

## IMPLEMENTATION OF THE HACCP SYSTEM FOR THE PRODUCT BREAD WITH POTATOES

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### ABSTRACT

*Bread is a product that has undergone a wide range of changes depending on the region, people, or culture and has become a symbol in certain parts of the world. In recent times the taste of the bread buyer has been modernized, with different secondary raw materials (seeds, potatoes, olives, onions, etc) being introduced into the dough.*

*Implementing the quality manual in a company whose main activity is bakery for the production of the product bread with potatoes consisted of going through the stages of the HACCP system, in strict compliance with the principles of HACCP. The main points were: checking the documentary system, establishing the work team, describing the product and distribution methods, describing the raw and secondary materials, constructing the technological flow diagram, determining the critical control points, and validating the HACCP plan.*

### INTRODUCTION

HACCP programs are based on knowing the specifics of the enterprise, technology, and technological flow as well as using specific scientific information to ease technological processes and increase food safety (Rochman et al., 2020.). The quality and safety of food have been a permanent concern of specialists, and they update recipes, and production technology to increase the nutritional and functional value of the human body (Baik et al., 2003, Radu et al., 2023).

Today, the industrial-scale production of bakery products is highly diversified, with a technology applied to each product, adapted to the requirements, which involves a set of stages and operations that transform the raw materials used in the technological process into the finished product (Voicu, 2011, Awuchi, 2023). The change regarding the technological processes of obtaining bakery products and their consumption has led to the updating and adaptation of the technology of obtaining, most often encountering the process of adding different secondary raw materials the purpose of which is multiple (consumer requirements, nutritional growth, formation of functional products, innovation, etc) (Guthman, 2008, Burton, 2008). The waste obtained from winemaking is utilized to increase the functionality of bread. And Ghaziani et al., 2022 studied the presence of waste amounts for traditional bread (1.70%) and non-traditional bread (2.50%). The inclusion of the innovative aspect leads to the forward-looking development of the bakery industry to obtain quality products increasingly demanded by consumers in line with

increasingly labor-intensive specific tastes and local traditions (Sleeter, 2022), bread with potatoes is one such product.

The implementation of the HACCP quality system becomes mandatory in this context. The hazard analysis and determination of critical control points for bread with potatoes was based on a systematic approach to ensuring consumer safety, based on the identification, assessment, and prevention of all hazards that could occur in the production, handling, and distribution of bread with potatoes (throughout the food chain) and the control of identified risks.

## **MATERIAL AND METHODS**

Hazard Analysis and Critical Control Point (HACCP) is a systematic approach to ensuring food safety, based on the identification, assessment, and prevention of all hazards that could occur in the manufacture, handling, and distribution of food (throughout the food chain) and the control of hazards at critical control points.

The methodology and development of the HACCP plan for the product bread with potatoes was based on the seven quality principles that constitute the guidelines for the implementation of the HACCP system (Qin et al., 2023).

The design of the quality control system (HACCP) for the product bread with potatoes was carried out section: the bakery, with the production and distribution of products as the object of quality. SR EN ISO 2200, 2005. Food safety management systems. Requirements for any organization in the food chain were the basis for the study.

## **RESULTS AND DISCUSSIONS**

The bakery good practice guide focuses on analyzing potential or existing risks and outlining measures to prevent these risks in terms of transportation procedures, processing of raw materials as well as the sale of finished products. The guide also contains several food safety rules to be applied by the staff involved in the process.

The structure of the HACCP manual for the product bread with potatoes contains general information (mailing list of the manual, list of amendments, approval of the HACCP manual, declaration of the General Manager), representation and organization of the company (company presentation - company data, company organization chart), HACCP plan and annexes. The aim of the HACCP system implementation action was defined, the HACCP team was built, the HACCP product and distribution methods were described, the raw materials, ingredients, and auxiliary materials were described, the technological flow diagram was built, the critical control points were determined, the HACCP plan was validated.

As far as the description of the raw materials is concerned, the following were used in the production of the bread with potatoes assortment: wheat flour type 650, potato flakes, water, compressed yeast, and iodized salt. Flour is the basic raw material, which accounts for the largest proportion of the bakery and farinaceous products. The flour was brought to room temperature and sifted by hand with a 2,0 mm mesh sieve to aerate and activate the enzyme package. The dough was digested and fermented using compressed yeast of the species *Saccharomyces cerevisiae*. The yeast was made into a suspension by mixing with part of the water provided in the recipe. The yeast suspension was activated by the addition of flour and kept at 30-32°C for 15 minutes.

Potato flakes were procured commercially and used in lyophilized form due to their high hydrating ability. Salt was used to make bread with potatoes to enhance the taste and increase the elasticity of the dough. It was dissolved in water to its maximum concentration using special dissolving and filtering equipment. Kashi, 2024 investigates the involvement of several raw materials, including salt, and shows that this ingredient plays a role in decreasing the degree of bread contamination. The water was heated to the temperature specified in the recipe (approx. 40°C), using the recipe described in Table 1.

Table 1

Recipe for the 500g bread with potatoes assortment

Raw materials and technological regime	U.M.	Quantities per 100 kg of flour		
		Total	Maya	Dough
White wheat flour	Kg	100	50	50
Potato flakes	Kg	20	-	-
Compressed yeast	Kg	1.400	1.400	-
Salt	Kg	1.700	-	1.700
Water	L	58.00	26	26

The description of the product bread with potatoes, weighing 500 g, obtained under the designation of traditional product consisted in analyzing the organoleptic characteristics: specific shape, well-developed product, no organoleptic defects, pleasant, characteristic taste, with the nuance of the added by-products, suitably salty, no foreign taste (rancid, musty, moldy, metallic, etc), the crust must be golden yellow, brown, uniform, without spots or cracks, the crumb must be yellowish-white, corresponding to the assortment (Table 2). Elkatry et al., 2023 obtain similar results regarding the organoleptic analysis of bread with potatoes.

Table 2

Organoleptic analysis of bread with potatoes

Characteristics	Eligibility conditions
General aspect	The specific size of the assortment, not flattened, whole slices of equal thickness
Aspect on the surface	Well-baked, golden yellow
Bread (in section)	Fine-pored, uniform mass Elastic, after a light pressing it returns immediately to its original state, without lumps or traces of unknaded flour
Flavor	Pleasant, characteristic of well-baked bread, no foreign smell (rancid, moldy)
Taste	Pleasant, characteristic of well-baked bread, without sour or bitter taste, no crunch due to mineral impurities (earth, sand)

The bread with potatoes has a shelf life of 72 hours at a maximum of 20°C. Storage took place on metal racks under the following storage conditions: maximum temperature of 20°C, relative air humidity of 65-70%, airy, clean premises, and free of rodents and mites. The general characteristics of the finished product were shaped (round), nominal mass (checked 2 hours after removal from the oven), general appearance (round, raised, 25 cm in diameter), and shell appearance (matt surface, without spots or other physical defects).

The HACCP team has identified the causes that led to the generation of an exceedance of the pre-established limits and determined the critical control points (CCPs) for each stage of the product, using the decision tree (Table 3).

Table 3

Determination of critical control points (CCP)

Stage	Type of hazard identified	Q1	Q2	Q3	Q4	CP/CCP
Reception raw materials	B	Yes	No	No	-	CCP <sub>1</sub> *
	C	Yes	No	No	-	CP *
	F	Yes	No	No	-	CP
Sifting the flour	B	Yes	No	No	-	CP
	F	No	-	-	-	-
Dosage of raw and auxiliary materials	C	Yes	Yes	-	-	CP
Maya kneading	B	Yes	No	No	-	CP
Maya fermentation	F	No	-	-	-	-
	B	Yes	No	No	-	CCP <sub>2</sub>
Kneading dough	F	No	-	-	-	-
	C	No	-	-	-	-
	B	No	-	-	-	-
Dough fermentation	F	No	-	-	-	-
	B	Yes	No	No	-	CP
Dough dividing	B	Yes	No	No	-	CP
Shaping the dough	F	No	-	-	-	-
	B	Yes	No	No	-	CP
Pregrowth	F	No	-	-	-	-
	B	Yes	No	No	-	CP
Growth	F	No	-	-	-	-
	C	No	-	-	-	CP
	B	Yes	No	No	-	-
Baking	F	Yes	Yes	-	-	CCP <sub>3</sub>
	B	Yes	No	No	-	-
Cooling	F	Yes	Yes	-	-	CCP <sub>4</sub>
Packaging	F	Yes	No	No	-	CP
	C	No	-	-	-	-
	B	Yes	No	No	-	CP
Storage	B	No	-	-	-	-

(\*PC- Critical Point; \*PCC-Critical Control Point; \*PCB-physical, chemical, biological)

Quality control was performed at each step of the process resulting in 12 CPs (control points) where loss of control would not lead to loss of food safety and 4 PCCs that required monitoring and corrective actions. A Critical Control Point (CCP) is a point that, if kept under control, will lead to the elimination or reduction of the risks identified in the production of bread with potatoes to an acceptable level. Four critical control points were identified in the study: CCP<sub>1</sub> at the raw material reception stage, CCP<sub>2</sub> at the sourdough fermentation stage, CCP<sub>3</sub> at the baking stage, and CCP<sub>4</sub> at the cooling stage. Two CCPs were physical and two were biological. Throughout the technological process of production, the identification of critical control points as well as the establishment of corrective actions that take into

account the most unfavorable situation before the occurrence of deviations from the essential limits to ensure the safety of the finished product (Table 4).

Table 4

Establishing corrective actions

CCPs	Parameters tracked	Preventive actions	Corrective actions
CCP <sub>1</sub>	-temperature; -hygiene.	- the temperature of the flour must not exceed 10°C. -the relative humidity of the air is correlated with its temperature. - reception and handling are carried out under maximum hygienic conditions.	-regulating air temperature and humidity in case of growth. -hygienization of reception rooms. - if the temperature in the potato flakes/flour storage room exceeds +10°C, the flour samples shall be periodically analyzed in the laboratory and a decision shall be taken on whether or not it can be re-introduced into the technological flow.
CCP <sub>2</sub>	-purity; -microbiological contamination.	-verification of the declaration of conformity received from the supplier.	-based on physicochemical and microbiological purity, whether or not ingredients are used in products.
CCP <sub>3</sub>	-temperature; -baking time.	- automatic temperature and baking time setting. -permanent monitoring.	-regulates the temperature.
CCP <sub>4</sub>	-temperature; -cooling time.	- in the thermal bread center to reach a temperature of min. 16°C. -time allowed - approx. 4 hours in conventional storage; approx. 20 min. in circular dryer	- If the temperature conditions have not been met, products are left to cool for longer.

Corrective actions have been taken for each CCP in the study, which provides certainty that the CCPs are under control thus preventing corrective actions being taken in case of reoccurrence of hazards.

### CONCLUSIONS

The implementation of the HACCP system in a bakery for the production of bread with potatoes consisted of going through the 14 steps while respecting the principles of implementation. To this end, the HACCP team was made up of specialists from different fields with competence in implementing the system.

We presented the company, its organizational structure, documentation, infrastructure, and technology for the production of the product bread with potatoes. The organizational chart of the company, the technological scheme for the production of the studied product, and the technological flow diagram were established. The plan was established with the definition of the aim of the action, the description of the analyzed raw materials, the finished product, and the working methods. Identification of data utilization, field verification of the manufacturing flow

diagram, and hazard analysis. To determine the critical control points, critical limits, monitoring system, and corrective actions where necessary were established.

A documentation system was established, the implementation of the HACCP system was checked for adequacy and dates were drawn for possible revision of the applied system.

The study revealed that bakery production is subject to a variety of risk factors throughout the technological flow and the HACCP monitoring system is an effective framework for determining risk factors in this context.

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