sustainability

MDPI

Article

Food Safety System (HACCP) as Quality Checkpoints in a Spin-Off Small-Scale Yogurt Processing Plant

Crina Carmen Mureşan [1], Romina Alina (Vlaic) Marc [1,*], Mirela Jimborean [1], Iulian Rusu [1], Andruţa Mureşan [1], Alina Nistor [2,3], Angela Cozma [4] and Ramona Suharoschi [2,3,*]

1 Food Engineering Department, University of Agricultural Science and Veterinary Medicine Cluj-Napoca, Faculty of Food Science and Technology, 3-5 Calea Mănăştur Street, 400372 Cluj-Napoca, Romania; crina.muresan@usamvcluj.ro (C.C.M.); mirela.jimborean@usamvcluj.ro (M.J.); iulian.rusu@usamvcluj.ro (I.R.); andruta.muresan@usamvcluj.ro (A.M.)

2 Food Science, University of Agricultural Science and Veterinary Medicine Cluj-Napoca, Faculty of Food Science and Technology, 3-5 Calea Mănăştur Street, 400372 Cluj-Napoca, Romania; alina.nistor@usamvcluj.ro

3 Molecular Nutrition and Proteomics Lab, CDS3, Institute of Life Sciences, University of Agricultural Science and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăştur Street, 400372 Cluj-Napoca, Romania

4 Department Internal Medicine, Clinique IV, Faculty of Medicine, "Iuliu Haţieganu" University of Medicine and Pharmacy, 400000 Cluj-Napoca, Romania; angelacozma@yahoo.com

* Correspondence: romina.vlaic@usamvcluj.ro (R.A.M.); ramona.suharoschi@usamvcluj.ro (R.S.)

Received: 4 September 2020; Accepted: 7 November 2020; Published: 13 November 2020

Abstract: The present study describes the implementation of a food safety system in the dairy pilot plant "Gourmeticus Academicum," a spin-off within the University of Agricultural Sciences and Veterinary Medicine of Cluj Napoca, Romania. In order to improve Hazard Analysis of Critical Control Points (HACCP) the preliminary programs were integrated into the quality management system (QMS) by monitoring the biological hazards. The process provides future specialists with good practice hands-on and educational tools. This study focused on hazard analysis, the determination and establishment of prerequisite programs, and the role of critical control points (CCPs) based on HACCP and the challenges found during the process as a critical thinking model on education programs. The determination of the CCPs in the processing of yogurt was made by applying the decision tree method. Besides, biological hazards are included as a by-control of the system's implementation performance. For the successful implementation of HACCP principles, prerequisite programs (PRPs) and operational prerequisite programs (OPRPs) were initially implemented. This process could be challenging but feasible to be reached in small-scale food industries with remarkable results as educational tools.

Keywords: yogurt; PRP; OPRP; HACCP; critical thinking model; education

1. Introduction

Yogurt is one of the most popular fermented dairy products, with a wide acceptance worldwide and whose nutritional and health benefits have been known for centuries [1]. As a general definition, yogurt is a fermented dairy product obtained from lactic acid fermentation by lactic acid bacteria (*Streptococcus thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus*). After fermentation, the milk acidifies and coagulates and increases the shelf life due to the low pH [2].

According to the available literature, yogurt is considered a functional food. The complexity of nutrients and digestibility gives this classification. It is a food that can be recommended for people with gastrointestinal disorders (irritable bowel disease, inflammatory bowel disease) and people with lactose intolerance. It helps increase the immune system and lose weight [3]. Yogurt and dairy products foster

a significant concern to the dairy industry and public health authorities [4]. Yogurt is a good source of probiotics, but it could also be an essential source of foodborne pathogens [5]. Several authors have reported the outbreaks or incidents of foodborne diseases associated with dairy products: *Brucellosis, Salmonella, Listeria, Clostridium botulinum* [6–9]. In industrialized countries, milk and dairy are involved in 2–6% of outbreaks of foodborne diseases [10].

The classical methods regarding the hygienic quality of the finished products are inadequate to control hazards occurring at early stages of the process [11]. Food safety requires compliance with good manufacturing practices (GMP), sanitation standard operating procedure (SSOP), good hygiene practices (GHP), also called operation prerequisite programs (OPRPs), and the principles of Hazard Analysis of Critical Control Points (HACCP) [12].

The concept of critical control points originated in 1959, when the National Aeronautics and Space Administration (NASA), Pillsbury, and US Army laboratories collaborated to provide safe food for future space expeditions. This scientific concept is based on the assessment of food safety hazards through a control system. This system is a preventive one that analyzes the biological, chemical, and physical hazards that affect the entire food chain [11,13]. Several reports indicated the effects of implementing HACCP on the microbiological quality of food products [11,14–16].

Note that the implementation of HACCP is mandated for all small- and medium-sized food companies in the European Union (EU), and HACCP is recognized in the international food safety community as a worldwide guideline for controlling foodborne safety hazards [17]. Its principles, detailed in the Codex Alimentarius guidelines, are integrated with International Standard ISO 22000:2018 [18]. The application of HACCP systems does not imply the existence of a traceability system as a direct consequence of the documentation procedures. However, the implementation of such a system is of particular importance. Even if Principle 7 of the HACCP system requires established documentation and record-keeping procedures, traceability systems are not mandatory under this system [19].

ISO 22000:2018, which was introduced worldwide on 19 June, 2018, states that organizations must conduct a risk analysis to identify significant hazards [18]. ISO 22000 was not recognized by the Global Food Safety Initiative as a standardized reference for food manufacturers in the past, as it imparts no detailed PRP (prerequisite program)-related information. Hence, ISO 22000:2018 comes with improvements essentially looking to determine a PRP for and the CCP (critical control point) of the significant hazards, having as fundamental principle risk-based thinking and risk reduction [18]. In food industries, identifying the hazards was the one of the 12 application steps for the HACCP approach that were considered critical. It also agrees with the first principle of Codex HACCP and ISO 22000:2018, which calls for the execution of hazard analysis. HACCP systems aim to identify, evaluate, and control hazards [16].

This work aims to implement a food safety system (HACCP) under the ISO 22000:2018 [18] standard by conducting a hazard analysis in a small-scale dairy pilot plant and yogurt production to develop a critical thinking model as an educational tool for food engineering students (FES) as well to identify CCPs, thus setting up an effective preventive system that will lead to a safer and more efficient production of yogurt and providing an example of good practice and educational tools for FES education programs.

2. Materials and Methods

2.1. Small-Scale Dairy Pilot Plant Description

This study was conducted at the small-scale dairy pilot plant (DPP) of the Faculty of Food Science and Technology, University of Agricultural Sciences and Veterinary Medicine of Cluj Napoca, Romania. This DPP is part of the food pilot chain consisting of six pilot plants, founded in 2012. The main goal is to implement the EN ISO 22000:2018 food safety management systems [18] within the pilot plant where the practical works are carried out with the FES (as internship in traineeship programs—integrated

education programs), thus setting up an effective preventive system that will lead to a safer and more efficient production of yogurt. Management commitment was realized by communicating to the organization the importance of meeting the International Standard statutory and regulatory requirements as well as customer requirements relating to food safety, and by ensuring the availability of financial, material, and human resources for the establishment of the necessary work environment, complying with the EU food standards and regulation. The products are directed exclusively to the internal market. DPP has implemented ISO 22000:2018 to improve the quality and safety of its products, customer expectations, the product image on the market, and to develop good practice as an educational tool. The identification, analysis, monitoring, and corrective actions established for CCPs and the verification of the effectiveness of the entire HACCP plan were performed according to the procedures underlying ISO 22000:2018. This standard has been implemented in production lines. However, the present study aims to integrate microbiological parameters (the total colony forming unit (CFU), somatic cell count (SCC), and *Enterobacteriaceae*) in the food safety system (HACCP) as quality parameters in a spin-off small-scale yogurt processing plant.

2.2. Materials

This manuscript analyzes the implementation of ISO 22000:2018 for natural yogurt with 3.6% fat made in a DPP.

Qualitative and quantitative reception of milk. Milk is transported from Cojocna farm in secured aluminum cans.

From the reception valve the milk is passed to an acid dairy products plant (IPI tank with 100 L capacity) using a pump (202 MHI type) a milk flow of 2000 L/h.

The acid dairy products plant is used for milk pasteurization and inoculation with the starter culture.

Milk pasteurization. Pasteurization is performed at high temperatures (85–90 °C) for 20–30 min. Pasteurization aims at the following:

- improvement of hygienic quality of milk;
- environment improvement for the development of lactic bacteria;
- yogurt consistency improvement: high temperatures of pasteurization favors a softer curd that retains more whey.

From the pasteurization device the milk is continuously passed through the meanings of a pump (MHI 202 type) in a heat exchanger placed above the tank until complete pasteurization of the milk. The pasteurization is done under continuous stirring (the valve is provided with an agitator).

Milk cooling. The cooling of the milk is done in the same valve as pasteurization by recycling the milk through the heat exchanger until the yogurt reaches a temperature of 45–46 °C. The heat exchanger uses water from the regular city supplies network to cool the milk.

Milk inoculation. This is done with starter cultures of lyophilized lactic bacteria. The culture is diluted in milk and then the milk is strongly stirred until uniform distribution of the culture is reached for 10–15 min. With the help of the second pump (MHI 202 type) the inoculated milk is sent to a packaging device (ADL-ATS 200 type, 200–250 cups/h capacity for 200 mL cups).

Packaging. The dosage in sales packaging is performed in a manual device (ADL-ATS 200 type). The yogurt has to be continuously stirred in the valve during packaging. The cups are thermosealed with aluminum foil after filling.

Tempering. The packaged products are placed in a thermostatic aluminum cabinet (with a capacity of 400 cups for each 200 mL). The yogurt tempering takes place at 43–45 °C for 2.5–3 h.

Precooling at 18–20 °C for 2 h.

Cooling and storing at 2–6 °C for 12 h.

2.3. Methods

2.3.1. Elaboration of Critical Thinking Model

The critical thinking learning model developed and applied is described in Figure 1. Through the learning process three stages were identified: (1) Evaluation of information; (2) description/identification of problems as main concept; and (3) analysis (interpretation and inferences). The evaluation of information is based on gathering and reporting data, facts, observations, and experiences that should be clear, relevant, accurate, adequate, and consistent. The description is focused on identifying the most important concepts, theories, ideas, regulations, procedures, principles, models, and definitions that should be clear, relevant, and accurately presented. The analysis is centered on interpretation and inferences and elaborate conclusions and solutions that should be clear, logical, justifiable, and consistent. The application of the model during the learning process of FSMS (food safety management systems) to food engineering students leads to achieving the ability of critical and design thinking.

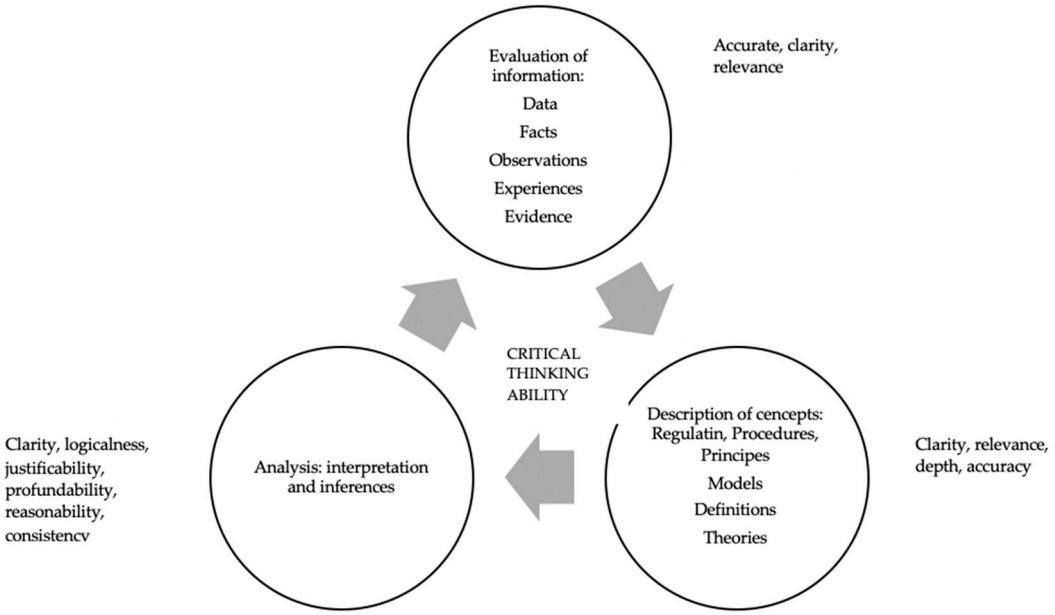

Figure 1. Critical thinking model developed and applied as an educational tool to learning FSMS (food safety management systems).

2.3.2. Elaboration of PRPs

The HACCP team was responsible for coordinating and implementing the corrective measures to improve the adaptation to the PRPs (GMPs, GHPs, and SSOPs). The definition of the production chain—from the farm to final consumer; the definition of food safety and contamination; types of contamination; the importance of microbiological contamination; optimal conditions for the growth of microorganisms; contamination by microorganisms—elimination, inhibition, and prevention; the application of GMP principles (personal hygiene, environment, and equipment); habits for the correct handling of foods; benefits of GMPs (food safety, longer shelf life, reduced losses, better working environment, and consumer satisfaction); the need to change the behavior and commitment of all employees; work instructions; the importance of hygiene (how to avoid contamination); conditions for effective cleaning; phases of the hygiene process; and the presentation of work instructions as described by Cusato [20] were followed.

2.3.3. Elaboration of the HACCP Plan

Based on ISO 22000:2018 [18] and HACCP principles, according to Codex Alimentarius, the overall technical process of yogurt production was drawn and a hazard analysis was performed following the 12 steps for developing an HACCP plan (Table 1). The identification of hazards is made according to their nature (biological, chemical, and physical). The analysis is done according to the likelihood occurrence level and its severity (Table 2) [12]. Hazard rating is calculated by multiplying likelihood by severity. The determination of CCPs is done with the help of the decision tree (DT) (Figure 2), in which only the stages with a hazard rating ≥3 are introduced [16].

Table 1. Steps of Hazard Analysis and Critical Control Points.

Step 1	Assemble HACCP [1] team
Step 2	Describe product
Step 3	Identify intended use
Step 4	Construct flow diagram
Step 5	On-site confirmation of flow diagram
Step 6. Principle 1	List all potentioal hazards, conduct a hazard analysis, and consider control measures
Step 7. Principle 2	Determine CCPs [2]
Step 8. Principle 3	Establish critical limits for each CCPs
Step 9. Principle 4	Establish a monitoring system for each CCPs
Step 10. Principle 5	Establish corrective actions
Step 11. Principle 6	Establish verification procedures
Step 12. Principle 7	Establish documentation and record-keeping

[1] HACCP, Hazard Analysis of Critical Control Points; [2] CCP, Critical Control Point. Adapted from Kamboj et al., 2020 [12].

Table 2. Level of likelihood of occurrence and hazard severity.

	Likelihood of Occurrence	**Hazard Severity**
High (3)	Highly probable; known history in the sector	Life-threatening or long-term chronic illness (e.g., infection, intoxication, or anaphylaxis), chronic effects or death
Medium (2)	Could occur; minimal history within the sector but has happened	Injury or intolerance; not usually life-threatening
Low (1)	Unlikely to occur; no known examples	Minor or no effect; short duration

Adapted from Kamboj et al., 2020 [12].

2.3.4. Microbiological Analyses

The mandatory analyses according to Romanian legislation were performed according to Regulation No. 853/2004 as amended and supplemented by Regulation No. 1020/2008 [21] for raw material milk and pasteurized milk, and according to Regulation No. 2073/2005 as amended and supplemented by Regulation No. 365/2015 [22] for yogurt, which is in conformity with the EU Council Directive 2002/99/EC [23], Regulation (EC) No 178/2002 [24], Regulation (EC) No 852/2004 [25], Regulation (EC) No 853/2004 [26], Regulation (EC) No 854/2004 [27], and Regulation (EC) 882/2004 [28] for the public health rules and safety food trade.

The total colony forming unit (CFU) was analyzed according to the SR EN ISO 4833-1: 2014 method [29], the somatic cell count (SCC) was analyzed according to the SR EN ISO

13366-1:2008/AC:2010 method [30], and the *Enterobacteriaceae* were analyzed according to the ISO 21528-1: 2017 method [31].

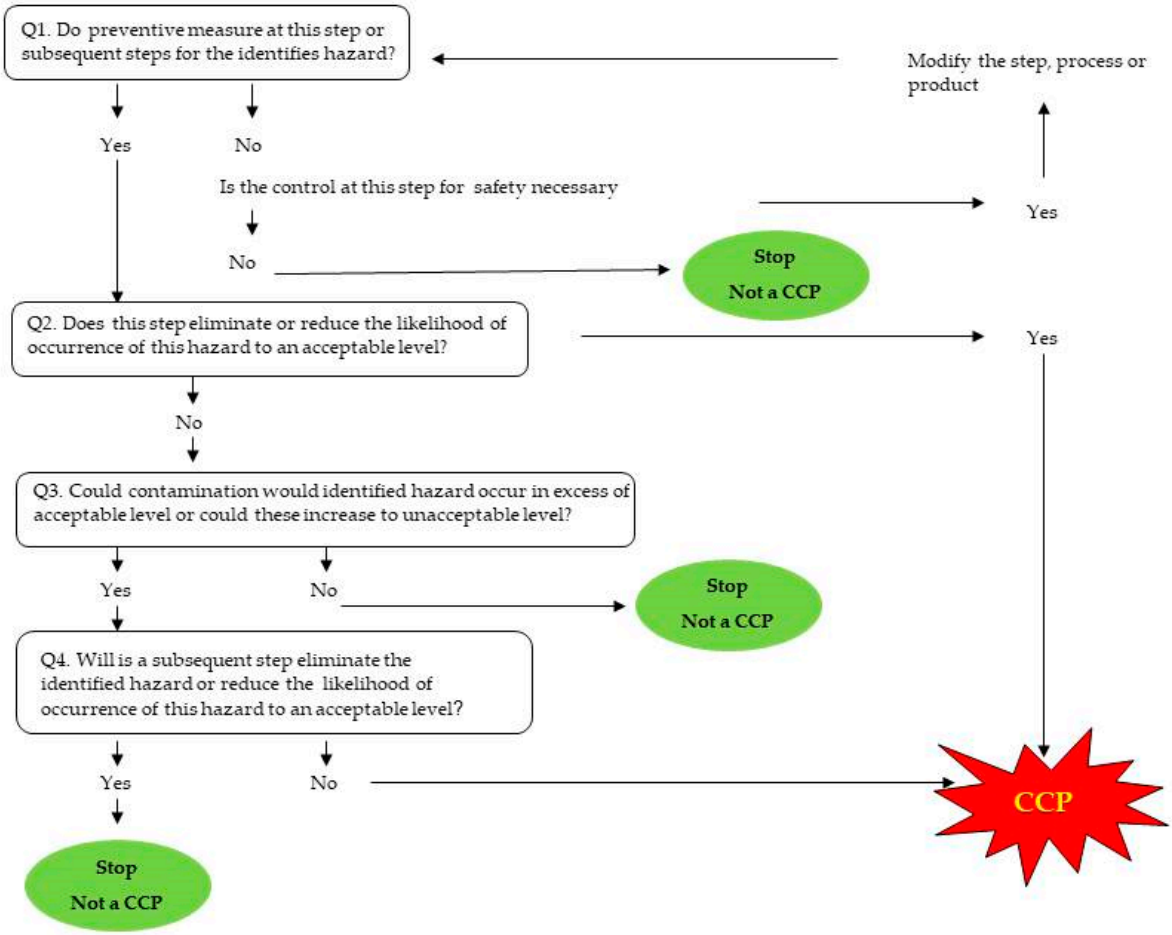

Figure 2. Decision tree (DT) protocol. The DT protocol was used to established CCPs.

3. Results and Discussion

3.1. Assessment and Implementation of the PRPs

The PRPs implemented in the DPP are hygiene of personnel and food hygiene, disinfection and cleaning, prevention of cross-contamination, the importance of maintaining a cold chain during food storage, hygiene premises and buildings, control pests, equipment maintenance, quality control of raw material at reception, food with water, waste and wastewater disposal, storage and transportation, product management, and supply management. A well-defined plan includes these programs. PRPs are fundamental conceptual programs for establishing security bases. There are more basic programs and assistance programs that provide foundations for HACCP [32]. The programs' basis is GMP and GHP for products and the handling and delivery of finished products, to be provided by technology [18,33].

For the implementation of PRPs, buildings, facilities, equipment, utensils, food handlers, production, transportation of food, and documentation were evaluated. Following the evaluation and the observed non-conformities, operational procedures were performed. As an educational tool, the essential stage of the implementation of FSMS is the training. Although most people involved, especially interns, know about food contamination, theoretical training is not sufficient to implement FSMS in practice. The theoretical and practical training applied was observed by changing habits and behavior regarding GMPs and GHPs (by applying the principles of GMP (personal hygiene, environment, and equipment), habits for the correct handling of foods, how to

avoid contamination, types of surfaces to be cleaned and cleaning agents, conditions for effective cleaning (solution concentration, water temperature, exposure time, and mechanical action), phases of the hygiene process (pre-rinsing, detergent solution, rinsing, and sanitizing), and the presentation of work instructions). Another aspect that encounters difficulties in DPP is the large rotation of the interns, delaying a team's consolidation with the desired standard work and resulting in improvements taking longer than expected. To improve this aspect, a technological engineer (a university assistant responsible for student practice) was delegated to do theoretical and practical training and verify the activity on PRPs and the necessary monitoring. A similar approach was noted by Cusato [20] in a small dairy factory and by Karaman [34] in a dairy factory in Turkey.

3.2. Implementation of HACCP Plan

Preliminary steps to enable hazard analysis (Step 1–6).

3.2.1. Food Safety Team

A multidisciplinary team composed of nine people was created to implement the requirements of the system. The team members were trained thoroughly on the HACCP system and ISO 22000:2018 standard [18]. The food safety team members are an HACCP team leader, dairy technological engineer, technological engineer (university assistant responsible for student practice), testing laboratory manager, hygiene manager (responsible), maintenance manager, supply manager, sales manager, and HACCP team secretary.

3.2.2. Product Characteristics and Intended Use

The food safety team preceded a complete description of the yogurt, identifying its composition; chemical, biological, and physical characteristics; treatments; durability; storage conditions; and distribution methods. Table 3 summarizes the yogurt's characteristics, and its use is recommended for all segments of the population, except sensitive people (people with a milk allergy or intolerance).

Table 3. Gourmeticus yogurt product description.

1	**Product name**	Gourmeticus yogurt
2	**Composition and ingredients**	Pasteurized milk and cultures of selected dairy bacteria (Lyofast Y 450 B, Lyofast Y 452 B)
3	**Organoleptic characteristics**	Compact, homogeneous curd, without gas bubbles or zircon; the ruptured clot has a porous granular appearance. Milk-specific white, uniform or yellowish in color. The specific smell and taste of yogurt, pleasantly sour, without foreign taste or smell.
4	**Physio-chemical characteristics**	It must not have any physical impurities. Fat minimum 3.0 ± 0.1%, total solids content minimum 11%, acidity minimum 0.6% lactic acid, protein substances minimum 2.8%
5	**Microbiological characteristics**	*Salmonella, E coli., Enterobacter, Shigella, Klebsiella*—absent
6	**Treatments**	Pasteurization
6	**Nutritional values**	Energy value 55.8 kcal 3% fat, of which 2 g saturated fatty acids, 4 g carbohydrates, 3.2 g protein, and 0.2 g salt.
7	**Packing method**	In 200 g plastic cups and the closure is made with heat-sealable metallic foil.
8	**Terms of validity**	21 days
9	**Storage instructions**	Refrigerated rooms, clean, disinfected, ventilated, no foreign smell at temperatures between 2–8 °C.

Table 3. *Cont.*

10 **Labelling instructions**	Labelling must be carried out following the regulations and include the following aspects: the name of the product, list of ingredients, any ingredient or technological adjuvant that causes allergies or intolerances used in the respective factory, the number of certain ingredients or ingredient categories, net quantity of food, date of minimum durability or expiration date, special storage conditions, name or trade name and address of the food business operator, country of origin or place of origin, instructions for use, nutrition statement, date of manufacture (day, month, batch).
11 **Instructions for use**	It is consumed as such.
12 **Delivery/sales conditions**	Authorized means of transport, isothermal, refrigerated, clean, ventilated, in the absence of toxic substances or a pungent smell at temperatures between 2–8 °C. The product is sold at the university store. The temperature in the storage refrigerator is between 2–8 °C.

3.2.3. Flow Diagram

The flow diagram includes all the technological process stages for making Gourmeticus yogurt (Figure 3). In addition to the technological process stages, the diagram shows the stages until delivery to consumers (storage on the market). This detail is essential for a better presentation of the environmental conditions that could affect the product's quality and safety. These aspects must be taken into account due to their importance for consumer health [35]. The flow diagrams were checked on-site by the food safety team.

3.2.4. HACCP Plan Principles (Steps 7–12): Hazard Identification and Determination of Acceptable Levels

The identification and assessment of hazards is a crucial principle for all HACCP systems [36] and a prerequisite to protecting public health. To achieve this step, the food safety team established a procedure specifying the methodology for hazard analysis, described in Table 4. Hazard analysis is applied from the receipt of raw materials to the delivery of the finished product. The dangers can have a direct or indirect impact on yogurt. They are based on the implementation of PRPs and aim to identify CCPs.

The identified hazards are classified according to pathogens (biological hazards), toxic substances (chemical hazards), and external particles (physical hazards) and are due to contamination, multiplication, and persistence. The HACCP team's identification and analysis of the dangers of yogurt were performed for all stages of the production process.

Assessment of hazards based on the severity (S) of known effects on consumer health and the likelihood of these hazards occurring in DPP. The probability (P) is established according to the history and expertise of the DPP. Each hazard is evaluated and receives a score between 1 and 3. A hazard is considered significant if the resulting hazard rating (HR) score from the multiplication of the probability by the severity is above 3 [12,16,37,38]. A significant hazard is one of such a nature that its elimination or reduction to an acceptable level is essential to the production of safe food.

Following the hazard analysis, an HR is established. For hazards of HR ≤ 2, which are considered low or almost non-existent hazards, control measures are made using PRPs, with no CP (control point) or CCP required [39].

The PRPs control the potential chemical hazards associated with milk, such as veterinary drug residues, food additives, residue of migration of substances from packaging materials, heavy metals, and oil-free air compressors or potential biological hazards in order to reduce the probability of occurrence [40].

Even if greater importance is given to chemical and biological hazards, physical hazards in dairy products are just as significant [40]. Physical hazards can easily occur through non-compliance with PRPs or accidental contamination [41], and are related to contact with various objects, packaging, or incorrect labelling [40].

Milk cleaning is not considered in our unit, with HR ≥ 3 (CCP or CP), but is periodically checked for the presence of external particles (glass, plastic, wood, metal, etc.) [39].

When significant hazards are identified as having HR ≥ 3, a 4Q (Questions) decision tree is used to decide whether a particular hazard is a CCP or control point (CP), analyzed in Table 5. Although it is not mandatory to use the CCP decision tree method of ISO 22000:2018, the decision tree, a clear, well-organized, and understandable visual analysis tool, should be used to determine [41] and to prioritize [42] the CCPs.

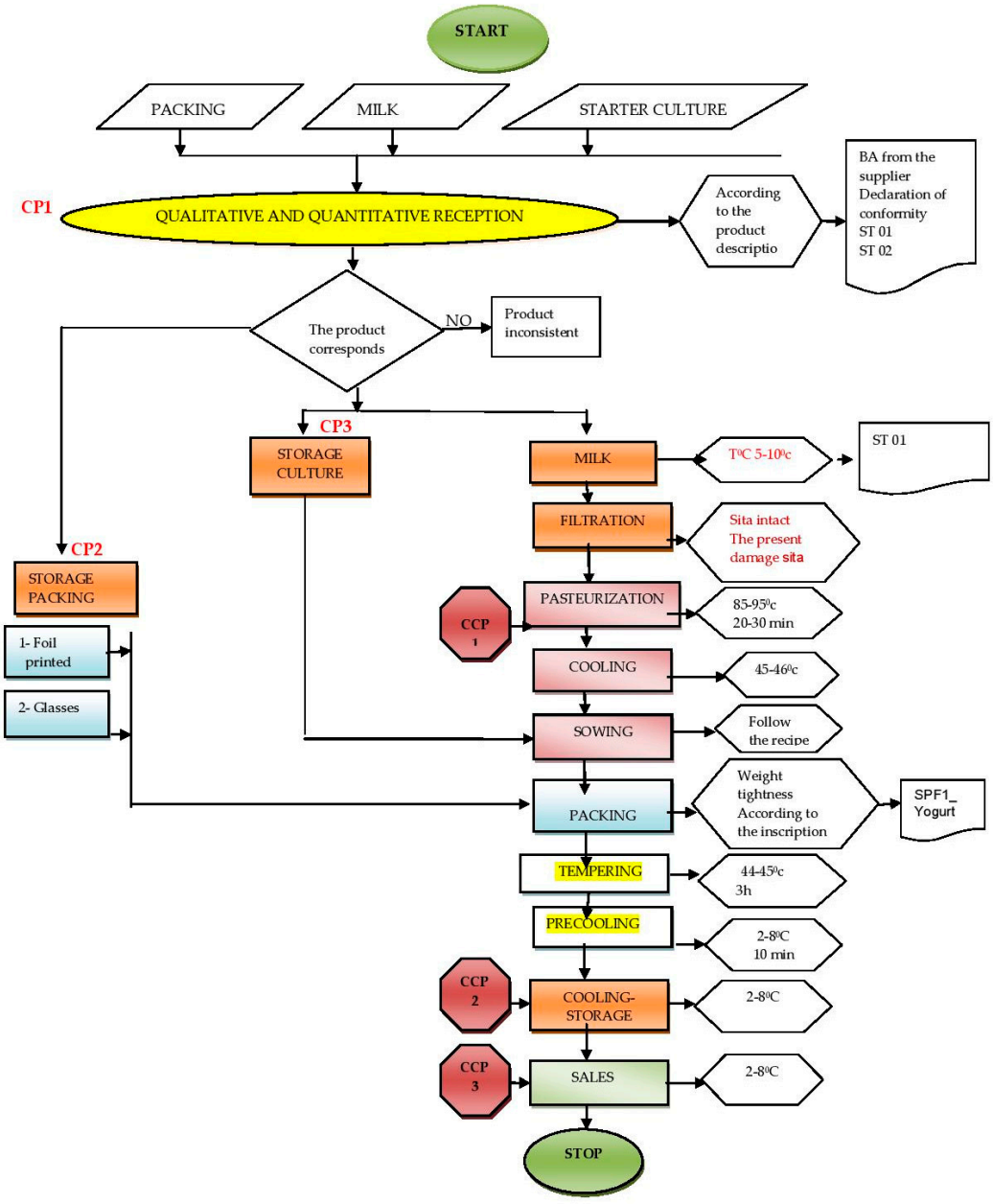

Figure 3. Flow diagram describing the technological steps of the Gourmeticus yogurt process.

Table 4. Hazard analysis and assessment. The table presents the hazard analysis of each steps of the technological flow diagram.

The Stage of the Technological Process	.2 Potential Hazards		.4 Is the Danger Potentially Significant?	Hazard Assessment			.2 Preventive Measures/Control Measures
				S [1]	P [2]	HR [3]	
1. Reception of milk	B [4]	*Mycobacterium tuberculosis*, *Salmonella*, *E coli*, *Staphylococcus aureus*, *Brucella campylobacter*, *Listeria monocytogenes*, *Bacillus cereus*, *Mycobacterium bovis* **CFU [7] max 100,000/mL, SCC [8] max 400,000 mL**	Yes—non-compliant milk can lead to obtaining an inappropriate product or even to the production of diseases.	3	1	3	-Compliance with GMP measures and training of staff on compliance with GMP measures -Performing a second party audit at the supplier to verify compliance with GHP measures -Checking the analysis reports, the declarations of conformity, and the sanitary approvals that accompanies the raw milk -Rejection of inadequate raw milk from a microbiological and physio-chemical point of view -Cooling the milk immediately after milking on the farm and transporting to a refrigerator -Checking the temperature and transport conditions
	C [5]	Antibiotics, pesticides, neutralizers, nitrates, mycotoxins, drugs, growth hormones, the presence of detergents and disinfection substances	Yes—it can lead to obtaining an inappropriate product or even to a health impact causing different diseases.	3	1	3	
	P [6]	Hair, straw, feces	No—the presence of foreign bodies cannot cause injury to the consumer.	2	1	1	
2. Reception and packaging storage	B	*E coli.*, *Staphylococcus*, *B. cereus*, molds	Yes—infected and infested packaging can lead to an unsuitable product or even disease.	3	1	3	-Compliance with GMP measures and training of staff on compliance with GMP measures -Evaluation and selection of suppliers -Verification of declarations of conformity accompanying packaging -Rejection of improper packaging from a microbiological and physio-chemical point of view -Proper storage of packaging
	C	-	-	-	-	-	
	P	-	-	-	-	-	

Table 4. *Cont.*

.5 3. Reception of lactic acid bacteria starter cultures	B	*Salmonella, E coli., Staphylococcus*	Yes—contamination can lead to an unsuitable product or even disease.	3	1	3	-Compliance with GMP measures and training of staff on compliance with GMP measures -Verification of the declarations of conformity that accompany the starter cultures -Monitoring the storage temperature and following the validity period written on the label -Observing the FIFO [9] principle and disinfecting the refrigerator after each defrost -Keeping in its own closed packaging
	C	-	-	-	-	-	
	P	-	-	-	-	-	
4. Milk filtration	B	-	-	-	-	-	-Compliance with GMP measures and staff training -Maintenance filters -Checking the hygiene and operation of the filter
	C	Contamination with detergent residues	No—the presence of residues of washing substances cannot cause serious illness.	2	1	2	
	P	Filtering surface	Yes—the presence of metallic impurities can cause illness and injury to the consumer.	2	1	2	
5. Pasteurization	B	*M. tuberculosis, Brucella, E coli.*	Yes—contamination can lead to an unsuitable product or even disease.	3	1	3	-Compliance with GMP measures and training of staff on compliance with GMP measures -Checking the equipment's hygiene and utensils by performing quarterly sanitation tests and by visual inspection before each pasteurization. -Respecting and monitoring the pasteurization conditions (time and temperature)—thermograms -Maintenance of washing and disinfection substances in specially arranged places, kept under lock and key -Control of washing solutions
	C	Contamination with detergent residues	No—the presence of residues of washing substances cannot cause serious illness.	2	1	2	
	P	-	-	-	-	-	

Table 4. *Cont.*

6. Cooling	B	-	-	-	-	-	-
	C	-	-	-	-	-	
	P	-	-	-	-	-	
7. Inoculation with the starter culture of lactic acid bacteria and fermentation	B	-	-	-	-	-	-Compliance with GMP measures and training of staff on compliance with GMP measures -Performing quarterly sanitation tests to check the hygiene of equipment, utensils, staff -Employee staff must have regular medical check-ups performed according to the legislation in force -Performing disinfection operations according to the planning
	C	Contamination with detergent residues	No—the presence of residues of washing substances cannot cause serious illness.	2	1	2	
	P	The presence of foreign bodies in the production space, from the staff, from the utensils	Yes—the presence of foreign bodies can cause injury to the consumer.	2	1	2	
.5 8. Packaging	B	-	-	-	-	-	-Compliance with GMP measures and training of staff on compliance with GMP -Performing quarterly sanitation tests to check the hygiene of equipment, staff, packaging -Employee staff must have regular medical check-ups performed following the legislation in force -Checking the heat seal of the lids
	C	Contamination with detergent residues	No—the presence of residues of washing substances cannot cause serious illness.	2	1	2	
	P	-	-	-	-	-	
9. Tempering	B	-	-	-	-	-	-
	C	-	-	-	-	-	
	P	-	-	-	-	-	

Table 4. *Cont.*

10. Pre-cooling	B	-	-	-	-	-	-
	C	-	-	-	-	-	
	P	-	-	-	-	-	
11. Storage Cooling	B	*Salmonella, E coli., Enterobacter, Shigella, Klebsiella*	Yes—contamination can lead to an unsuitable product or even disease.	3	1	3	-Compliance with GMP, GHP measures and training of staff in compliance with GMP, GHP -Performing disinfection operations according to the planning made by the HACCP coordinator -Monitoring the temperature in the cold storage and following the shelf life written on the label -Respect the FIFO principle -Carrying out the disinfection operations according to the planning
	C	-	-	-	-	-	
	P	Pests, mice	Yes—contamination can lead to an unsuitable product or even disease.	2	1	2	
12. Sales	B	*Salmonella, E coli., Enterobacter, Shigella, Klebsiella*	Yes—contamination can lead to an unsuitable product or even disease.	3	1	3	-Compliance with GMP, GHP measures and training of staff on compliance with GMP, GHP -Respecting the sales parameters and checking the validity term written on the label -Respecting the FIFO principle and sanitizing the refrigerator after each defrost -Performing disinfection operations according to the planning made by the HACCP coordinator
	C	-	-	-	-	-	
	P	-	-	-	-	-	

[1] **S**, severity; [2] **P**, probability; [3] **HR**, hazard rating; [4] **B**, biological; [5] **C**, chemical; [6] **P**, physical; [7] **CFU**, colony forming units; [8] **SCC**, somatic cell count; [9] **FIFO**, first-in first-out.

Table 5. CCP [1]/CP [2] identification.

Stage	Q[3]1	Q2	Q3	Q4	CCP/CP
Qualitative and quantitative reception of milk	Yes	No	No	-	CP
Qualitative and quantitative reception and packaging storage	Yes	No	No	-	CP
Qualitative and quantitative reception of lactic acid bacteria starter cultures	Yes	No	No	-	CP
Pasteurization	Yes	Yes	-	-	CCP1
Cooling, storage	Yes	No	Yes	No	CCP2
Sales	Yes	No	Yes	No	CCP3

[1] CCP, Critical Control Point; [2] CP, Control Point; [3] Q, Question.

The first CCP identified was pasteurization, because non-compliance with the parameters of this stage could lead to the survival of pathogenic bacteria, which has the consequence of causing health problems to consumers. Several publications have been identified that describe the effect of term treatment on the inactivation of toxins and bacteria [43–45].

The second CCP is considered cooling, followed by storage. At this stage of the technological process, the temperature is reduced from 85 °C to 2–8 °C in 1 h. This CCP is considered essential because keeping it under control prevents the growth of potentially present thermotolerant bacteria. After pasteurization, product cross-contamination can be controlled by applying strict cleaning and disinfection rules [11].

The growth of bacteria can be controlled by strict time–temperature control. Consequently, time and temperature must be carefully monitored during the storage process [46]. The same strict conditions must be observed for the delivery and sales stages—CCP 3.

After the correct performance of the CCPs, the critical limits are established for each, monitoring procedures and actions to be taken if critical limits or action limits or action criteria are exceeded, as illustrated in Table 6.

Table 6. Identifying critical limits, monitoring procedures, and corrective actions.

		Pasteurization	Storage, Cooling	Sales
Target value		85–95 °C 20–30 min	2–8 °C	2–8 °C
Critical value		≤85 °C; ≤20 min	≥8 °C	≥8 °C
Monitoring	Responsible	Technological engineer	Technological engineer	Refrigerator driver
	Method	Physical method, visual	Physical method, visual	Physical method, visual
	Frequency	Continue	Continue	Continue
	Document	Monitoring sheet	Monitoring sheet	Monitoring sheet
Correction/ Corrective action	Correction	For parameters (temperature, time)	For parameters (temperature)	For parameters (temperature)
	Corrective action	Bringing the parameters to the critical value (increasing the temperature and time)	Bringing the parameters to the critical value (temperature drop)	Bringing the parameters to the critical value (temperature drop)
	Responsible	Technological engineer	Technological engineer	Technological engineer

To check whether the HACCP plan is functioning as envisaged, the food safety team established a verification plan in Table 7, which specifies the application domain, frequencies, and responsibilities for the verification activities.

Table 7. Establishing verification procedures.

Crt. No	Field of Verification	Check Frequency	Responsible for Verification
1.	Verification of compliance with the procedure for selecting suppliers and procurement of raw milk and materials	Monthly	HACCP team leader/FES
2.	Checking the quality and safety of food	Monthly	Responsible for hygiene and quality/FES
3.	Checking the mode of transport of raw milk and materials	Monthly	Technological engineer/FES
4.	Checking the storage and output mode for processing raw milk and materials	Monthly	Technological engineer/FES
5.	Drinking water supply check	Annually	Responsible for hygiene and quality/FES
6.	Verification of compliance with the stages of preparation of raw milk and materials	Monthly	Technological engineer/FES
7.	Verification of compliance with equipment maintenance	Biannually	Maintenance manager/FES
8.	Verification of calibration of measuring and control devices	Biannually	HACCP team leader/FES
9.	Checking the hygiene of production spaces, annexes, and social groups	Monthly	HACCP team leader/FES
10.	Checking the control of the health status of the staff	Biannually	HACCP team leader/FES
11.	Checking the hygiene of the work equipment	Monthly	HACCP team leader/FES
12.	Checking the way to ensure the disposal of waste	Biannually	HACCP team leader/FES
13.	Verification of compliance with the pest control procedure	Monthly	HACCP team leader/FES
14.	Verification of CCP records; deviations from critical limits; execution of corrective measures	Daily	HACCP team leader/FES
15.	Checking CP records	Daily	HACCP team leader/FES
16.	Checking the way to ensure staff training	Biannually	HACCP team leader/FES
17.	Checking the quality control and safety of the finished products	Monthly	Responsible for hygiene and quality/FES
18.	Checking the registration activity	Monthly	HACCP team secretary/FES
19.	Checking the registration and settlement mode of complaints	Monthly	HACCP team secretary/FES

FES—food engineering students.

In this study, to achieve the last principle of the HACCP plan, the documents and records prepared during the implementation of the plan are used. These documents represent evidence regarding the realization of the HACCP principles, the monitoring of the parameters of the CCPs, and the proposed corrective actions. These documents are divided into instructions and procedures and consist of the documents elaborated for the educational tool [11]. Their structural elements are title, purpose,

application/scope, definitions, abbreviations, authorities, responsibilities, description of activities, records, related documents, references, and annexes.

3.3. Microbiological Analysis Results of Yogurt

The microbiological characteristics of raw milk, pasteurized milk, and yogurt samples are shown in Table 8. The samples were analyzed before and after the implementation of ISO 22000:2018 to verify the advantages of FSMS.

Table 8. Microbiological characteristics of raw milk, pasteurized milk, and yogurt samples quantified before and after the HACCP implementation.

	Analyze/Sample	Before/After HACCP Implementation	Raw Milk	Pasteurized Milk	Yogurt
.5	CFU SR EN ISO 4833-1:2014	Before HACCP implementation	250,000 cfu/mL	754 cfu/mL	-
		After HACCP implementation	80,182 cfu/mL	97 cfu/mL	-
.5	SCC SR EN ISO 13366-1:2008/AC:2010	Before HACCP implementation	345,000 NCS/mL	-	-
		After HACCP implementation	14,000 NCS/mL	-	-
.5	*Enterobacteriaceae* ISO 21528-1:2017	Before HACCP implementation	-	6 cfu/mL	3 cfu/mL
		After HACCP implementation	-	0 cfu/mL	0 cfu/mL

Following the HACCP plan's implementation, a decrease in the specific microbiological load is observed, as shown in Table 8. In the case of raw milk, CFU decreases from 250,000 cfu/mL to 80,182 cfu/mL. In the case of pasteurized milk it decreases from 754 cfu/mL to 97 cfu/mL. These values are within the maximum allowed [21] of 300,000 cfu/mL for raw milk and 100,000 cfu/mL for pasteurized milk. In the case of NCS there is a decrease in raw milk from 345,000 NCS/mL to 14,000 NCS/mL, with the maximum allowed [21] being 400,000 NCS/mL. Spectacular decreases are also observed in the case of *Enterobacteriaceae*: In the case of pasteurized milk it decreases from 6 cfu/mL to 0 cfu/mL, and in the case of yogurt it decreases from 3 cfu/mL to 0 cfu/mL, within the maximum allowed values [22] of 10 cfu/mL. In the literature, the HACCP system application in dairy establishments has improved the microbial quality of the dairy product [14,20]. A study by Cusato [20] show similar results and showed the reduction of total coliform, mold, and yeast count in yogurt after the application of the HACCP plan in a dairy factory.

4. Limitation of the Study

The study integrates the microbiological parameters as a quality control (QC) tool of FSMS (Food Safety Management Systems) (HACCP) concerning good hands-on practice for FES implemented on-site in a small-scale yogurt pilot plant as educational programs. The model is adapted to a small-scale yogurt pilot plant, implementing only a simple FSMS (Food Safety Management System) involving HACCP principles and PRPs. These limitations help define new good practice and thinking models for teaching and learning FSMS in food-scale yogurt plant production.

5. Conclusions

The implementation of PRPs has a significant impact on the implementation of the HACCP system. The decision tree application shows that pasteurization, cooling/storage, and distribution processes are the selected hazard control measures, classified as CCP. The results of microbiological analysis

of packed yogurt showed that the implementation of HACCP could improve the microbial quality of yogurt. The implementation of the HACCP plan in a small-scale yogurt pilot plant has brought benefits to food security. This system allows immediate action to be taken when safety issues are reported from the receipt of the raw milk to the delivery of the yogurt and the basis of educational tools for practice and learning the implementation of FSMS.

The results obtained following the implementation of ISO 22000:2018 regarding the processing of yogurt in a small-scale yogurt pilot plant have implications for the yogurt industry and education programs. The HACCP approach in DPP and the results obtained can be easily applied in pilot stations or food industry factories at a food scale-up, assessing the advantages and drawbacks of implementing FSMS in the food industry. This study's conclusions underlie future research regarding the development of FSMS by applying predictive microbiology models and risk-assessment schemes, being an integrated model of good practice and education tools.

Author Contributions: Conceptualization, C.C.M. and R.A.M.; methodology, C.C.M. and M.J.; software, R.S.; validation, C.C.M., R.A.M. and A.C.; formal analysis, A.M. and A.N.; investigation, A.C.; resources, R.S.; data curation, C.C.M. and M.J.; writing—original draft preparation, C.C.M. and I.R.; writing—review and editing, C.C.M., R.A.M. and R.S.; visualization, C.C.M. and R.A.M.; supervision, C.C.M. and R.S.; project administration, R.A.M.; funding acquisition, R.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by FDI 0252.

Acknowledgments: The authors give thanks to the anonymous reviewers and all the editors in the process of manuscript revision.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

DPP	Dairy pilot plant
CCP	Critical control point
CP	Control point
PRPs	Prerequisite programs
OPRPs	Operational prerequisite programs
GMP	Good manufacturing practices
SSOP	Sanitation standard operating procedure
GMP	Good manufacturing practices
GHP	Good hygiene practices
HACCP	Hazard Analysis Critical Control Points
FSMS	Food safety management system
QMS	Quality management system
QS	Quality system
CFU	Colony forming units
SCC	Somatic cell count
FES	Food engineering students

References

1. Zhang, S.S.; Xu, Z.S.; Qin, L.H.; Kong, J. Low-sugar yogurt making by the co-cultivation of *Lactobacillus plantarum* WCFS1 with yogurt starter cultures. *J. Dairy Sci.* **2020**. [CrossRef]
2. Corrieu, G.; Béal, C. Yogurt: The Product and its Manufacture. *Encycl. Food Health* **2016**, 617–624. [CrossRef]
3. Aryana, K.J.; Olson, D.W. A 100-Year Review: Yogurt and other cultured dairy products. *J. Dairy Sci.* **2017**, *100*, 9987–10013. [CrossRef]
4. Melo, J.; Andrew, P.W.; Faleiro, M.L. *Listeria monocytogenes* in cheese and the dairy environment remains a food safety challenge: The role of stress re-sponses. *Food Res. Int.* **2015**, *67*, 75–90. [CrossRef]
5. Soni, R.; Jain, N.K.; Shah, V.; Soni, J.; Suthar, D.; Gohel, P. Development of probiotic yogurt: Effect of strain combination on nutritional, rheological, organoleptic and probiotic properties. *J. Food Sci. Technol.* **2020**, 1–13. [CrossRef]

6. Garcell, H.G.; Garcia, E.G.; Pueyo, P.V.; Martín, I.R.; Arias, A.V.; Serrano, R.N.A. Outbreaks of brucellosis related to the consumption of unpasteurized camel milk. *J. Infect. Public Health* **2016**, *9*, 523–527. [CrossRef]
7. Gould, L.H.; Mungai, E.; Barton Behravesh, C. Outbreaks attributed to Cheese: Differences between outbreaks caused by unpasteurized and pasteurized dairy products, United States, 1998-2011. *Foodborne Pathog. Dis.* **2014**, *11*, 545–551. [CrossRef]
8. Lindstrom, M.; Myllykoski, J.; Sivela, S.; Korkeala, H. Clostridium botulinum in cattle and dairy products. *Crit. Rev. Food Sci. Nutr.* **2010**, *50*, 281–304. [CrossRef]
9. Motarjemi, Y.; Moy, G.G.; Jooste, P.J.; Anelich, L.E. Milk and dairy products. In *Food Safety Management—A Practical* Guide for the Food Industry; Motarjemi, Y., Lelieveld, H., Eds.; Academic Press: New York, NY, USA, 2014; pp. 83–117.
10. Claeys, W.L.; Cardoen, S.; Daube, G.; De Block, J.; Dewettinck, K.; Dierick, K.; De Zutter, L.; Huyghebaert, A.; Imberechts, H.; Thiange, P.; et al. Raw or heated cow milk consumption: Review of risks and benefits. *Food Control* **2013**, *31*, 251–262. [CrossRef]
11. Allata, S.; Valero, A.; Benhadja, L. Implementation of traceability and food safety systems (HACCP) under the ISO 22000:2005 standard in North Africa: The case study of an ice cream company in Algeria. *Food Control* **2017**, *79*, 239–253. [CrossRef]
12. Kamboj, S.; Gupta, N.; Bandral, J.D.; Gandotra, G.; Anjum, N. Food safety and hygiene: A review. *Int. J. Chem. Stud.* **2020**, *8*, 358–368. [CrossRef]
13. Manley, D. Quality management systems and hazard analysis critical control point (HACCP) in biscuit manufacture. *Manley's Technol. Biscuitscrackers Cookies* **2011**, 23–28. [CrossRef]
14. El-Hofi, M.; El-Tanboly, E.S.; Ismail, A. Implementation of the hazard analysis critical control point (HACCP) system to UF white cheese production line. *Acta Sci. Pol. Technol. Aliment.* **2010**, *9*, 331–342.
15. Nada, S.; Ilija, D.; Igor, T.; Jelena, M.; Ruzica, G. Implication of food safety measures on microbiological quality of raw and pasteurized milk. *Food Control* **2012**, *25*, 728–731. [CrossRef]
16. Chen, H.; Chen, Y.; Liu, S.; Yang, H.; Chen, C.; Chen, Y. Establishment the critical control point methodologies of seven major food processes in the catering industry to meet the core concepts of ISO 22000:2018 based on the Taiwanese experience. *J. Food Saf.* **2019**, 1–10. [CrossRef]
17. Panghal, A.; Chhikara, N.; Sindhu, N.; Jaglan, S. Role of Food Safety Management Systems in safe food production: A review. *J. Food Saf.* **2018**, *38*. [CrossRef]
18. ISO 22000:2018. *ISO 22000-Food Safety Management Systems Requirements for Any Organization in the Food Chain*; ISO: Geneva, Switzerland, 2018.
19. Chhikara, N.; Jaglan, S.; Sindhu, N.; Anshid, V.; Veera, M.; Charan, S.; Panghal, A. Importance of traceability in food supply chain for brand protection and food safety systems implementation. *Ann. Biol.* **2018**, *34*, 111–118.
20. Cusato, S.; Gameiro, A.H.; Corassin, C.H.; Sant'Ana, A.S.; Cruz, A.G.; Faria, J.d.A.F.; de Oliveira, C. AF Food Safety Systems in a Small Dairy Factory: Implementation, Major Challenges, and Assessment of Systems' Performances. *Foodborne Pathog. Dis.* **2013**, *10*, 6–12. [CrossRef]
21. Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 Laying Down Specific Hygiene Rules for Food of Animal Origin as Amended and Supplemented by Reg. Nr. 1020/2008. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004R0853&from=en (accessed on 11 May 2020).
22. Regulation (EU) No. 365/2010 of the Commission of 28 April 2010 Amending Regulation (EC) No Regulation (EC) No 2073/2005 on Microbiological Criteria for Food as Regards Enterobacteria in Pasteurized Milk and Other Liquid Pasteurized Milk Products and Listeria Monocytogenes in Food Salt. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010R0365&from=EN (accessed on 11 May 2020).
23. EU Council Directive 2002/99/EC. Council Directive 2002/99/EC of 16 December 2002 Laying Down the Animal Health Rules Governing the Production, Processing, Distribution and Introduction of Products of Animal Origin for Human Consumption. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0099&from=DE (accessed on 11 May 2020).

24. Regulation (EC) No 178/2002. Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 Laying Down the General Principles and Requirements of Food Law, Establishing the European Food Safety Authority and Laying Down Procedures in Matters of Food Safety. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002R0178&from=EN (accessed on 11 May 2020).
25. Regulation (EC) No 852/2004. Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the Hygiene of Foodstuffs. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004R0852&from=EN (accessed on 11 May 2020).
26. Regulation (EC) No 854/2004. Regulation (EC) No 854/2004 of the European Parliament and of the Council of 29 April 2004 Laying Down Specific Rules for the Organisation of Official Controls on Products of Animal Origin Intended for Human Consumption. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004R0854&from=EN (accessed on 11 May 2020).
27. Regulation (EC) 882/2004. Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on Official Controls Performed to Ensure the Verification of Compliance with Feed and Food Law, Animal Health and Animal Welfare Rules. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004R0882&from=EN (accessed on 11 May 2020).
28. SR EN ISO 4833-1:2014 Microbiology of the Food Chain—Horizontal Method for the Enumeration of Microorganisms—Part 1: Colony Count at 30 Degrees c by the Pour Plate Technique. Available online: https://www.iso.org/standard/53728.html (accessed on 11 May 2020).
29. SR EN ISO 13366-1:2008/AC:2010 Milk—Enumeration of Somatic Cells—Part 1: Microscopic Method (Reference Method). Available online: https://www.iso.org/standard/40259.html (accessed on 11 May 2020).
30. *ISO 21528-1:2017 Microbiology of the Food Chain—Horizontal Method for the Detection and Enumeration of Enterobacteriaceae—Part 1: Detection of Enterobacteriaceae*; ISO: Geneva, Switzerland, 2017.
31. Da Cruz, A.G.; Cenci, S.A.; Maia, M.C. Quality assurance requirements in produce processing. *Trends Food Sci. Technol.* **2006**, *8*, 406–411. [CrossRef]
32. Gaaloul, I.; Riabi, S.; Ghorbel, R.E. Implementation of ISO 22000 in cereal food industry "SMID" in Tunisia. *Food Control* **2011**, *22*, 59–66. [CrossRef]
33. Karaman, A.D.; Cobanoglu, F.; Tunalioglu, R.; Ova, G. Barriers and benefits of the implementation of food safety management systems among the Turkish dairy industry: A case study. *Food Control* **2012**, *25*, 732–739. [CrossRef]
34. Martínez-Rodríguez, A.J.; Carrascosa, A.V. HACCP to control microbial safety hazards during winemaking: Ochratoxin A. *Food Control* **2009**, *20*, 469–475. [CrossRef]
35. Mortimore, S. How to make HACCP really work in practice. *Food Control* **2001**, *12*, 209–215. [CrossRef]
36. Fernandez-Segovia, I.; Perez-LIacer, A.; Peidro, B.; Fuentes, A. Implementation of a food safety management system according to ISO 22000 in the food supplement industry: A case study. *Food Control* **2014**, *43*, 28–34. [CrossRef]
37. McSwane, D.; Rue, N.; Linton, R. *Essentials of Food Safety and Sanitation*, 3rd ed.; Pearson Education: Upper Saddle River, NJ, USA, 2003.
38. Arvanitoyannis, I.S.; Varzakas, T.H.; Koukaliaroglou-van Houwelingen, M. Implementing HACCP and ISO 22000 for Foods of Animal Origin—Dairy Products. In *HACCP and ISO 22000-Application to Foods of Animal Origin*; Arvanitoyiannis, I.S., Ed.; Wiley-Blackwell: Oxford, UK, 2009; pp. 91–180.
39. Papademas, P.; Bintsis, T. Food safety management systems (FSMS) in the dairy industry: A review. *Int. J. Dairy Technol.* **2010**, *63*, 489–503. [CrossRef]
40. MacSwane, D.; Rue, N.; Linton, R. Food safety. In *Essentials of Food Safety and Sanitation*, 2nd ed.; McSwane, D., Rue, N., Linton, R., Eds.; Prentice Hall: Upper Saddle River, NJ, USA, 2000; pp. 1–75.
41. Van Asselt, E.D.; Noordam, M.Y.; Pikkemaat, M.G.; Dorgelo, F.O. Risk-based monitoring of chemical substances in food: Prioritization by decision trees. *Food Control* **2018**, *93*, 112–120. [CrossRef]
42. Trevisani, M.; Mancusi, R.; Valero, A. Thermal inactivation kinetics of Shiga toxin-producing *Escherichia coli* in buffalo mozzarella curd. *J. Dairy Sci.* **2014**, *97*, 642–650. [CrossRef]
43. Valero, A.; Cejudo, M.; García-Gimeno, R.M. Inactivation kinetics for *Salmonella* Enteritidis in potato omelet using microwave heating treatments. *Food Control* **2014**, *43*, 175–182. [CrossRef]

44. Van Lieverloo, J.H.M.; de Roode, M.; Fox, M.B.; Zwietering, M.H.; Wells- Bennik, M.H. Multiple regression model for thermal inactivation of *Listeria monocytogenes* in liquid food products. *Food Control* **2013**, *29*, 394–400. [CrossRef]
45. Lu, J.; Pua, X.H.; Liu, C.T.; Chang, C.L.; Cheng, K.C. The implementation of HACCP management system in a chocolate ice cream plant. *J. Food Drug Anal.* **2014**, *22*, 391–398. [CrossRef]
46. Kassem, M.; Salem, E.; Ahwal, A.M.; Saddik, M.; Gomaa, N.F. Application of hazard analysis and critical control point in dairy industry. *Rev. Sante Mediterr. Orient.* **2002**, *8*, 114–128.