepared / sold in	Restaurants, hotels, homes
Labelling instructions	Keep refrigerated
Special distribution control	Store in refrigerator (below 5°C) under hygienic conditions

2. Ingredients of green salads

Lettuce

Fresh
No Codex standard available[a]

Tomato

Fresh
No Codex standard available[b]

Cucumber

Fresh
No Codex standard available[c]

Salt

As per CODEX STAN 150-1985 [10]

Lemon

Fresh
No Codex standard available[d]

Parsley

Fresh
No Codex standard available[e]

Oil

Vegetable oils
As per CODEX STAN 210-2003 [10]

Water

WHO *Guidelines for drinking-water quality* [5]

Vinegar

No Codex standard available[f]

Other types of fresh vegetables

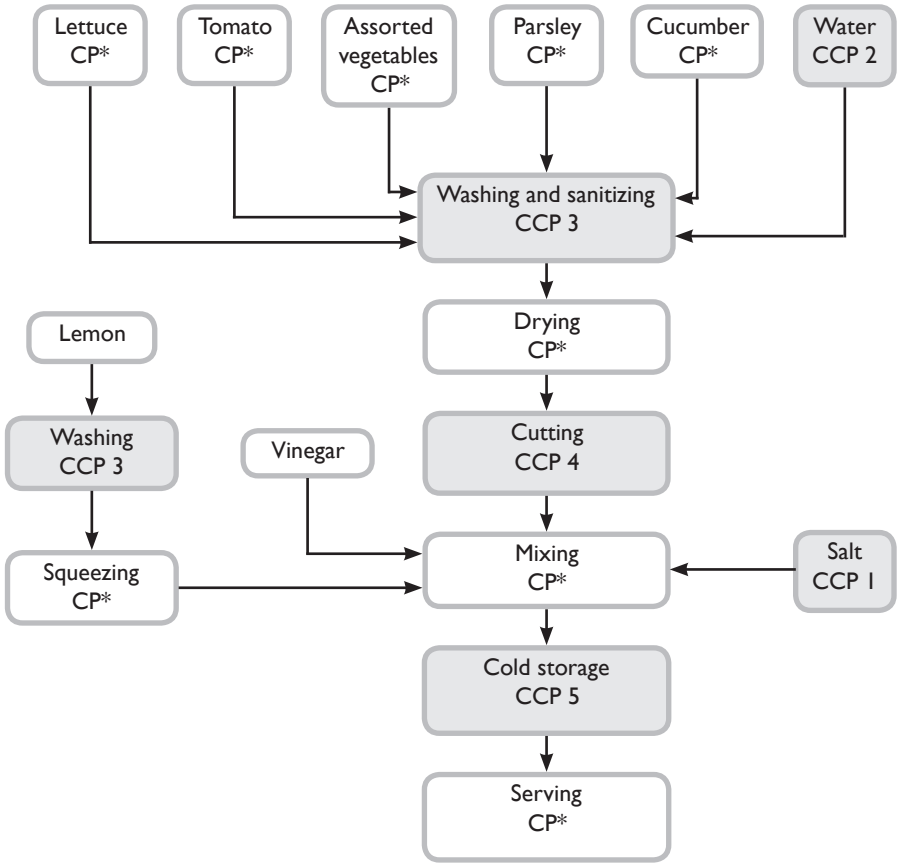
Fresh / cooked
No Codex standard available

[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 20:2004 [11]
[b] Related national standard, e.g., JISM 20:2004 [11]
[c] Related national standard, e.g., JISM 20:2004 [11]
[d] Related national standard, e.g., JISM 20:2004 [11]
[e] Related national standard, e.g., JISM 20:2004 [11]
[f] Related national standard, e.g., JISM 311:2004 [11]

3. Preparation of green salads

Green salad is usually a mixture of raw vegetables that are washed, cut up and mixed together, with the addition of salt, oil, and vinegar as desired, then kept refrigerated until serving. A typical combination in the Region is tomato, cucumber, lemon, parsley, and lettuce.

4. Process flow chart for salad production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for the production of green salads

Step	Hazard	Preventive measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure the adequacy of filters, tanks and hydrants	1	Coliforms not detectable in 100ml samples	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Salt	*Physical:* Foreign matter	Sieving	2	Mesh size of sieve	Visual examination	Each batch	Re-sieve salt
Washing and sanitizing	*Biological:* Disease-causing microorganisms, insects *Chemical:* Sanitizing agents *Physical:* Foreign bodies, dust	• Decontaminate produce using sanitizer e.g., chlorine (free available chlorine 0.05g/L–0.1g/L with a contact time of 1–2 min) • Remove foreign bodies	3	• Dust and soil on produce • Free available chlorine not more or less than 0.05g/L–0.1g/L with a contact time of 1–2 min • Absence of foreign bodies	• Visual examination • Measurement of chlorine in water using a certified technique	• Each washing step • Each washing step	• Re-wash produce • Adjust chlorine dose • Re-wash using non-chlorinated water, in case of high doses
Cutting	*Physical:* • Foreign matter (insects, parts of cutting plate, dust) • Cross contamination	• Use well maintained equipment • GMPs	4	• Presence of foreign matter or metal • Adhere to GMPs	Visual examination for parts of metal	Continuous	Remove foreign matter or metal if possible and discard if not
Storage	*Biological:* Growth of disease-causing microorganisms	Store under refrigeration (temperature 2–5°C)	5	Storage temperature 2–5°C	Temperature measurement	Continuous	Adjust temperature

* WHO *Guidelines for drinking-water quality* [5]

شاورما

Generic HACCP model for

shawerma

1. Product description

Product names	*Shawerma, shawarma*
Important product characteristics	*Shawerma* is cut from big slabs of spicy chicken or sliced meat grilled on a spit, and wrapped in Arabic bread with sliced tomato, onion and *tahini* sauce
Intended use	Grilled and served as a sandwich or on plates Consumed by general public
Packaging	Polyethylene covered containers or in sandwiches
Shelf life	Depends on size and slice thickness; meat on the spit to be grilled within 6 hours and sandwiches to be consumed directly after preparation
Prepared / sold in	Restaurants, hotels
Labelling instructions	Not specified
Special distribution control	Not specified

2. Ingredients of *shawerma*

Frozen deboned chicken

Frozen boneless chicken breast and legs
No Codex standard available[a]

Sliced meat

Frozen boneless meat
No Codex standard available[b]

Cardamom

Ground green
No Codex standard available[c]

Garlic

Cloves garlic
No Codex standard available[d]

Lemon

Fresh juice
No Codex standard available[e]

Onion

Fresh (used sometimes)
No Codex standard available[f]

Salt

As per CODEX STAN 150-1985 [10]

Black Pepper

Freshly ground
No Codex standard available[g]

Tomato paste

Packaged in a glass container
As per CODEX STAN 13-1981 [10]

Vinegar

Packaged in a glass container
No Codex standard available[h]

Nutmeg

Ground mace
No Codex standard available[i]

Cinnamon

Ground (used sometimes)
No Codex standard available[j]

Cayenne pepper

Crushed hot chili pepper (used sometimes). No Codex standard available[k]

Spices

Packaged allspice
No Codex standard available[l]

Water

WHO *Guidelines for drinking-water quality* [5]

[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 204:1997 [11]
[b] Related national standard, e.g., JISM 174:2000, 471:2002 [11]
[c] Related national standard, e.g., JISM 320:1996 [11]
[d] Related national standard, e.g., JISM 705:1990, 985:2001 [11]
[e] Related national standard, e.g., JISM 20:2004, 627:2001 [11]
[f] Related national standard, e.g., JISM 50:1997 [11]
[g] Related national standard, e.g., JISM 346-1:1999: JISM 346-2:1999 [11]
[h] Related national standard, e.g., JISM 1195:2000 [11]
[i] Related national standard, e.g., JISM 1150:1997 [11]
[j] Related national standard, e.g., JISM 411:2001 [11]
[k] Related national standard, e.g., JISM 355:2004 [11]
[l] Related national standard, e.g., JISM 411:2001 [11]

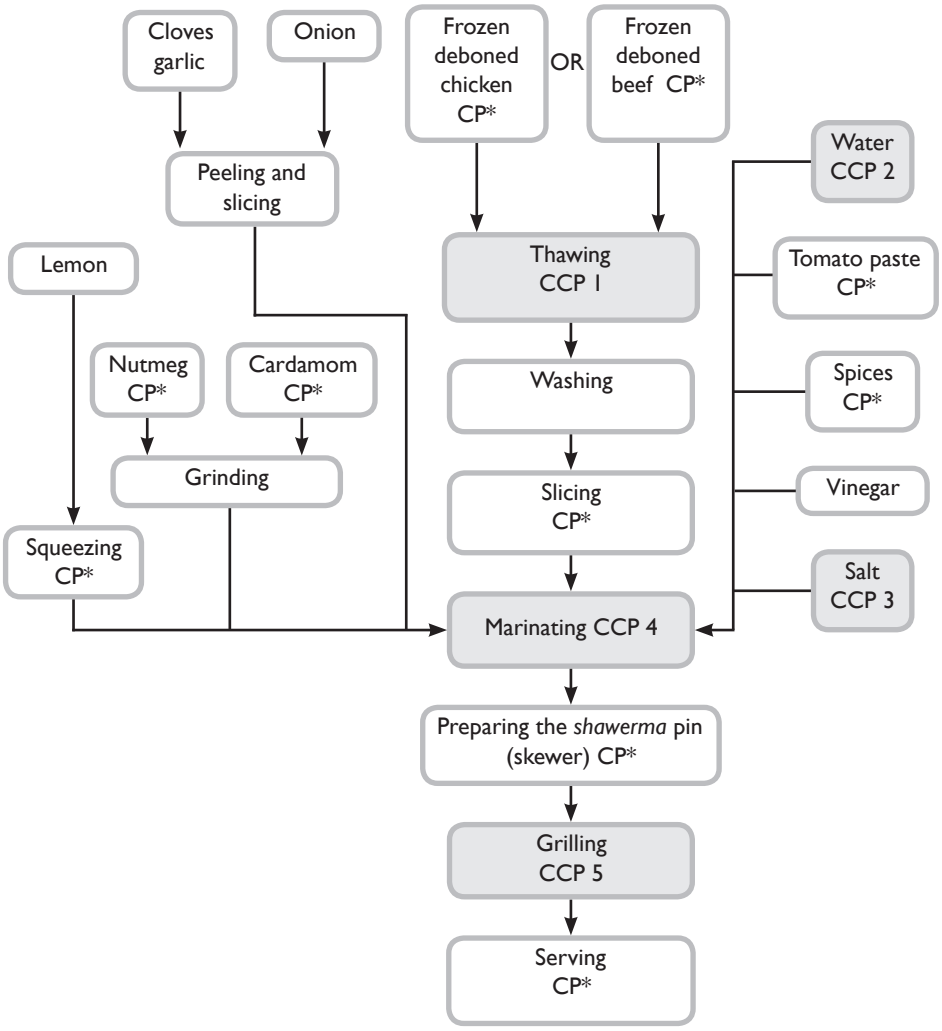
3. Preparation of *shawerma*

Shawerma is roasted spicy marinated deboned beef, lamb or chicken served warm in Arabic bread with fresh tomatoes, onions, pepper, and *tahini* sauce or mayonnaise.

Shawerma is prepared by combining all the marinade ingredients (lemon juice, minced garlic, hot pepper sauce, vinegar, salt, tomato paste, cardamom, minced onion, spices and black pepper), adding sliced beef, lamb or chicken, and marinating (usually overnight under refrigeration).

Meat slices are then assembled together around a large pin (skewer) and placed in a rotisserie (vertical gas grill). The cooked meat is sliced and wrapped in Arabic bread with sliced tomato, onion and *tahini* sauce or mayonnaise.

4. Process flow diagram for *shawerma* production

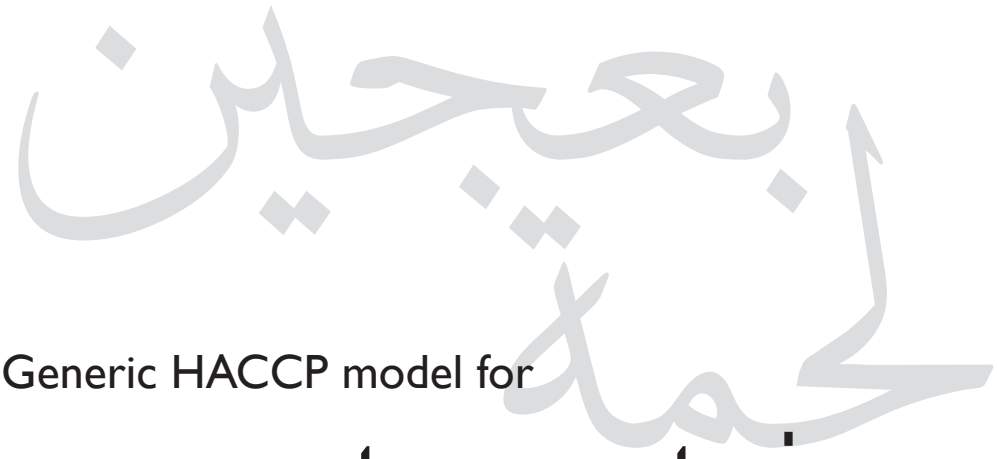


* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for *shawerma* production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Thawing	*Biological:* Growth of pathogenic microorganisms	Thaw in refrigerator at < 7°C for 24 h	1	• < 7°C for 24 h • Acceptable sensory quality	• Checking temperature and time of thawing • Visual inspection	Each batch	• Discard if thawing at > 7°C for > 24 h • Discard if unacceptable sensory quality
Water	*Biological:* Disease-causing microorganisms *Chemical:* Toxic contaminants	Ensure adequacy of filters, tanks and hydrants	2	• Coliforms not detectable in 100-ml samples* • Limits of chemical contaminants of potable water*	• Estimation of coliforms count • Sensory tests • Testing chemical contaminants	Each month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Salt	*Chemical:* Impurities *Physical:* Foreign matter	• Purchase from reputable supplier • Sieve salt before use	3	Absence of impurities and foreign matter	• Ensuring purchase from reputable supplier • Checking sieves	Each batch	• Re-sieve salt
Marinating	*Biological:* Growth of pathogenic microorganisms *Chemical:* Sanitizing agents	• Preserve marinated meat in a refrigerator at 5°C and pH < 4.6 • GMPs	4	• Overnight marinating at 5°C in a refrigerator and pH < 4.6 • Acceptable sensory quality • GMPs	• Checking storage temperature and pH • Sensory tests	Each batch	• Discard if temperature > 5°C or pH > 4.6 • Discard if unacceptable sensory quality
Grilling	*Chemical:* Carcinogens e.g. aromatic hydrocarbons and heterogeneous amines	• Avoid overcooking and charring • Discard black crusts	5	Absence of charred crusts	Checking cooked meat during cooking	Each batch	• Discard black crusts • Re-adjust griller

* WHO *Guidelines for drinking-water quality* [5]



Generic HACCP model for

meat pastries

1. Product description

Product name(s)	Meat pastries
Important product characteristics	No preservatives are used
Intended use	Ready-to-eat food Consumed by general public
Packaging	No packaging is used
Shelf life	Usually 24 h under refrigeration
Prepared / sold in	Restaurants, homes, hotels
Labelling instructions	Keep refrigerated
Special distribution control	Shipping and storage under hygienic conditions and under refrigeration

2. Ingredients of meat pastries

Yeast

Packaged
No Codex standard available[a]

Oil

Vegetable oils
As per CODEX STAN 210-2003 [10]

Wheat flour

White powder
As per CODEX STAN 152-1985 [10]

Powdered milk

Packaged
As per CODEX STAN A-5-1971 [10]

White sugar

White, free of any suspensions
No Codex standard available[b]

Salt

White
As per CODEX STAN 150-1985 [10]

Garlic

Fresh
No Codex standard available[c]

Onion

Fresh
No Codex standard available[d]

Tomato paste

Packaged in a glass container
As per CODEX STAN 13-1981 [10]

Black pepper

Freshly ground
No Codex standard available[e]

Pine nuts

Not affected by moulds
No Codex standard available[f]

Pomegranate molasses

Packaged in glass bottles
Expiry date two years
No Codex standard available[g]

Yogurt

As per CODEX STAN 243-2003 [10]

Tahini

Packaged in plastic or metallic containers
No Codex standard available[h]

Meat

No Codex standard available[i]

[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 295:1998 [11]
[b] Related national standard, e.g., JISM 18:1996 [11]
[c] Related national standard, e.g., JISM 985:2001, 705:1990 [11]
[d] Related national standard, e.g., JISM 50:1997 [11]
[e] Related national standard, e.g., JISM 746-1:1999 [11]
[f] Related national standard, e.g., JISM 748:2005 [11]
[g] Related national standard, e.g., JISM 728:1990 [11]
[h] Related national standard, e.g., JISM 124:2003 [11]
[i] Related national standard, e.g., JISM 174:2000, 471:2002 [11]

3. Preparation of meat pastries

A. Dough preparation

Oil, powdered milk, yeast, wheat flour, sugar and water are mixed and kneaded until smooth. The dough is covered and allowed to stand in a warm place until it doubles in size.

B. Filling preparation

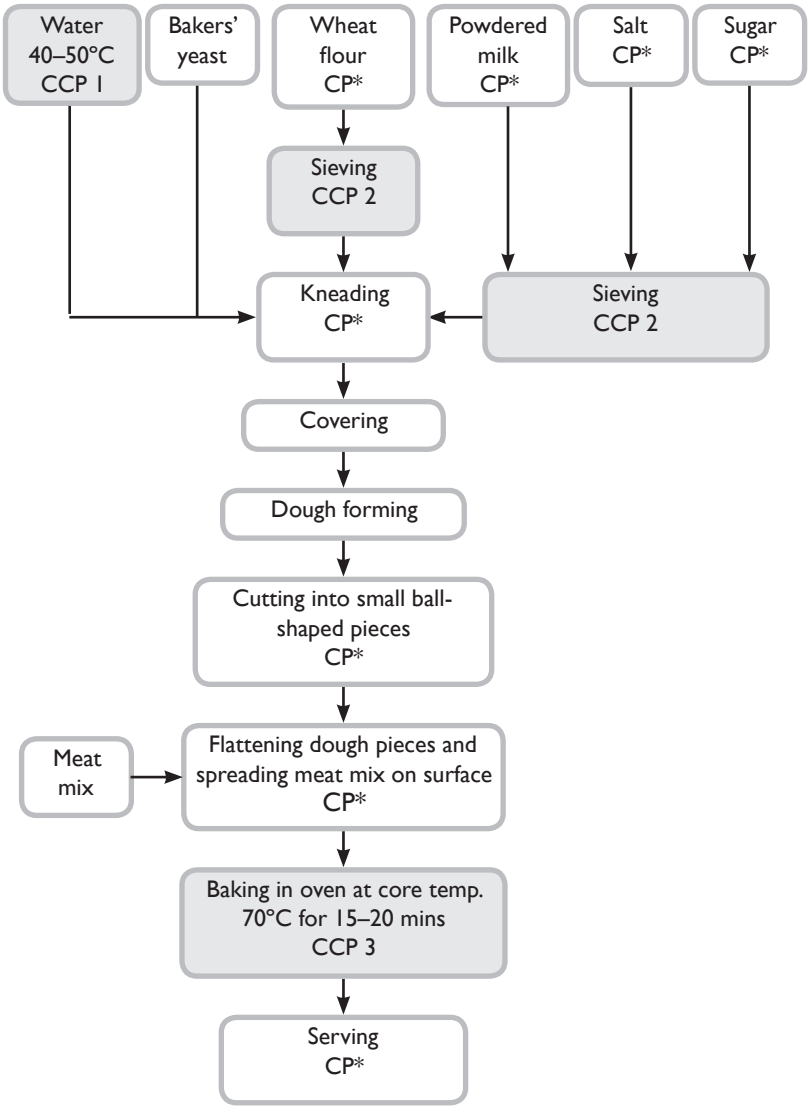
The meat is minced, then minced garlic and onion, black pepper, pomegranate molasses, salt, minced tomatoes, spices, pine nuts and sometimes *tahini* with yogurt are added and mixed well.

C. Finished pastry assembly

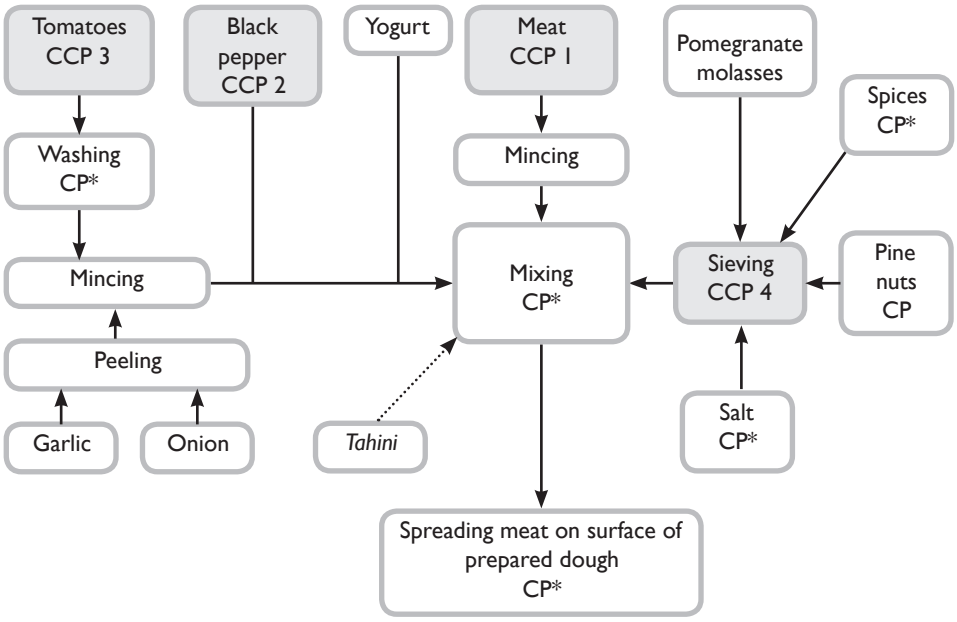
The dough is divided into small balls, which are then rolled into a flat circle or other shape. These are then stretched thin, and meat mix is put on the surface. The assembled pastries are left to rest, then arranged on a greased baking sheet and baked in a moderate oven until golden.

4. Process flow diagram of meat pastry production

A. Dough preparation and final product assembly



B. Process flow diagram of meat mix preparation for meat pastry preparation



⋆ Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for production of meat pastries

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filters, tanks and hydrants	1	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Sieving	*Physical:* Foreign matter	Sieving	2	Mesh size of sieve	Visual examination	Each batch	Re-sieve flour
Baking	*Biological:* Survival of vegetative pathogen	Baking at specified time and temperature > 200°C	3	Product temp > 70°C for > 20 min in core	Temp / time measurement	Each batch	Re-bake properly

* WHO *Guidelines for drinking-water quality* [5]

6. HACCP chart for preparation of meat mix for meat pastries

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Meat*	*Biological:* Disease-causing microorganisms	• Purchase from reputable source • During transport and storage temperature constant < –18°C • Check meat on delivery for proper shipping conditions – temperature	1	• Reputable source, and conformance to local specification of meat • Transport and storage temp. < –18°C	• Check source certificates are consistent with specification • Check freezer temp.	Each batch	Reject and change the supplier
	Physical: Bone fragments			• Absence of bones	• Visual inspection		
Black pepper *	*Biological:* Moulds	• Visual inspection	2	• Mould growth	Visual inspection	Each batch	• Discard mouldy pepper
	Physical: Foreign bodies	• Sieving		• Foreign materials			• Re-sieve flour
Tomatoes	*Biological:* Pest infection		3	Absence of bruises or pest infestation holes or traces of dust	Visual inspection	Each batch washing step	• Pick good quality tomato
	Physical: Foreign bodies, dust						• Discard damaged pieces
Sieving	*Physical:* Foreign matter	Sieving	4	Mesh size of sieve	Visual examination	Each batch	Re-sieve flour

⋆ Sourcing from reputable suppliers is part of the prerequisite programme of GMPs

طحينة

Generic HACCP model for

tahini

1. Product description

Product name(s)	*Tahini (tehineh, tahina, tehena)*
Important product characteristics	pH 5.9; very low moisture content < 3% (a_w 0.16)
Intended use	Used in preparation of some traditional foods like *hummus* and some salads; a major ingredient of *halawa* Consumed by general public
Packaging	Plastic containers (450 g – 960 g) Tin container (18 kg)
Shelf life	One year
Sold in	Supermarkets
Labelling instructions	Keep at room temperature and dry conditions
Special distribution control	Shipping and storage under hygienic conditions.

2. Ingredients of *tahini*

Sesame	Plastic containers	Tin containers
Dried, not affected by moulds or their toxins No Codex standard available[a]	*In different sizes, must be stored in dry and hygienic conditions* No Codex standard available[b]	*Must be stored in dry and hygienic conditions* No Codex standard available
	Salt	
	As per CODEX STAN 150-1985 [10]	

[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 440:1995 [11]
[b] Related national standard, e.g., JISM 617:2005 [11]

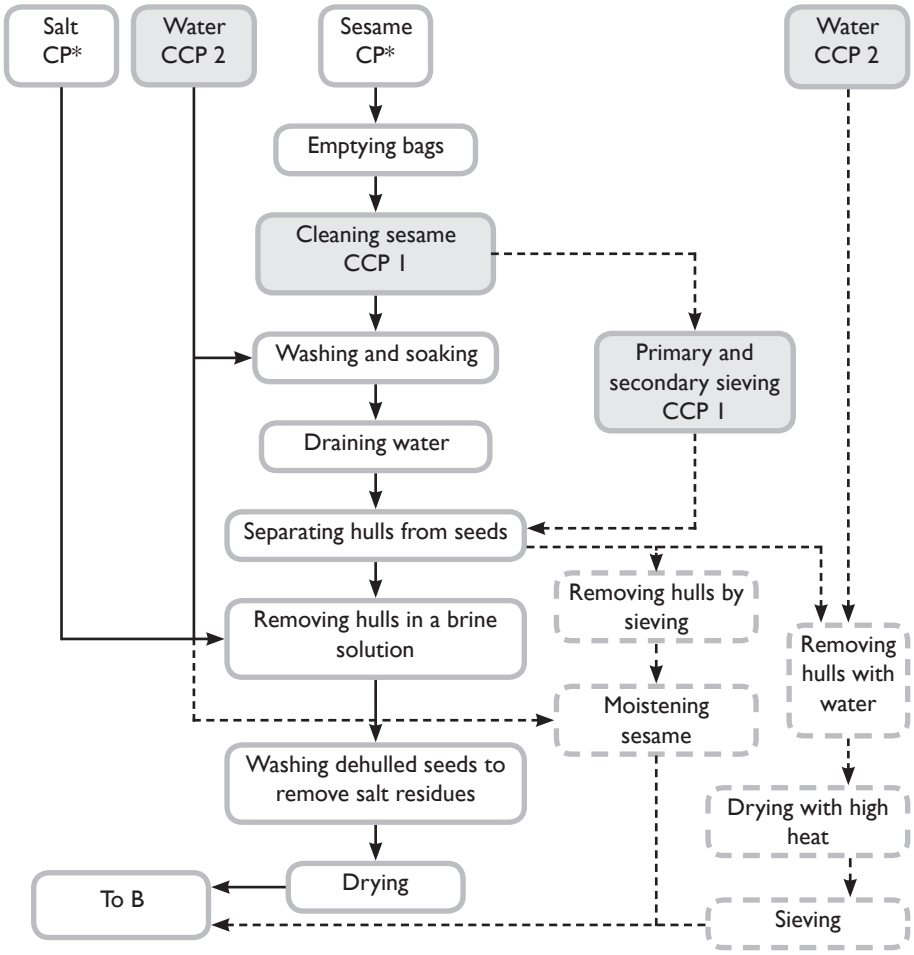
3. Preparation of *tahini*

Tahini, a traditional food of the Region, is an oily viscous fluid produced by the milling of dehulled, roasted sesame seeds. Two basic methods are currently used in the production of *tahini*. In the traditional method, hulls are separated from the seeds by the use of a brine; in the modern method, hulls are separated mechanically. The following flow diagrams show the steps of these methods. Dashed lines show steps of the modern method where they differ from those of the traditional method.

Tahini is usually packaged into plastic containers of different shapes and sizes and in 18-kg tin containers for catering.

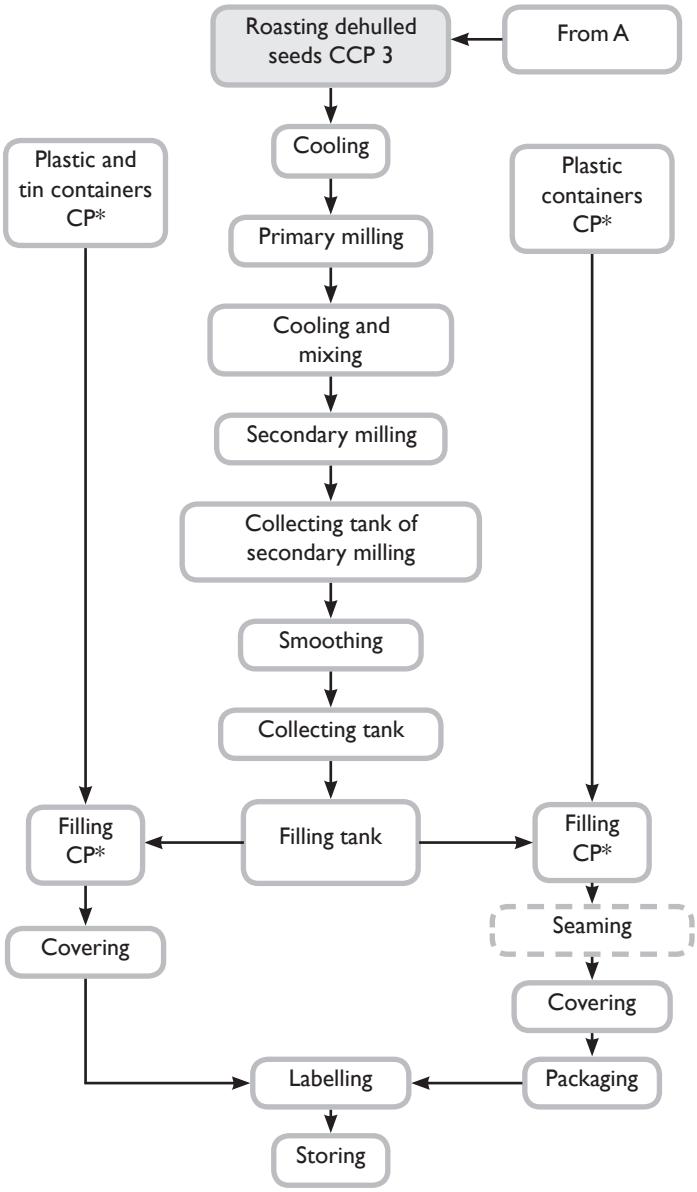
4. Process flow chart for *tahini* production

A. Sesame seed preparation and dehulling



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

B. Roasting and milling of sesame seeds; *tahini* packaging



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for *tahini* production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Cleaning sesame, primary and secondary sieving	*Physical:* Foreign bodies	Removal of foreign bodies using sieves, magnets and dust suction machine	1	Absence of foreign bodies	Ensuring efficiency of sieves, dust suction machine and magnets	Every batch	Reclean non-conforming seeds
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filters, tanks and hydrants	2	Coliforms not detectable in 100-ml samples*	Estimation of coliform count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Roasting	*Biological:* Disease-causing microorganisms	Proper heat treatment to eliminate disease-causing microorganisms	3	Absence of disease-causing microorganisms	Monitoring of time and temperature	Every batch	Re-roast

* WHO *Guidelines for drinking-water quality* [5]

حلاوة

Generic HACCP model for

halawa

1. Product description

Product name(s)	*Halawa (halwa, halawah, halva)*
Important product characteristics	pH 5.5 Very low moisture content < 3% (a_w 0.16)
Intended use	Usually consumed as sweet or with bread Consumed by general public
Packaging	Plastic containers (450 g – 960 g) or portions wrapped in aluminium foil
Shelf life	One year
Sold in	Grocery shops and supermarkets
Labelling instructions	Keep in dry conditions (closed) at room temperature
Special distribution control	Shipping and storage under hygienic conditions

2. Ingredients of *halawa*

Flavours and vanilla	**Plastic containers**	***Tahini***
Dry FEMA[a] specifications	*Different sizes, must be stored in dry and hygienic conditions* No Codex standard available[b]	*Must be stored in dry and hygienic conditions* No Codex standard available[c]
Cocoa	**Sugar**	**Nuts**
As per CODEX STAN 105-1981 [10]	*White, no suspensions and dry* As per CODEX STAN 4-1981 [10]	*Free of moulds and their toxins* No Codex standard available[d]
Soapwort roots	**Citric acid**	
No Codex standard available[e]	Food Chemicals Codex[f]	

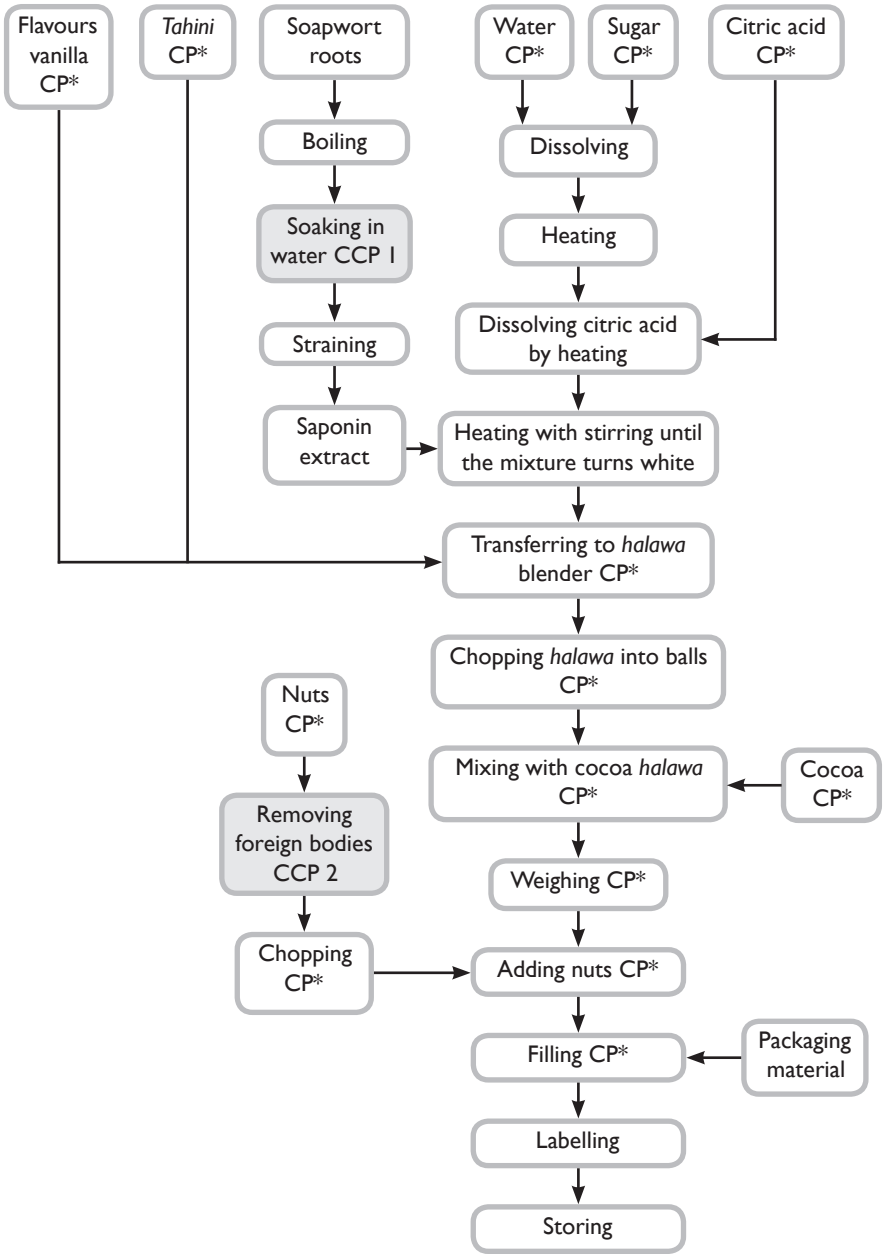
[a] Flavor and Extract Manufacturers Association
[b] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 617:2005 [11]
[c] Related national standard, e.g., JISM 124:2003 [11]
[d] Related national standard, e.g., JISM 319:2005 [11]
[e] Related national standard, e.g., JISM 65:1995 and 107:1979 [11]
[f] Related national standard, e.g., JISM 649:2000 [11]

3. Preparation of *halawa*

Halawa is a traditional food in the countries of the Eastern Mediterranean. The basic version is prepared from *tahini* (see HACCP model for *tahini*), sugar and soapwort root (*Saponaria officinalis*) extract. Optionally flavours, cocoa and nuts may be added.

Sugar and citric acid are dissolved in water and soapwort extract is then added. The solution is heated (~115ºC / 30 min) and stirred until it turns white; this mix is called *natef*. *Natef* is then mixed with *tahini* and packaged into containers. Other optional ingredients are added as desired just before filling. *Halawa* is stored at room temperature with a one year expiry date.

4. Process flow chart of *halawa* production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for the production of *halawa*

Step	Hazard	Preventive measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Soaking in water	*Biological:* Mould growth	Soaking in refrigerator, not exceeding two days	1	Temperature: < 5°C Time: max. 2 days	• Visual test for mould growth • Time and temperature monitoring	Each batch	Discard product with mould growth
Removing foreign bodies	*Physical:* Foreign bodies	Manual cleaning using sieves	2	Absence of foreign bodies	Visual testing	Each batch	Re-clean non-conforming product

كنافة

Generic HACCP model for

kunafa

1. Product description

Product name(s)	*Kunafa (kunafeh, knafeh)*
Important product characteristics	Product is usually consumed directly after preparation
Intended use	As dessert Consumed by general public
Packaging	Laminated cardboard trays
Shelf life	Not specified
Sold in	Arabic sweet shops, restaurants, hotels
Labelling instructions	Not specified
Special distribution control	Not specified

2. Ingredients of *kunafa*

Flour	Nuts	Red food colour
Packaged As per CODEX STAN 152-1985 [10]	*Free of any moulds or physical particles* No Codex standard available[a]	Food Chemicals Codex [19]
Ghee	**Boiled white cheese (Nabulsi cheese)**	**Sugar**
Metallic covered containers No Codex standard available	*White cheese* No Codex standard available[b]	*White sugar* No Codex standard available[c]
	Water	
	WHO *Guidelines for drinking-water quality* [5]	

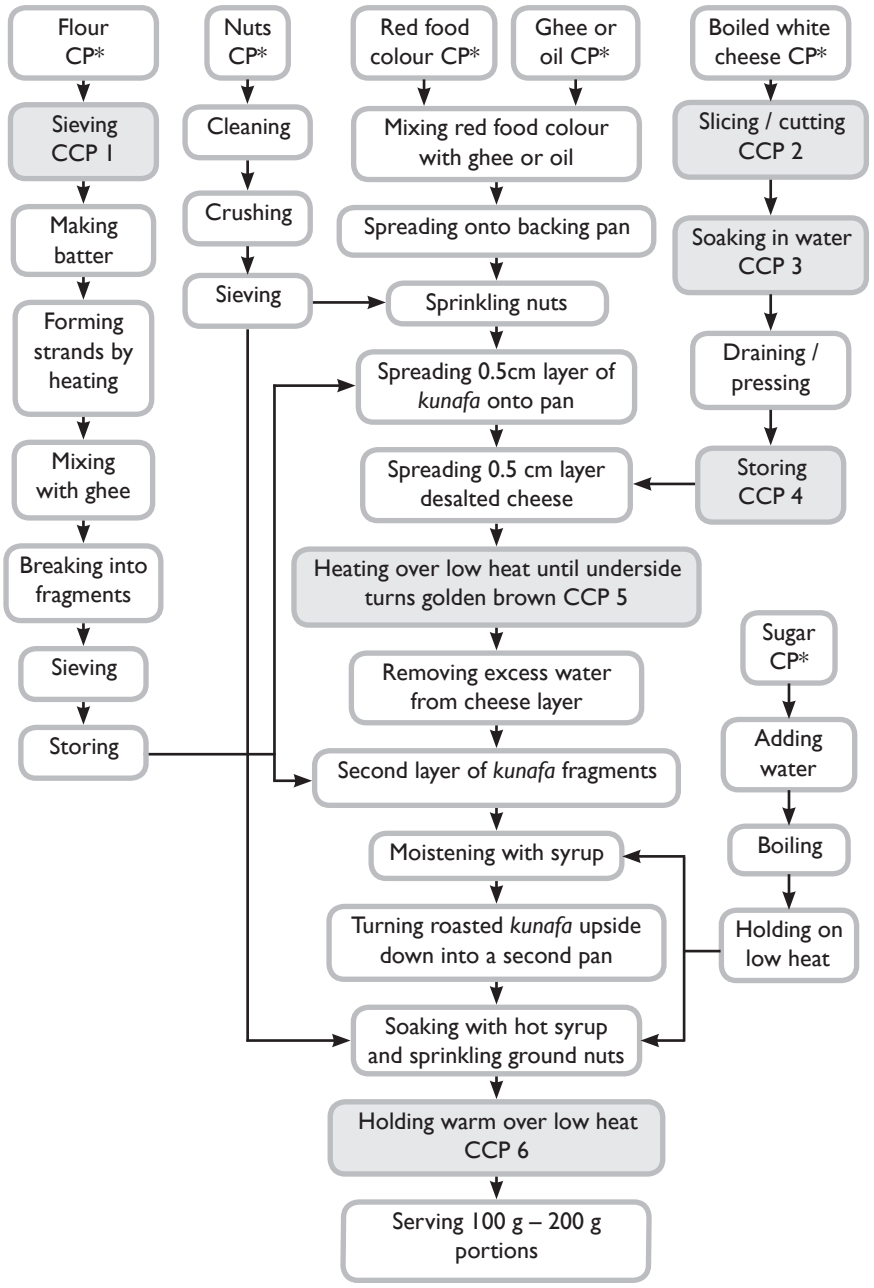
[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 319:2005 [11]
[b] Related national standard, e.g., JISM 393:2003 [11]
[c] Related national standard, e.g., JISM 36:1978 and 18:1996 [11]

3. Preparation of *kunafa*

Kunafa is a sweet dish known in most countries of the Eastern Mediterranean; it is served mainly as a dessert at occasions such as weddings and big receptions.

Kunafa is basically prepared from a thin flour batter that is drizzled through fine nozzles onto a hot plate. The resulting vermicelli-like strands are collected, mixed with ghee, then pressed down into a thin layer in a large flat baking dish and a mixture of ghee and red/orange food colour poured on. Desalted boiled white cheese is spread over this layer followed by another layer of *kunafa* strands and ghee. The dish is then heated over a low flame until the underside of the *kunafa* turns golden brown; the whole slab is then turned upside down in order to cook the other side. To serve, a few *kunafa* fragments and sometimes crushed nuts are spread on top and thick hot sugar syrup is poured on. [16]

4. Process flow diagram chart for *kunafa* production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for *kunafa* production

Step	Hazards	Control measures	CCP	Critical limit	Monitoring		Corrective measures
					Test	Frequency	
Sieving	*Physical:* Foreign matter	Sieving	1	Sieve with a suitable mesh size	Visual examination	Each batch	Re-sieve flour
Slicing/ cutting cheese*	*Biological:* Growth of pathogens *Physical:* Foreign bodies and insects	• Using sanitizers for contact surfaces • GMPs	2	• Presence of dirt or food residues in joints and equipment parts • Absence of foreign bodies or insects in sliced cheese (GMPs)	• Visual inspection • Adherence to GMPs • Observation	Continuous	• Washing and sanitizing equipment • Personal hygiene • No skin contact with products
Soaking cheese in water	*Biological:* Growth of bacterial pathogens	Soaking below 5°C	3	• Maximum soaking time 24 h • Maximum temperature 5°C	Temperature control	Continuous	Discard cheese
Storing cheese	*Biological:* Growth of bacterial pathogens	Storing below 5°C	4	Maximum temperature 5°C	Temperature control	Continuous	Discard cheese
Heating *kunafa*	*Biological:* Survival of vegetative pathogens		5	Core temperature > 73°C / 2 min	Temperature and time measurement	Continuous	Re-heat
Warm holding	*Biological:* Growth of bacterial pathogens	Warm holding (60°C / max 1 h)	6	Holding at 60°C / max 1 h	Temperature and time measuring	Continuous	Adjust holding temperature to the proper level

* Ensure equipment and the attached surfaces are rinsed with sufficient water to exclude residues of cleaning agents

تمرهندی

Generic HACCP model for tamarind drink

1. Product description

Product name(s)	Tamarind drink (*tamr hindi*)
Important product characteristics	pH 2.8 No preservatives are used
Intended use	Commonly served as a cold drink in summer and during Ramadan Consumed by general public
Packaging	Plastic bottles, sometimes plastic containers or bags
Shelf life	Not specified
Prepared / sold in	Home, drink shops, restaurants, street vendors
Labelling instructions	Not specified
Special distribution control	Not specified

2. Ingredients of tamarind drink

Tamarind	Sugar	Citric acid
Free of any defects, mould and foreign bodies	*White, no suspensions and dry* As per CODEX STAN 4-1981 [10]	*Dried white* No Codex standard available[(1)]

Water

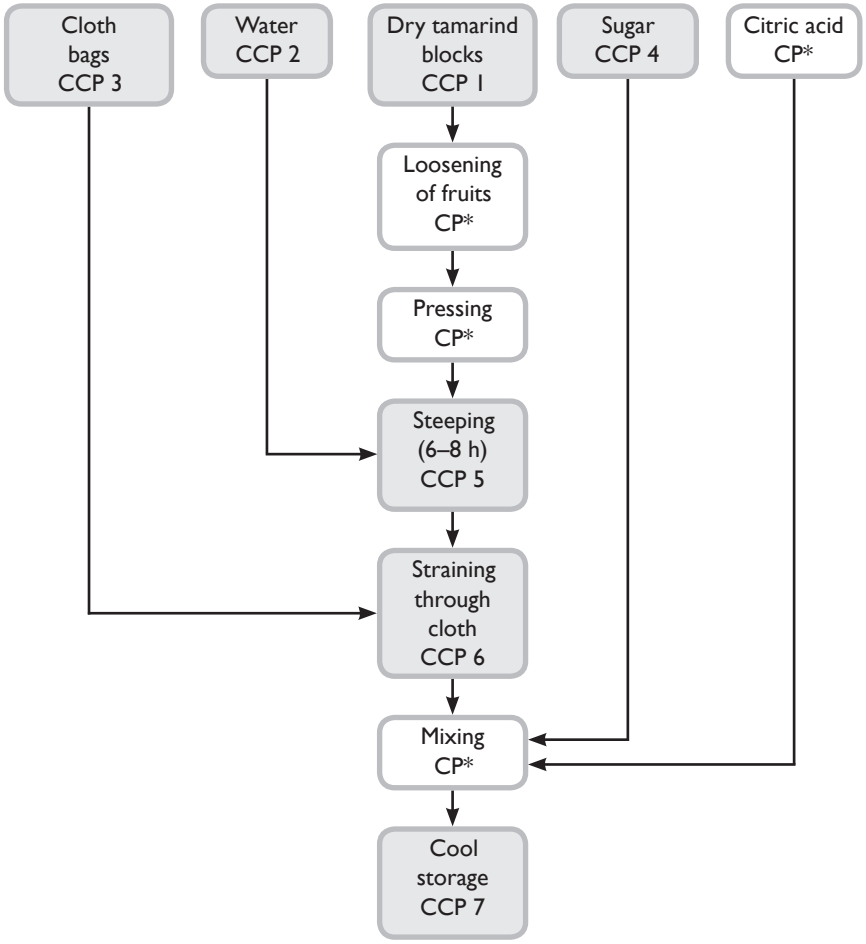
WHO *Guidelines for drinking-water quality* [5]

[(1)] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 649:2000 [11]

3. Preparation of tamarind drink

The tamarind belongs to the subfamily *Caesalpinioideae*, family *Fabaceae*. The variety used in the drink is classified as *Tamarindus indica*. It is a street-vended drink, and can be produced at home or in restaurants. The drink is a mixture of the pulp of ripe tamarind pods, sugar, citric acid and water. It is steeped usually overnight, pressed, and strained, and then mixed with other ingredients and served as a cooled drink. [20]

4. Process flow diagram for tamarind drink production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for tamarind drink production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Dry tamarind blocks	*Biological:* Disease-causing microorganisms, insects, moulds	• Purchase from reputable source that complies with local specifications • Visual inspection	1	• Compliance with local specifications • Absence of foreign bodies and insects	• Check source • Visual inspection	At each purchasing process	Remove foreign bodies if possible and discard blocks if not
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filters, tanks and hydrants	2	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Cloth bags	*Biological:* Disease-causing microorganisms, moulds	• Washing straining cloth • Proper rinsing after cleaning and disinfection	3	Cloth bags to be clean and free from any food traces	Check for proper cleaning	Every batch	Re-wash bags
Sugar	*Physical:* Foreign matter	Sieving	4	Sieve with a suitable mesh size	Visual examination	Each batch	Re-sieve sugar
Steeping	*Biological:* Disease-causing microorganisms	Steep at < 4°C	5	Refrigerated steeping at < 4°C	Temperature measuring	Each batch	Adjust temperature
Straining	*Biological:* Growth of disease-causing microorganisms *Physical:* Foreign bodies	Strain in refrigerator at < 4°C	6	• Refrigerated straining at < 4°C • Absence of foreign bodies	• Visual test • Temperature measuring	• Continuous • At each process step	Adjust temperature
Cool storage	*Biological:* Growth of disease-causing microorganisms	Maintain cool storage at temperature < 4°C	7	Cooling temperature < 4°C	Temperature measuring	Continuous	Adjust temperature

* WHO *Guidelines for drinking-water quality* [5]

سوس

Generic HACCP model for

SOUS drink

1. Product description

Product name(s)	*Sous* drink *('irq'sus)*
Important product characteristics	pH 8.6 No preservatives are used
Intended use	Commonly served as a cold drink in summer and during the month of Ramadan
Packaging	Plastic bottles, sometimes plastic bags
Shelf life	Not specified
Prepared / sold in	Drink shops, street vendors, homes, restaurants
Labelling instructions	Health warning if bottled (see section 3)
Special distribution control	Keep refrigerated under hygienic conditions

2. Ingredients of *sous* drink

Sous	**Water**	**Sodium bicarbonate**
Free of any defects, moulds and foreign bodies	WHO *Guidelines for drinking-water quality* [5]	*Powder* No Codex standard available[(a)]

[(a)] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 987:1994 [11]

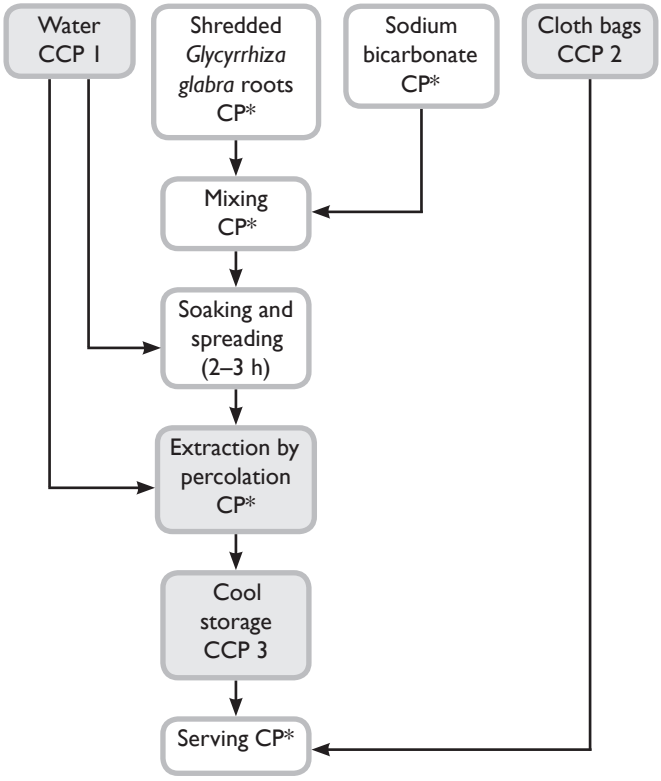
3. Preparation of *sous* drink

Sous is primarily a street vended beverage, but it is also produced at home or in restaurants. It is usually served as a cold drink in summer and during Ramadan (the ninth month of the Islamic year, during which strict fasting is practised daily from dawn to sunset by Muslims).

In certain health and physiological conditions (e.g., pregnancy, fasting, hypertension, renal disease, gall bladder disease or diabetes), *sous* drink should be avoided or consumed in limited amounts. Glycyrrhizic acid is the active principle in *sous*, and high intake of substances containing this acid can cause increased blood pressure, and oedema with sodium retention and potassium loss.

Sous is prepared by mixing the dry shredded roots of *Glycyrrhiza glabra* with sodium bicarbonate, soaking in water, spreading this mixture out to expose it to air for a few hours and then extracting the liquid components by percolation.
[20]

4. Process flow diagram for *sous* drink production



⋆ Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for *sous* drink production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filters, tanks and hydrants	1	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Cloth bags	*Biological:* Disease-causing microorganisms, moulds	• Washing straining cloth • Proper rinsing after cleaning and disinfection	2	Cloth bags should be clean and free from any food traces	Check for proper cleaning	Every batch	Re-wash bags
Cool storage	*Biological:* Disease-causing microorganisms	• Covering prepared *sous* drink • Maintain cool storage at temperature < 5°C for 24 h • Date code for storage	3	Temperature < 5°C for 24 h	Temperature monitoring	Continuous	Adjust temperature to within proper limits

* WHO *Guidelines for drinking-water quality* [5]

شراب اللبن

Generic HACCP model for laban drink

1. Product description

Product name(s)	*Laban* drink (*sharab al-laban*)
Important product characteristics	pH 3.3 No preservatives are used
Intended use	Commonly served as a cold drink in summer and in hot weather Consumed by general public
Packaging	Served directly from storage containers; bottled
Shelf life	24 h, below 5°C
Prepared / sold in	Street vendors, restaurants, homes
Labelling instructions	Keep refrigerated (2–5°C)
Special distribution control	Keep refrigerated (2–5°C)

2. Ingredients of *laban* drink

Garlic

Fresh
No Codex standard available[a]

Yogurt

As per CODEX STAN A-11a-1975 [10][b]

Salt

white
As per CODEX STAN 150-1985 [10]

Water

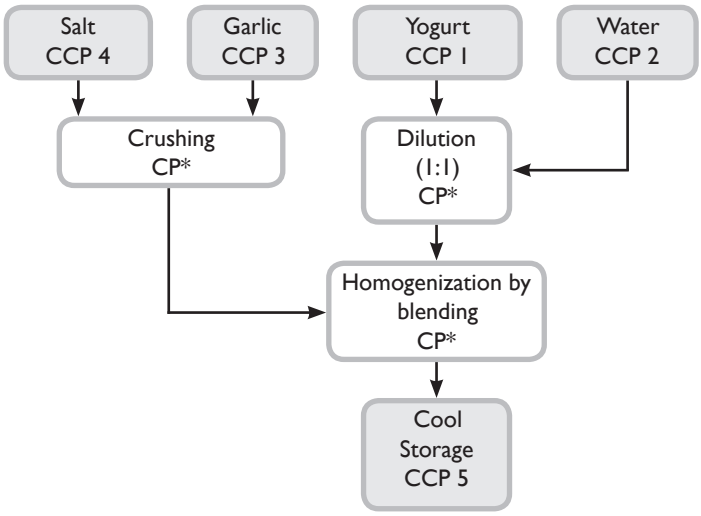
WHO *Guideline for drinking-water quality* [5]

[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 985:2001 and 705:1990 [11]
[a] Related national standard, e.g., JISM 135:1991 [11]

3. Preparation of *laban* drink

Laban drink is made and served at drink shops, homes and in restaurants, and is also served by street vendors. It is prepared by mixing yogurt with water (1:1), crushed garlic and salt, using a blender. *Laban* drink is then kept in a refrigerator until serving. [20]

4. Process flow diagram for *laban* drink production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for *laban* drink production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective actions
					Test	Frequency	
Yogurt	*Biological:* Disease-causing microorganisms	Yogurt pH < 4.6	1	pH < 4.6	Measure pH	Each batch	Discard yogurt
Water	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure the adequacy of filters, tanks and hydrants	2	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filters • Investigate root cause and eliminate
Garlic	*Physical:* Hull residues after peeling step	Remove all undesirable parts of garlic cloves	3	No hulls visible	Visual test	Each process step	Re-clean garlic to remove hulls
Salt	*Physical:* Foreign matter	Sieving	4	Sieve with suitable mesh size	Visual examination	Each batch	Re-sieve salt
Cool storage	Growth of moulds	Maintain at temperature < 5°C	5	Temperature < 5°C	Temperature probe	Continuous	Adjust refrigerator temperature (2–5°C)

* WHO *Guidelines for drinking-water quality* [5]

لبنة

Generic HACCP model for

labaneh

1. Product description

Product name(s)	*Labaneh (labna, labneh)*
Important product characteristics	pH between 3.6 and 4.0
Intended use	*Labaneh* is widely consumed with olive oil at breakfast, supper or as a snack, usually as a sandwich spread
Packaging	Plastic press-to-seal or thermally sealed
Shelf life	Up to two weeks
Sold in	Supermarkets
Labelling instructions	Keep refrigerated (below 5°C)*
Special distribution control	Ship and store refrigerated (below 5°C) under hygienic conditions

[14,21]

* As recommended by Codex Alimentarius for refrigerated foods

2. Ingredients of *labaneh*

Water	Salt	Raw milk
WHO *Guidelines for drinking-water quality* [5]	*White* As per CODEX STAN 150-1985 [10]	No Codex standard available[a]
	Plastic containers	
	No Codex standard available[b]	

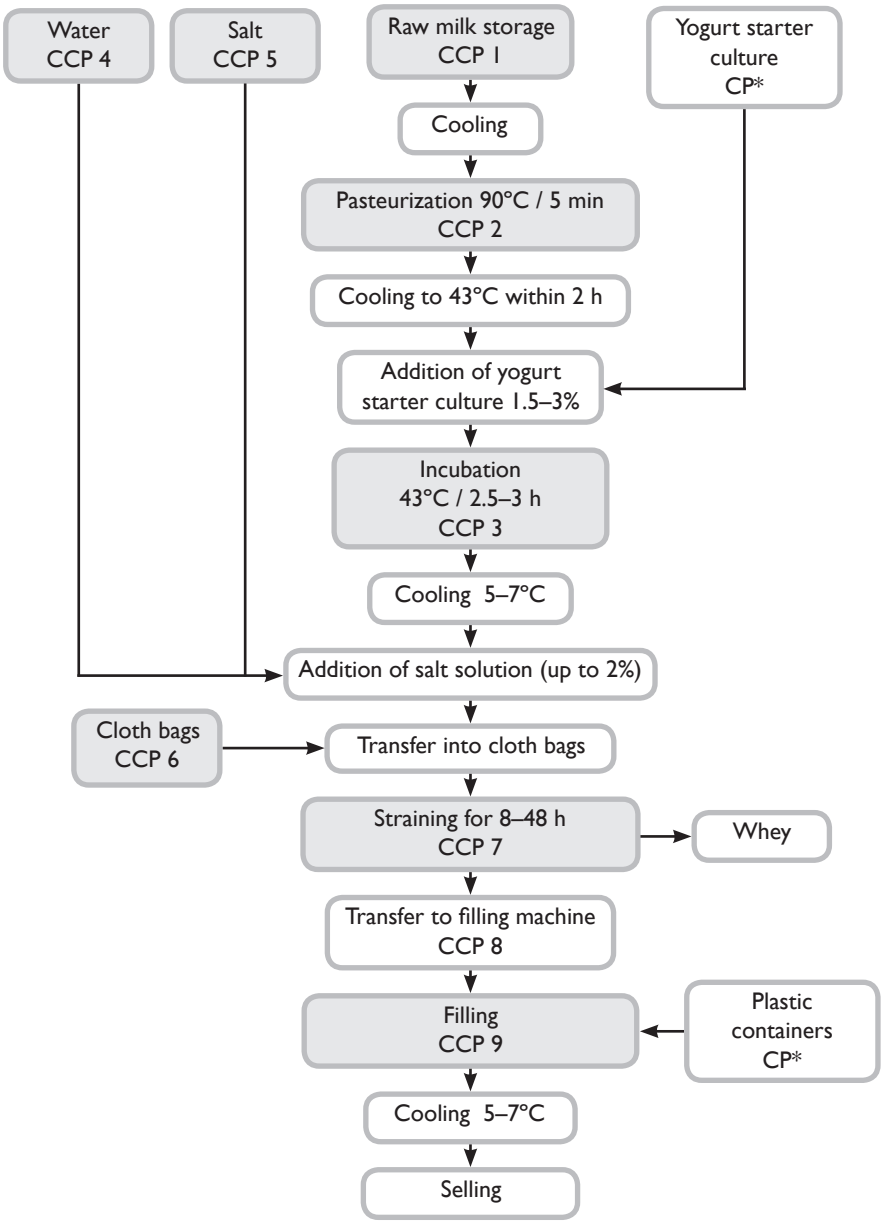
[a] Related national standard, e.g., Jordanian Institute for Standardization and Meteorology (JISM) 4:2003 [11]
[b] Related national standard, e.g., JISM 617:2005 [11]

3. Preparation of *labaneh*

Labaneh is the name used in Jordan and other Arab countries for the semisolid dairy product made when part of the whey from set yogurt is removed by straining in cloth bags.

The milk (usually from cow, sheep or goat) is boiled (pasteurized) for a few minutes, cooled to 40–45°C, inoculated with 1.5–3% yogurt starter culture, stirred, incubated for several hours to become yogurt and cooled overnight. Salt (up to 2%) is added, then the yogurt is placed into cloth bags to drain the whey. The concentrated yogurt is then transferred to a filling machine. [14,21]

4. Process flow diagram for *labaneh* production



* Control points that should already be dealt with as a part of the prerequisite programme of basic good manufacturing practices (GMP).

5. HACCP chart for *labaneh* production

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Storing raw milk*	*Biological:* Pathogen growth/ toxin production from time and temperature abuse	• Store raw milk under refrigeration (2–5°C)	1	• Raw milk storage temperature < 7°C • Maximum storage period 72 hours	• Storage temperature and time of every raw milk storage tank	Each batch	• Discard affected batch • Investigate, identify and correct cause of problem
	Chemical: Antibiotic residues	• Antibiotic residues test		• Absence of antibiotic residues	• Antibiotic residues test		
Pasteurization	*Biological:* Pathogen survival due to improper time and/or temperature of pasteurization	Pasteurization of milk at not less than 73°C for a holding time of not less than 3 minutes	2	Pasteurization temperature not less than 75°C for a holding time of not less than 16 seconds	Check temperature and time during heat treatment	Every batch	• Discard affected batch • Investigate, identify and correct cause of problem
Incubation	*Biological:* Growth of disease-causing microorganisms	Check pH development within 4 h (pH < 4.5 time < 4 h)	3	• pH < 4.5 • Time < 4 h	Check pH and time	Every batch	• Check starter culture efficiency • Discard batch
Water**	*Biological:* Disease-causing microorganisms	• Use a potable supply from the local authority • Ensure adequacy of filter, tanks and hydrants	4	Coliforms not detectable in 100-ml samples*	Estimation of coliforms count	Every month	• Discard contaminated water • Sanitize tanks and filter • Investigate root cause and eliminate
Salt	*Physical:* Foreign matter	Sieving	5	Sieve with suitable mesh size	Visual examination	Each batch	Re-sieve salt
Cloth bags	*Biological:* Growth of disease-causing microorganisms and moulds	• Washing the cloth • Proper rinsing after cleaning and disinfection	6	Cloth bags to be clean and free from any food traces	Check for proper cleaning	Every batch	Re-wash bags

Step	Hazard	Control measure	CCP	Critical limit	Monitoring		Corrective action
					Test	Frequency	
Draining	*Biological:* Mould growth after draining whey at room temperature for more than 48 h	Draining whey in refrigerator at 5–7°C	7	• Draining whey time < 24 h • Temperature surrounding draining whey < 7°C	Measure draining temperature and time	Continuous	Adjust draining temperature
Transferring *labaneh* to filling machine	*Biological:* Disease-causing microorganisms *Chemical:* Cleaning agents	• Cleaning, disinfection and rinsing adjoining surfaces and equipment • Proper washing to eliminate detergents and sanitizer residues	8	• Proper cleaning and rinsing • Absence of sanitizer or detergent residues	• Check cleaning and disinfection, funnel cover • Checking sanitizer or detergent residues using kits	Continuous	Discard batch
Filling	*Biological:* Disease-causing microorganisms *Physical:* Foreign bodies in filling machine funnel *Chemical:* Cleaning agents	• Cleaning, disinfection and rinsing adjoining surfaces and equipment • Covering funnel • Proper washing of utensils to eliminate detergent and sanitizer residues	9	• Proper cleaning and rinsing • Absence of foreign bodies • Absence of sanitizer or detergent residues	• Check cleaning and disinfection, • Observe funnel cover and check for presence of foreign bodies • Checking sanitizers or detergents residues using kits	Continuous	• Recleaning and rinsing • Review cleaning procedure efficiency

* Some milk producers may feed animals with mouldy products without being aware of the probability of mycotoxin transfer into milk. In such cases, mycotoxins in feed should be dealt with as a hazard to be controlled at receiving of milk

** WHO *Guidelines for drinking-water quality* [5]

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