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APPLICATION OF HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) PRINCIPLES TO BEEF MORTADELLA PRODUCTION

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ABSTRACT

A mortadella is a cooked sausage made from raw pork, beef, chicken or lamb. It is popular in Jordan and neighboring countries for its taste, texture, nutritional value and ease of inclusion in sandwiches. The product is sold in plastic packaging, in circular rolls or vacuum packed. Although it poses no serious threat to human health, the heat can be dangerous if used improperly. A HACCP system is used to manage the production process, with a focus on quality control (CCP) throughout the manufacturing phase. Safety risks are identified at all stages of production, from raw materials to storage and distribution. Foodborne illnesses are primarily caused by pathogenic microorganisms, and these raw materials include pathogenic plant cells, *Bacillus cereus, Clostridium botulinum* and *Clostridium perfringens* that survive after cooking and contamination detected after monitoring. Post-manufacturing controls are performed through Good Manufacturing Practices (GMPs). The objectives of the study were to identify potential hazards associated with the production of beef mortadella, determine the CCPs to be implemented, develop a monitoring plan and establish corrective action on a case-by-case basis. The HACCP plan was developed in collaboration with local stakeholders and follows a process flow diagram to identify potential hazards and preventive measures. The system includes the steps for obtaining and storing the ingredients, preparing the meat, adding non-meat ingredients, and transferring the raw mixture to an incubator. The meat is weighed and filled with the mixture to improve cleanliness and avoid excess nitrite. The storage time between incubation and cooking is controlled to allow bacteria to multiply. To kill plant pathogens and reduce the total number of microorganisms, the product is cooked in a steam oven at 75°C for 5 minutes. The aim of the cooking process is to reduce microbial growth before lethal temperatures have been reached and uniform heating of the product has been ensured. Cooking suitability is checked by thermographic records and visual inspection of the cooked product. The plan also includes personnel in charge of every stage of production, ensuring a clean and hygienic environment.

Key words: HACCP, Mortadella, meat processing, hygiene control, food safety

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INTRODUCTION

Mortadella is a cooked, cured, emulsion-type sausage that can be prepared from raw pork, beef, poultry or lamb, or combinations of these meats, depending on religious constraints and consumer preferences. Before cooking, the meat is seasoned and cured with sodium nitrite, which gives rise to a characteristic pink color and a distinctive flavor; it also has a preservative effect. Beef mortadella is increasingly popular in Jordan and neighboring countries because of its flavor, texture, nutritional value and ease of incorporation in sandwiches [1,2]. The product is contained in a plastic casing and is sold either in the form of a cylindrical roll or as vacuum-packed slices [3, 4, 5].

While the above type of product generally presents only a low risk to human health, it is manufactured from raw meat and low levels of contamination with foodborne pathogens cannot be ruled out. Therefore, the product can become hazardous if it is temperature-abused [6,7]. The use of nitrite in the curing process is a critical factor [8,9] and spore outgrowth in *Clostridium botulinum* can be inhibited by this means, but there is a need to ensure that the production process as a whole is properly controlled to minimize any potential public health hazard [10]. Such control is achieved by implementing the HACCP system, which focuses on CCPs at all stages of product manufacture [3, 11]. The numerous advantages of the HACCP approach are summarized in Table 1 and the system is considered more effective for assuring the safety of both local and imported foods than relying on traditional end-product testing [11, 12, 13]. In this study, safety hazards have been identified and described in all stages of the manufacturing process, starting with the incoming raw materials and ending at storage and distribution of the finished product. It is evident that microbial pathogens are the primary cause of foodborne illness [14,15] and these come mainly from meat that is used as a raw material [14,16]. The resultant hazards are of three kinds. One relates to the presence of vegetative cells of pathogens in raw ingredients, which are destroyed by the cooking process. Examples include Salmonella, *Staphylococcus aureus* and cells of spore-forming organisms. Another type of hazard is posed by spores of *Bacillus cereus*, *Cl. botulinum* and *Cl. perfringens* that would be expected to survive cooking. In this case, refrigeration of the finished product is essential to maintain food safety. The third category is relevant to all ready-to-eat meat products and involves recontamination of the product during post-processing handling. The organisms of concern include *Salmonella* and the psychrotrophic pathogens *Listeria monocytogenes* and *Yersinia enterocolitica*. Control is achieved mainly by implementation of Good Manufacturing Practices (GMPs) after processing to minimize exposure of the product and prevent recontamination from the environment [17, 18, 19].

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The objectives of the study were to: (i) identify the potential hazards associated with production of beef mortadella, (ii) determine CCPs for the process as a whole and establish critical limits for the relevant parameters, (iii) develop a monitoring system to ensure that control is maintained at all CCPs and (iv) establish the corrective action in each case, should there be a deviation from a critical limit.

MATERIALS AND METHODS

Mortadella manufacture

The ready-to-eat product was manufactured in 1.0 kg amounts in a plastic casing at a meat products factory in Amman, Jordan. The ingredients were: raw beef (31.5 kg), spices (300 g), garlic (50 g), starch (2.5 kg), sodium ascorbate (500 ppm), Sodium tripolyphosphate (160 g), sodium chloride (720 g), sodium nitrite (125 ppm) and ice water (6 kg) with total weight 41.54 kg. The formulation was in accordance with the Jordanian Standard (2008) for emulsion-type sausages and the technology of the process was as described previously [2, 20].

HACCP plan

The plan was developed at the factory in collaboration with local staff and followed the guidelines shown in Fig. 1. The CCPs were determined according to the procedure outlined in Fig. 2 [21].

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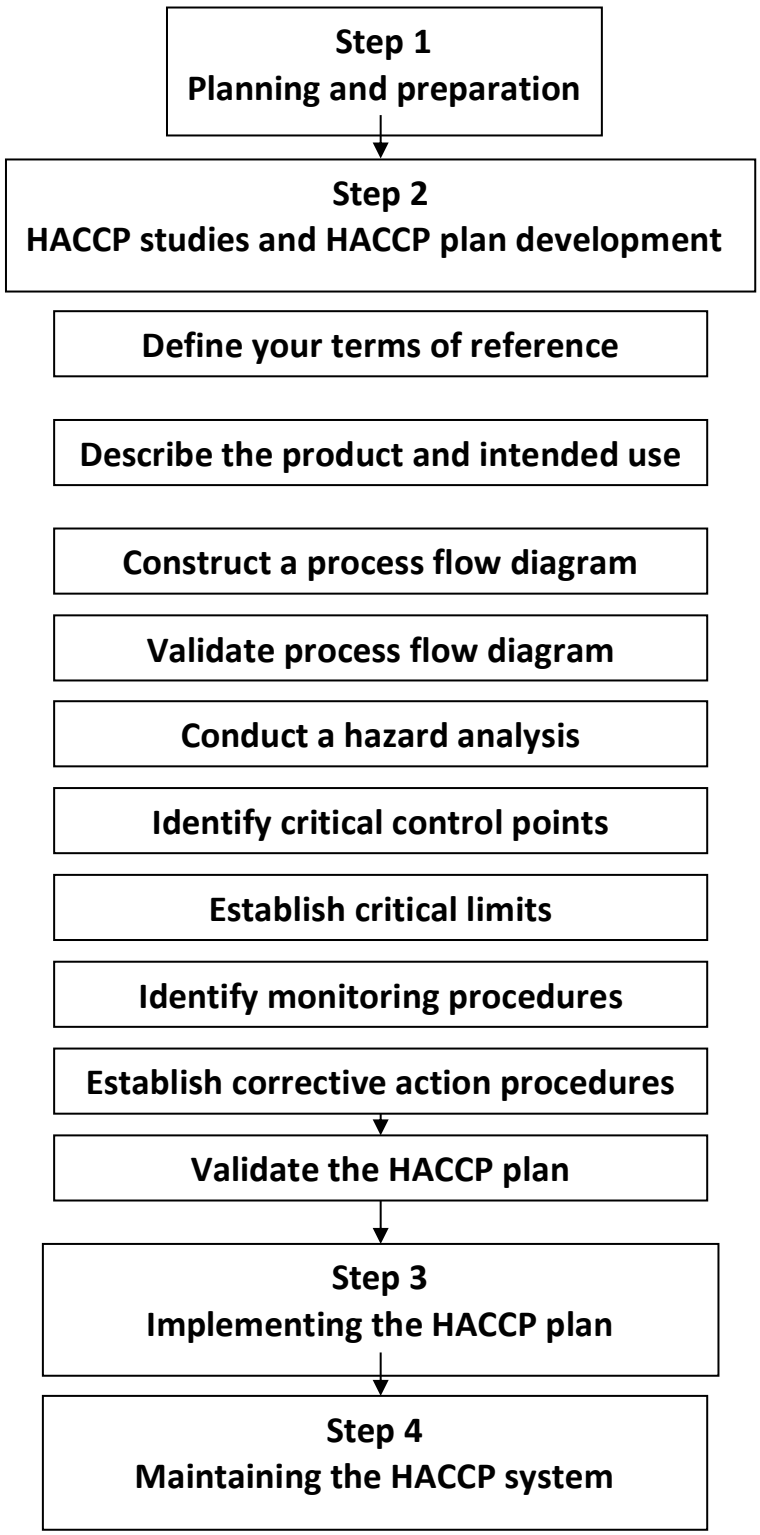

Figure 1: Guidelines for the application of the HACCP system

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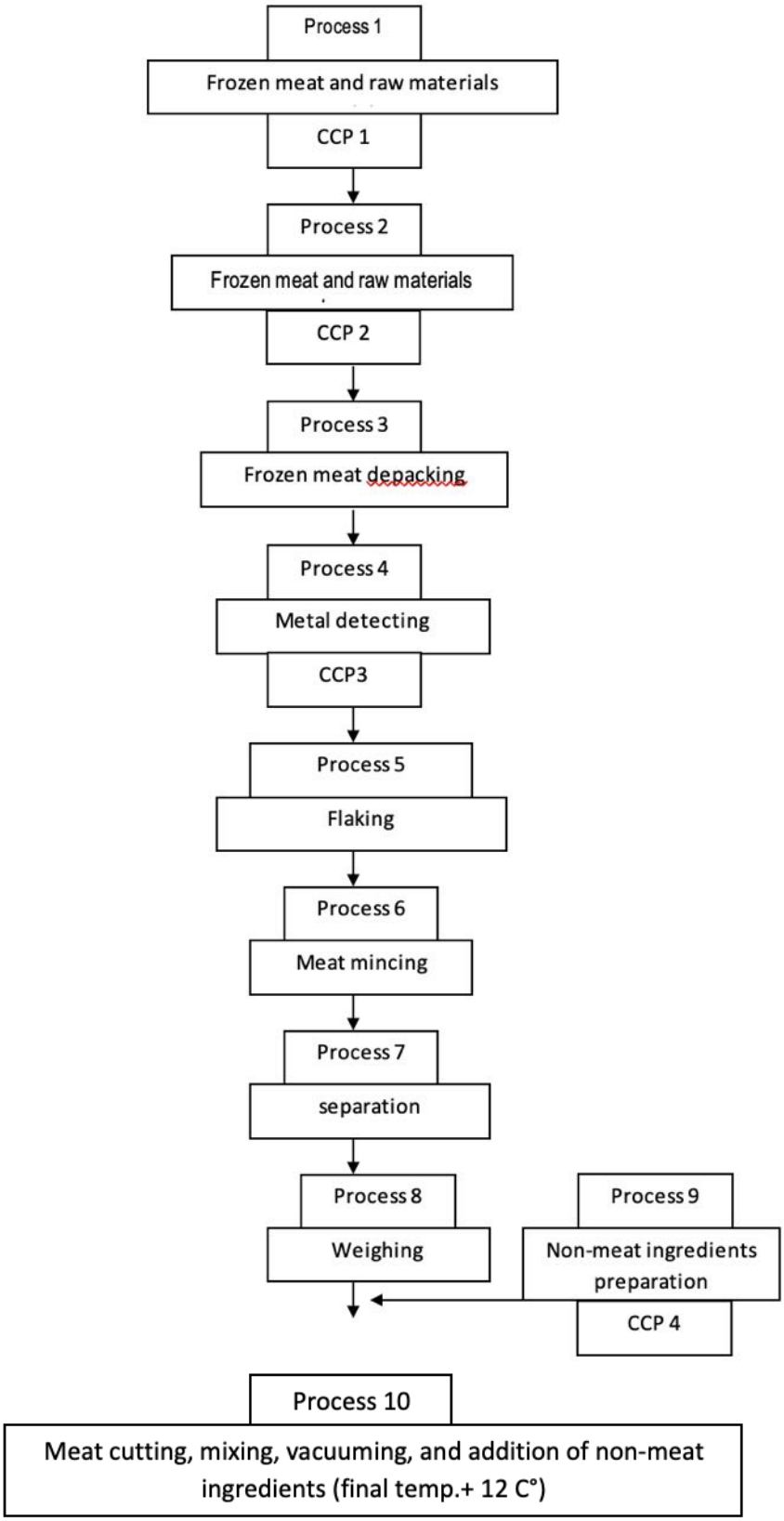

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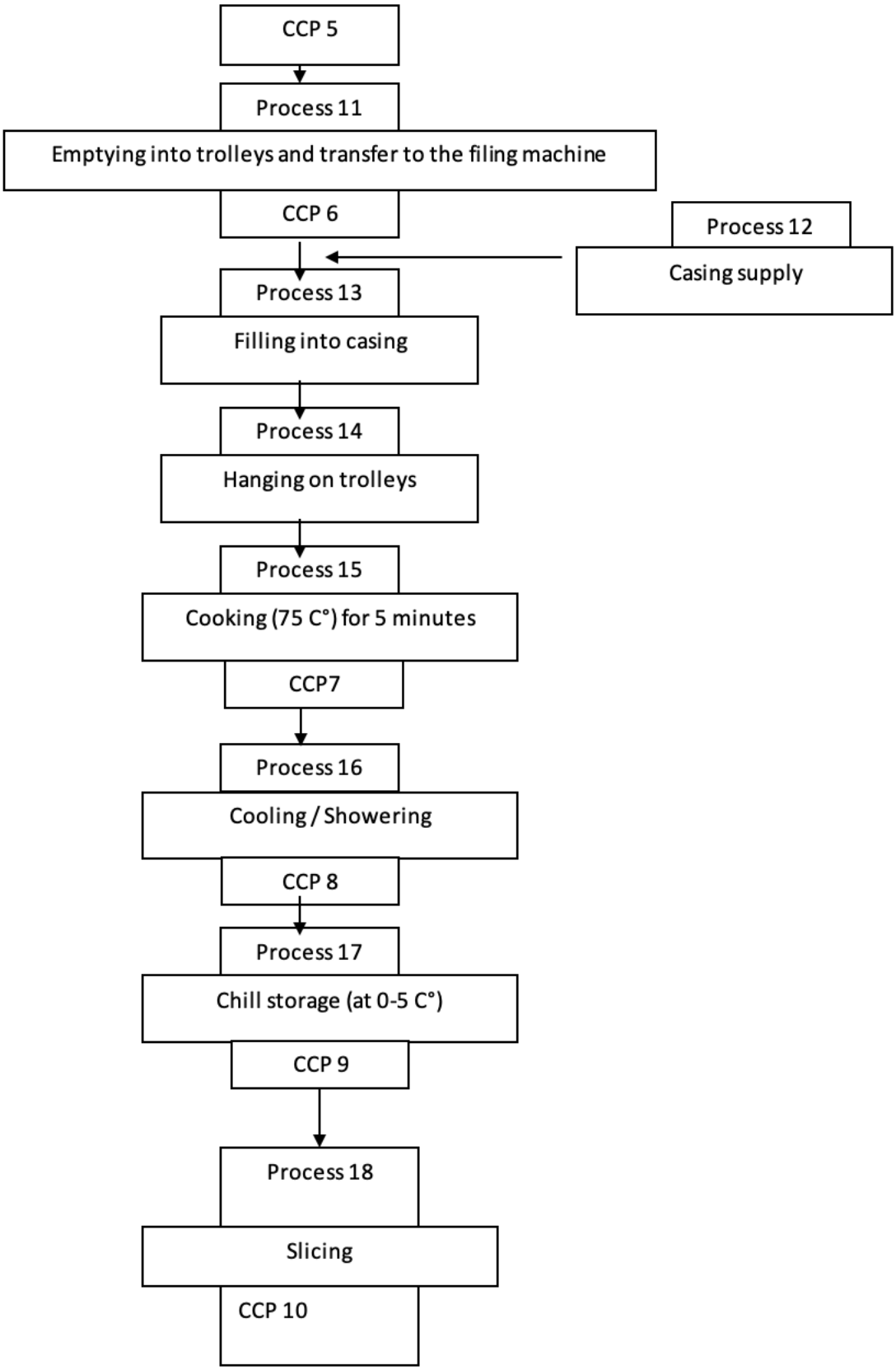

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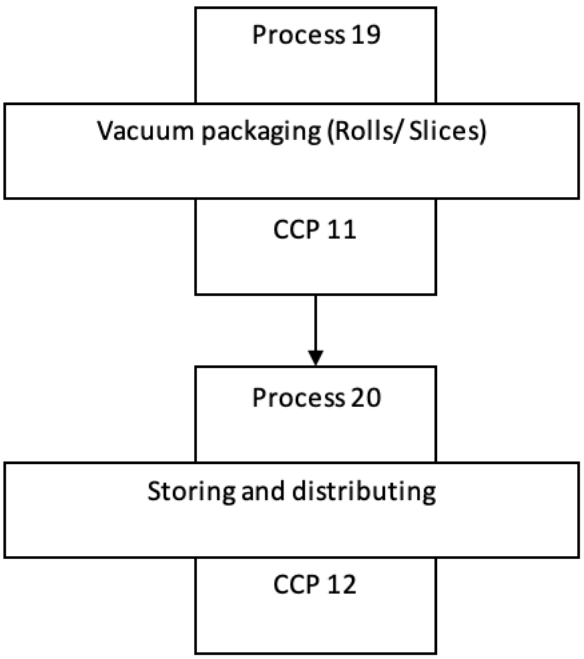

Figure 2: Mortadella production flow diagram

RESULTS AND DISCUSSION

The first stage of the exercise was to establish a process flow diagram, giving a clear, simplified description of the manufacturing process (Fig. 3). The diagram was completed and verified by the HACCP team and formed the basis for developing the control plan. It also shows the steps at which CCPs were subsequently identified. Table 2 lists the potential hazards associated with the product, measures necessary for their control at each CCP, including critical limits, and any corrective action required. The monitoring of CCPs is summarized in Table 3, which includes the staff responsible for this activity at each production step.

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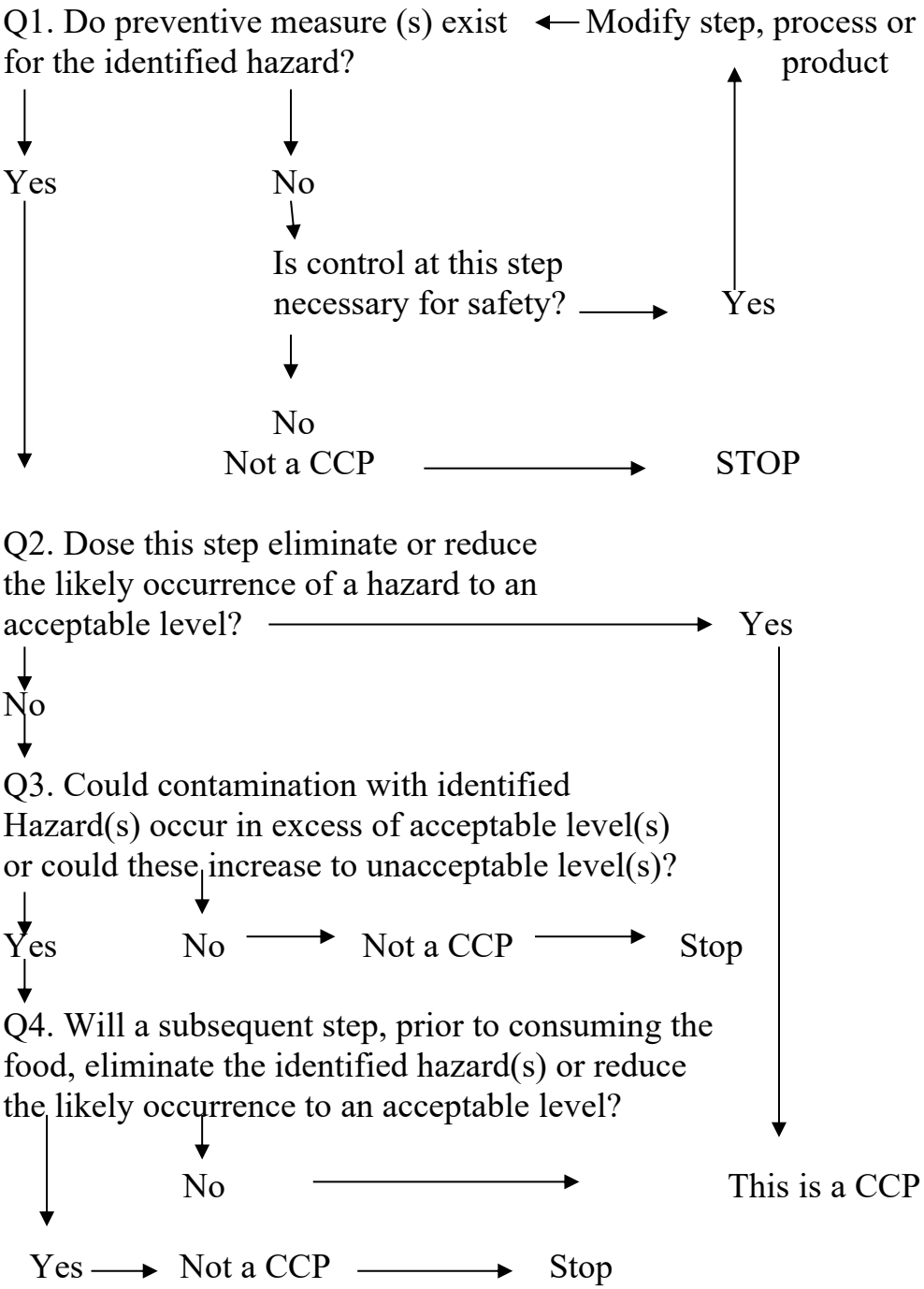

Figure 3: Critical control points decision (Codex Alimentarus Commission Tree)

Receiving and storage of raw materials (CCPs 1 – 3)

At the start of the process, attention is given to the frozen raw meat and other ingredients prior to use. The inspection procedures are based on Jordanian standards and company-specific requirements for the meat, which must satisfy

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organoleptic, chemical and microbiological criteria. Also, the temperature of the meat and the delivery vehicle are monitored and recorded.

Table 2 shows that the hazards involved are not confined to pathogenic microorganisms, but include foreign bodies and residues of hormones, antibiotics and pesticides as well. Thus, all raw materials must comply with the relevant specifications and pass the inspection procedures. The frozen meat is examined with a metal detector and, if any metal is found, the batch is rejected immediately. Attention is also given to the storage conditions for raw materials, which may or may not include refrigeration, but must be checked to ensure that the facilities are clean and hygienic, with appropriate control of temperature and humidity. All stored items must be packaged properly.by simple examination and evaluation one cannot eliminate the indicated hazards and hence one wonders how reception becomes a CCP.

Meat preparation and addition of non-meat ingredients (CCPs 4 and 5) cross-check what makes a CCP as per decision tree

The meat is first transferred to a mechanical cutting machine. Then, each of the other ingredients is weighed out, using a pre-calibrated balance, and added in the amount specified by the product formulation. Particular care is taken to avoid adding an excess of nitrite. It is also necessary to prevent any increase in the temperature of the resultant mixture during the cutting and mincing processes, and to ensure that good hygiene is practiced in relation to personnel, equipment and the surrounding environment.

Transfer of raw mixture to the filling machine (CCP6)

The time taken to fill the plastic casing with the raw mixture ('batter') should be as short as possible. This process is carried out under vacuum and the cased product is immediately closed off with metal clips. To minimize any multiplication of pathogens or spoilage microorganisms, the holding time between filling and cooking is monitored and should not exceed 4 h.

The cooking process (CCP 7)

The product is cooked in a steam oven at 75^{o}C for 5 min to kill vegetative pathogens and reduce the overall microbial load. The cooking process has two important goals: to minimize any microbial growth before a lethal temperature is reached internally and to ensure that the product batch is heated uniformly to the required temperature for the specified time [18]. Thus, the process must allow all units in the batch to receive adequate heat treatment. To achieve these objectives, the temperature of the steam and internal temperature of the product are monitored and recorded continuously during the cooking cycle. The adequacy of

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cooking is verified by examination of the thermographic records and by visual inspection of the cooked product, with occasional microbiological checks.

Product cooling (CCP 8)

After cooking, the product is cooled rapidly inside the oven by spraying with cold water to prevent germination and outgrowth of bacterial spores [22]. By controlling the temperature and time of cooling, the internal temperature of the product can be reduced to 40°C within 30 min. On removal from the oven, further cooling occurs in a chill room, the core temperature of the product reaching 10°C within 1 h. Then, the batch is transferred to another chill room at 5°C for storage.

The water used in cooling the product must be of potable quality and is chlorinated to minimize microbial contamination [18]. The internal temperature of the product is monitored continuously by means of sensors, and thermographic records are examined at the end of the process. Microbiological tests are used to check the quality of the cooling water.

The rate at which the product cools to 20°C is important. Below this temperature, mesophilic spore-forming pathogens multiply relatively slowly and those likely to occur in cooked meat products are unable to grow below 10°C [18].

Product slicing (CCP 9)

Ultimately, the temperature of the final product must be no more than 4°C. The product is then packed into cardboard boxes for chill storage or is first sliced and packaged. During slicing, the product is exposed to the risk of recontamination. Therefore, high standards of hygiene control are needed for personnel, equipment and the processing environment. Each is monitored and verified by microbiological testing, with special attention being given to the slicing machine, the conveyor belt carrying the cut slices, and the hygiene of the food handlers.

Vacuum-packaging of rolls or slices (CCP 10)

Either the cooked rolls or sliced product can be vacuum-packed. At this CCP, strict control of personnel and environmental hygiene is again important. Packs are examined to ensure that they are intact and the seal is complete. To verify pack integrity, the degree of vacuum present is measured.

Product storage and distribution (CCP 11)

Both rolls and slices are either stored under chill conditions or distributed to local markets. Because the product is ready-to-eat, but perishable, it should be kept at 5°C or below at all times to prevent pathogen growth. The holding conditions should be monitored continuously throughout storage and distribution.

At the factory where the HACCP plan was developed and implemented, it was evident that control of product safety had been improved significantly and staff

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awareness of food-safety requirements was greatly increased. It was concluded that the most important aspects of the process for the manufacturing of a safe end-product are:

1. The quality of raw materials and their storage conditions.
2. Efficient cooking and cooling processes.
3. Chill storage and distribution of the product.

If HACCP implementation becomes a legal requirement in Jordan and neighboring countries for food manufacturing, the study described here could be utilized by the meat industry both for mortadella and other, similar types of meat product.

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

The study aimed to develop a beef mortadella and implement a HACCP system for food safety. The main finding is that the most reliable way to make sure that products like mortadella are safe is to follow the following procedures: "Identifying potential hazards, establishing manufactured critical points, developing monitoring plans, and implementing corrective actions."

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CONFLICT OF INTEREST

The authors declare that there are no known competing financial interests.

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Table 1: Reasons for using HACCP [19]

HACCP is a systematic, disciplined approach to process control that is based upon science.
HACCP requires record keeping which provides an auditable document trail and a historical perspective of control.
HACCP avoids the use of statistically unreliably end product testing to assure food safety.
Traditional inspection procedures are inadequate because many food safety hazards cannot be detected by traditional means.
Resources, which are often limited, are focused on and encourage improvements in food safety.
Responsibility and accountability are clearly assigned.
Timely adjustments are made to processes which will prevent loss of control and loss of product.
If control is lost, it will be detected and appropriate actions can be taken to assure food safety and avoid costly product recalls.
The HACCP concept is a logical, common sense approach that can be used to educate employees and the public in safe food handling procedures.
HACCP is the most cost-effective means to assure food safety.
Successful implementation of HACCP maintains consumer confidence in product safety with no perceptible change in product cost.

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Table 2: HACCP control chart for mortadella production

Product: Mortadella						
Process Step		**Hazard**	**Control Measures**	**Critical Limit**	**Corrective Actions**	**CCP No.**
No	**Title**					
1	Frozen meat and raw materials receiving	**B:** Pathogens: E. Coli., Coliforms, S. aureus, Clostridium, Streptococcus . P: Forgien Bodies (Bone pieces, feathers, wood pieces, glass, packaging materials) **C**: Hormons, antibiotics residues, pesticides residues	• Received meat temperature not more than -18 °C • Laboratory analysis for microbiological and chemical hazards. Specifications and standards. • Standard packaging frozen meat. • All other ingredients should be in compliance with specifications. • Raw materials must be from approved or clean sources. • Raw materials must meet a standard quality.	Meat temp*= - 15 °C Vehicle temp= -12 °C Certificate of products shall be available. All products shall be in compliance with specifications. Locally purchased products shall pass laboratory analysis and confirm compliance with specs. For imported materials, a testing report must be received All products shall pass inspection.	• Reject meat if receiving temp. is more than -15 °C Reject meat if vehicle temp. is more than – 12 °C • Ask for material certificate if not supplied with consignments. • Reject material if not in-compliance with specs. • Reject locally bought materials and meats if not pass inspection and laboratory analysis.	1

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
2	Frozen meat and raw materials storage	**B:** • Microbial growth including pathogens. Contamination **C:** • Chemical Deterioration. **P:** • Contamination with foreign bodies (wood pieces, glass, packaging materials)	• **Store meat** at – 18 °C or less. • Control and check temp. of storage area • **Prevent** Contaminati on with other substances. • Keep meat Packaged properly. • **Keep all** Ingredients in suitable containers or packaged properly. Visual inspection.	• Stores temp = - 10 C° for 12 h. • All products shall be packaged or kept in suitable containers. • All freezers and stores shall be clean and in good conditions. • Stores shall be dry and clean.	• Reduce the freezer temp. as soon as possible. • Transfer frozen meat to another properly working freezer if the room temp. exceeds – 10 °C for 12 hr. • Inform maintenance department if deviation in the freezer temp. occurs. • Handle packaged products carefully . • Take action to reduce relative humidity of dry stores (ventilation). • Store all dry ingredients in dry places. • Keep stores clean and in hygienic conditions.	2

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
4	Metal detecting	• Physical (metal pieces)	• A Metal detector to be installed between unpacked frozen meat area and Grinder. • The metal Detector should be tested prior to production by passing a special metallic piece. • The results of the unsatisfactory test should be recorded.	Failure of Metal Detector following previous test.	• If testing the Metal Detector reveals that it is non-conforming, the previously produced lot shall be segregated and identified as non-conforming.	3
9	Non-Meat ingredients preparation.	**B:** • High endospores number. • Parasites • Insects. **C:** • High moisture contents • Excess amounts of added ingredients. • Cleaning and sanitizing	• Accurate weighing of added ingredients. • Visual inspection of all weighed ingredients. • Proper mixing of ingredients where needed. • Keep all ingredients	• Weights shall be accurate. • Use of accurate and calibrated balances . • Keep materials separated properly.	• Reject prepared batches if their added ingredients are not weighed properly. • Rework the wrong batches to adjust added ingredients levels. • Discard cooked batches if contain wrongly	4

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
		materials residues **P:** • Excess of impurities. (insects, pieces of wood, glass, cartons, metal pieces).	separated properly to prevent cross contamination • Calibrate balances regularly.		added ingredients. • Discard the ingredients that have been mixed during storage. • Calibrate balances if needed.	
10	Meat cutting, mixing, vacuuming, and addition of non-meat ingredients.	**B:** • Rapid microbial growth. • Contamination **C:** • Improper mixing of added ingredients. **p.** • Low vacuum. • Inclusion of air. • Fall foreign bodies (metal pieces, glass, plastic pieces).	Check temp. of raw mix. • Inspect for possible fall of foreign bodies. • Ensure proper mixing of dry added ingredients. Ensure sufficient vacuum value and time. Proper hygienic practices surrounding the cutter. Proper personnel hygienic practices. Clean and sanitize the	Temp of raw mix = + 18 C° Meat shall pass visual inspection Sufficient vacuum. Proper cleaning and hygienic practices.	Reduce the raw mix temp. Discard raw mix if ingredients do not pass inspection. • Clean and sanitize the cutter as necessary .	5

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
			cutter regularly.			
11	Emptying into trolleys and transfer to the filling machine (Holding).	**B:** Microbial growth due to long holding period and raise in temp. **C:** Chemical deterioration **P:** • Fall of foreign bodies into trolleys. Presence of foreign bodies in hopper.	• Limit hold time of trolleys containing the raw mix. Keep trolleys in chiller if long holding time is expected. • Check temp. of mix during holding. Cover trolleys during the holding time.	Hold time = 4 h (12 C°)	Transfer trolleys to the chiller if holding time exceeds 1 hr. Cover trolleys during holding period. Discard raw mix if temp. exceed 12 °C. for more than 4 h.	6
15	Cooking	**B:** Cooking temp and time is under critical limits, causing survival of pathogens.	Control the core temp. during cooking (75 °C) Control the time of cooking (5 mints).	• Cooking temp. = 75 °C/5mins	Increase the time and temp. of cooking to achieve the target value. Discard batches if target temp and time are not achieved.	7
16.	Cooling/ showering	**B:** Too long showering time. Survival of pathogens. Rapid Multiplication	Reduce temp. as low as possible within short possible time.	• Reaching 55 °C within ≥ 60 minutes.	Reduce showering water temp. as much as possible. • Treat water to be in compliance	8

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
		of microorganisms. Hazards contributed by the cooling water.			with potable water specs. *	
17	Chill storage	**B:** • Rapid growth of microorganisms. **C:** • Chemical deterioration. **P:** • Contamination with non-cooked products, or foreign bodies.	Keep chiller temp. at 5 °C or less. Proper cleaning and hygienic practices in chillers. No raw materials shall contact the cooked product.	Chiller temp > 8 °C for >6 h Chillers are not cleaned properly. Raw materials come in contact with cooked products.	Reduce the chiller temp. to 5 °C or less. Transfer products into another chiller. Discard chilled products if their temp. Increased to > 8 °C for > 6 h. Proper cleaning and hygiene of chillers. Keep materials separated.	9
18	Mortadella slicing	**B:** • Microbial recontamination from personal, surfaces surrounding, and the slicer. • Increase in area temp. **P:** - Fallen foreign bodies.	Avoid recontamination by proper personal, surfaces, surrounding , hygiene, and equipment sanitation. Control area temp. (< 10 °C). Avoid the presence of	All surfaces are cleaned properly. Proper personal hygiene. Area tem. < 10 °C. Area or slicing room is well designed for this propose. Avoid detergent	Stop slicing if area is not cleaned properly . stop slicing if area temp > 10 °C. clean equipment and surfaces properly.	10

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
		C: - Cleaning detergent residues.	any foreign bodies in the slicing room. Rinse slicer and surfaces with sufficient fresh water before use.	residue remaining on surfaces.		
19	Vacuum packaging (Rolls / Slices)	**B:** - Increase microbial and pathogens growth due to product temperature increase . - Contamination due to insufficient vacuum, punctured pack, improper sealing of pack due to incorrect sealing bar temp. **C:** None **P:** None	• package inspection minimizing holding time before and after packing .	Rapid packaging of the product, time should not exceed 2 hr. Proper functioning of the sealer. Vacuum is sufficient. Packing room temperature < 10 °C.	Reject product if holding time exceeds 2 h in the area . • Inadequate cleaning and sanitation of the packaging machine and area, clean and sanitize immediately. • Insufficient sealer temperature or vacuum, check sealer . Slicing and packaging room temperature > 10 °C, lower temperature as soon as possible.	11

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Product: Mortadella						
Process Step		Hazard	Control Measures	Critical Limit	Corrective Actions	CCP No.
No	Title					
20	Product storing and distributing	**B:** • Microbial including pathogens multiplication due to chill store or vehicle chiller temperature increase. C: • Taints from vehicle • Vehicle chilling chamber is not clean. P: Non	• Control chill store and vehicle temperature and keep it below limit. • Vehicle inspection	• Refrigeration temperature is not > 6 °C. • Good hygienic and cleaning conditions of the vehicle.	In case of deviation of chiller or vehicle temperature: call maintenance to fit the temperature problem if vehicle temperature outside critical limit (during distribution) stop product distribution.	12

Temp*: Temperature, Spec*.: Specifications

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Table 3: **Monitoring procedures and criteria**

	Process step				
No	**Title**	**Monitoring procedure & criteria**	**Frequency**	**Responsibility**	**CCP No.**
1	Frozen meat and raw materials receiving	According to the Jordanian standards of the related material. Inspector will check the temperature of each batch of meat received (meat and vehicle temperature). All findings will be recorded in HACCP receiving log. Inspector will ensure that a random sample from each lot received for foreign materials and record the results in the receiving log.	From the received batch, minimum one sample from each batch. At receiving of each batch.	Quality control (Q.C) Supervisor Q.C. Supervisor Q.C. Supervisor	1
2	Frozen meat and raw materials Storage	Meat stores temperature Store cleanliness and hygiene. Packaging properly - Shelf life.	Ever 3 h Daily Daily Every week.	Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor	2
4	Metal detecting	Ensure metal detector functioning and sensitivity.	Beginning of production	Q.C. Supervisor	3
9	Non-meat ingredients preparation	Ingredients standard analysis including drinking water. Sensory testing	At receiving of each batch or material .	Q.C. Supervisor Q.C. Supervisor	4

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		Monitoring performance of person responsible for preparation.	At receiving of each batch or material. Daily	Production supervisor	
10	Meat cutting, mixing, vacuuming, and addition of non-meat ingredients	Hold duration Mix temperature Vacuum value Nitrite concentration Equipment and surfaces cleanliness	Each Batch Each Batch Each Batch Each Batch At start & end of shift.	Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor & production supervisor. Production supervisor	5
11	Emptying into trolleys and transfer to the filling machine (Holding)	Filling duration Temperature of dough	Each Batch Each Batch	Q.C. Supervisor Q.C. Supervisor	6
15	Cooking	Cooking temperature and time (temperature 75°C/5 min).	Continuously and recorded every 30 mints. For each batch.	Production supervisor	7
16	Cooling/ showering	Cooling duration and final cooling temperature. Cooling water microbiological quality chlorine level 0.2 – 1.0 ppm. Showering water flow sufficiency.	For each batch. Daily Monthly	Production Supervisor Q.C. Supervisor Maintenance Supervisor	8

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17	Chill storage	Chiller temperature Chiller cleanliness and hygiene GMPs inside the chiller Packs integrity Chilled product shelf life.	Every 2 h Daily Daily Daily Every week	Q.C. Supervisor Q.C. Supervisor and stores supervisor Q.C. Supervisor and stores supervisor Q.C. Supervisor and stores supervisor	9
18	Mortadella slicing	Slicer cleanliness and hygiene Slicing room temperature Personal hygiene Cleaning and sanitizer residues on slicer and surfaces.	Every hour Continuously Continuously After each sanitation of the slicer and the surrounding surfaces.	Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor	10
19	Vacuum packaging	Package integrity Vacuum formation and value Packaging room temperature Packaging room and personal hygiene and cleanliness. Sealer bar temperature	Every 30 mints. Every 30 mints. Continuously Continuously Every 30 mints.	Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor Q.C. Supervisor	11
20	Storing and distributing	Chiller store temperature and cleanliness Vehicle temperature and cleanliness	Every 3 h. At the beginning of distribution and then every 3 h.	Q.C. Supervisor Driver and marketing representative.	12

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