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THE APPLICATION OF HACCP FOR THE DEVELOPMENT OF RISK MANAGEMENT IN THE PRODUCTION OF YOGURT WITH THE ADDITION OF VEGETABLE BY-PRODUCTS

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Abstract

With the removal of by-products and waste from food production processes, valuable bioactive compounds (vitamins, antioxidants, dyes, etc.) are lost. By recovering and reusing them in a new technological process, in the context of the circular economy, they can solve technological problems that would have required the use of additives that have harmful effects on health and can also give the products the status of functional food. In order to obtain the status of a by-product, according to European legislation, the substances resulting from technological processes must meet food safety conditions, not endanger the health of the population and not negatively affect the environment. This research shows the importance of applying the Hazard Analysis and Critical Control Points (HACCP) in the development of yogurts that have as an addition by-products recovered within the circular economy from vegetable products. The purpose of recovering these by-products is to replace certain additives and they have the role of improving the sensory characteristics and preventing defects in acidic dairy products.

For the recovery of these by-products and waste from the food industry, the legislation in force and the conditions it imposes were taken into account. The by-product resulting from the processing of grapes from the Feteasca Neagra variety (grape purslane) was used in a proportion of 2% in the manufacture of yogurt so its quality to be improved. By analyzing the manufacturing process of this product, the critical control points (CCP) were determined using a decision tree, also corrective measures for possible deviations and plans for tracking and implementing corrective actions were identified.

After making the technological flow diagram and identifying the potential hazards, the severity and probability of occurrence of the hazards was determined. Then the CCP were identified such as: the primary processing of the by-products to adapt to the technological flow and to provide microbiological safety, preservation (when the milk processing plant is provided with a section for the processing of by-products), thermal processing of milk as well as thermosetting and cooling of yogurt. The critical limits for each CCP were identified according to the norms and legislation in force and the corrective actions were proposed for each critical point of the CCP.

The application of the HACCP system ensures good traceability throughout the production process of yogurts with by-product additions. It allows a good follow-up of the critical control points and keeping them under control to ensure safe products for human consumption.

***Key words**: Yogurt, By-products, Bioactive compounds, HACCP, Risk.*

1. Introduction

Yogurt is part of the category of fermented dairy products, having the greatest popularity among consumers compared to all products in this category. Traditionally, yogurt is made from two ingredients: milk and selected lactic cultures (*Streptococcus thermophilus* and *Lactobacillus delbrueckii* spp. *bulgaricus*) which are responsible for the fermentation of milk and its transformation into yogurt.

Although yogurt traditionally contains only those two ingredients, many times it has proven necessary to add other ingredients both from a technological and sensory point of view (improving texture, taste, preventing the appearance of defects, increasing shelf life, improving activity prebiotics, etc.), as well as to improve the functional qualities of the product.

In addition to the finished product, food chains also result in by-products and waste that pose an ever-increasing problem for the environment. For this reason their recovery is a growing concern for science. In addition to the environmental problems caused by the disposal of these by-products and waste, a lot of valuable bioactive compounds are lost that could be used in the production of natural additives (antioxidant properties, polyphenols, dyes, texturizing agents, aromatic compounds, antimicrobials, prebiotic activity, water and fat binding capacities, stabilizers, but also some medicinal properties). (Faustino *et al.*, [1]). Moreover, one of the sustainable development objectives of Romania, for the year 2030, provides for: halving per capita food waste at retail and consumption level, and reducing food losses along the production and distribution chains supply, including post-harvest losses [2].

Grape pomace (GP) is a residue of the winemaking process and represents an important ecological and economic problem of waste management, as approximately 20% of the weight of grapes remains as GP. (Beres *et al.*, [4]). The by-product, called grape pomace, consists of skin, seeds and pulp. Due to its rich content of flavones, anticyanins and tannins, this by-product has been integrated by scientists in various fields such as the food industry to obtain functional foods, the cosmetic industry and the medical industry, but also as an additive in animal feed and fertilizer for ground. It has been proven that grape pomace has a strong antioxidant effect due to the content of polyphenols. It is also effective in preventing oxidative stress, has antimicrobial and anti-inflammatory activities (Teixeira *et al.*, [3]).

Feteasca Neagră is an old autochthonous variety of grapes from Romania, from which red and rosé wines are obtained. GP from the Romanian red variety of *Vitis vinifera* (L.) var. fenugreek is reported to be an important source of natural antioxidants, due to the high concentration of different phenolic compounds. Recently, research has been reported on the antioxidant and cardioprotective effects of Feteasca neagră GP (Balea *et al.*, [8]).

In order to acquire the status of by-product, according to Directive 2008/98/EC [5], a substance or object, resulting from a production process whose main objective is not its production and not be considered waste, must meet the following conditions:

- further use of the substance or object is safe;
- the substance or object can be used directly, without being subjected to any additional processing other than that provided for by usual industrial practice;
- the substance or object is produced as an integral part of a production process;
- further use is legal, i.e. the substance or object meets all relevant product, environmental and health protection requirements for the specific use and will not produce overall harmful effects on the environment or the health of the population.

The present work studies the application of the Hazard Analysis Critical Control Points (HACCP) plan for the manufacture of yogurt with the addition of Feteasca Neagra grape peels to improve the sensory and textural qualities of the yogurt, as well as to improve the prebiotic activity of the product. The design of the yogurt production plant includes a section for the processing of grape pomace, which reaches the milk factory in a refrigerated state and must be processed to ensure the technological quality of the product and to ensure microbiological safety.

2. Materials and Methods

The present study aims to implement the HACCP plan in a factory that produces yogurt using as a by-product Tescovina resulting from the processing of Fetească Neagră grapes for the production of wine. In addition to the production space dedicated to yogurt processing, this factory has an additional space where they process the pomace obtained from a winery so that it is safe to be added to the product.

In order for grape pomace to be added to yogurt, it needs to be dried and ground, obtaining a fine powder consisting of skin and pulp (in a very small amount). The grape seeds from the grape pomace were also separated. Grape seeds can be used to make oil or they can be used to obtain extracts that can also be added to food products due to their rich content of valuable substances. (Shan *et al.*, [6]).

2.1 Materials

The production of yogurt with the addition of pomegranate from Feteasca Neagra grapes is done according to the following description:

2.1.1 Qualitative and quantitative reception of raw materials

The milk is transported by refrigerated tanks and is filtered and pumped into buffer storage tanks using centrifugal pumps. The storage temperature is 2 - 4 ^{0}C. Fetească Neagra grape pomace is transported from wine grape processing factories. In order to prevent

contamination and over-fermentation of the grape pomace, the transport is done with refrigerated trucks and the buffer storage until the time of processing is done in cold stores at 2 - 4 ^{0}C.

Grape pomace is dried in the Fruit and Vegetable Dryer at a temperature of 50 ^{0}C for 72 hours.

2.1.2 Separation of grape seeds

The separation of seeds from the mass of grape pomace is carried out using the system of sieving and the air blown by a turbo blower, thus separating the seeds from the rest of the pomace, leaving only the skin and the pulp.

2.1.3 Grinding of the dried peels

Grinding is done using a cutter so that they pass through a sieve with mesh sizes of 600 µ. After grinding, the grape pomace is stored in well-ventilated ventilated rooms.

2.1.4 Pasteurizationd of the milk

Milk is pasteurized at high temperatures (85 - 90 ^{0}C) for 20 - 30 minutes, using a pasteurization tank through the walls of which warm water circulates as a heating agent. The pasteurization tank is equipped with a stirrer so that the heat is evenly distributed in the milk mass.

2.1.5 Milk cooling

Milk is cooled within the same installation as the one for pasteurization, with cold water from the mains circulating through the walls of the tank. Cooling is done until the milk reaches a temperature slightly higher than the starter culture's development temperature, approximatix 45 - 48 ^{0}C.

2.1.6 Addition of grape pomace powder

Grape pomace powder addition is done before inoculation, the milk continues to be stirred so that the flour mass is distributed evenly in the milk mass.

2.1.7 Milk inoculation

Milk is seeded with a culture of thermophilic bacteria (consisting of two microorganisms *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus*) during which the milk is stirred for the uniform distribution of the culture of microorganisms in the milk mass.

2.1.8 Packaging

Packaging is done in glass jars with metal lids of 150 g capacity using an automatic dosing machine.

2.1.9 Thermostating

Thermostating is carried out in the thermostat chamber at a temperature of 42 - 45 ^{0}C, the temperature necessary for the development of the two microorganisms. Fermentation takes about 4 hours or until titratable acidity reaches 80 - 90 ^{0}T and pH 4.56 - 4.7.

2.1.10 Yogurt cooling

Cooloing is done in two stages: pre-cooling - to the temperature of 20 ^{0}C for 2.5 - 3 hours, and cooling to 2 - 8 ^{0}C for 10 - 12 hours.

2.1.11 Yogurt storage

Yogurt is sored at a temperature of 2 - 4 ^{0}C until the moment when the yogurt is delivered.

Table 1. Steps of Hazard Analysis and Critical Control Points (Codex Alimentarius [11])

Step No.	Principle	Description
Step 1	Preliminary steps	Asamble HACCP 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 potential hazards, conduct a hazard analysis, and consider control measures
Step 7	Principle 2	Determine CCPs
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

2.1 12 Sale

The yogurt is transported to the distributor in refrigerated trucks.

2.2 Methods

2.2.1 Elaboration of the HACCP plan

The development of the HACCP plan consists in going through all 12 steps (Table 1) after the yogurt manufacturing process with the addition of Tescovina de Grape Fetească Neagră has been established and indicated (ISO 22000:2018 [7], Codex Alimentarius [11]).

The technological flow diagram was established and the hazards were identified according to their nature (biological, chemical or physical). The evaluation of the hazards (Table 2) is done according to the level of the likelihood of occurrence and the level of their severity, multiplying the two values. The determination of Critical Control Points (CCPs) is done with the help of a decision tree (Figure 1), including only the steps in the technological process that have a hazard rating ≥ 3. (Kamboj *et al.*, [9]) (Chen *et al.*, [10]).

3. Results and Discussion

3.1 Formation of the HACCP team

The HACCP team must be a multidisciplinary team that fully knows the manufacturing process of the product. Bringing together the knowledge that the team members have leads to an effective analysis of the manufacturing process, and thus all hazards can be identified and prevented in order to sell products that are safe for consumption. The team was trained in the establishment of the HACCP plan.

The HACCP team consists of the HACCP team leader, dairy technology engineer, test laboratory manager, hygiene manager (responsible), maintenance manager, supply manager, sales manager and HACCP team secretary.

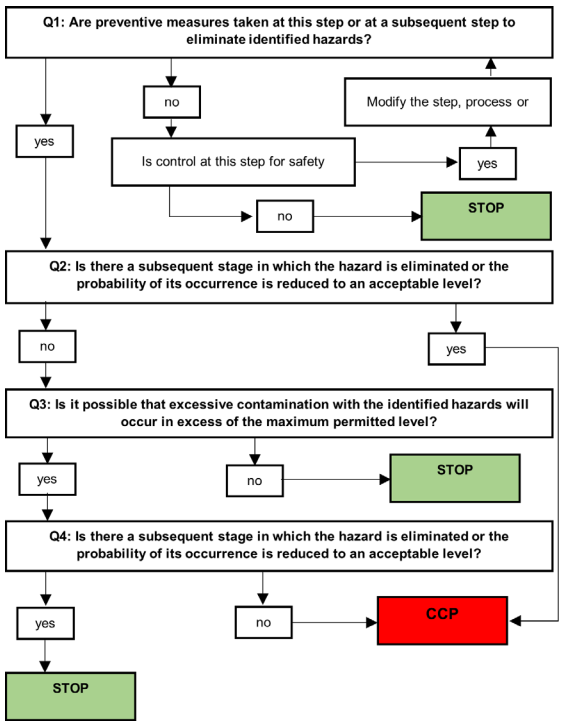

Figure 1. The decision tree for establishing CCPs

Table 2. Level of likelihood occurrence (Kamboj *et al.*, [9])

	Likelihood of occurrence	Hazard severity
High	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	Could occur; minimal history within the sector but has happened	Injury or intolerance; not usually life-threatening
Low	Unlikely to occur; no known examples	Minor or no effect; short duration

Table 3. Product description

Product name	Yogurt with Fetească Neagră grape peels
Ingredients	Pasteurized cow's milk, dried and ground Fetească Neagră grape skins, sectioned yogurt cultures
Organoleptic characteristics	The curd is compact and homogeneous, without air bubbles. Light purple-blue color due to the addition of grape skins. Taste and smell specific to yogurt, a faint fruity aroma can be felt. No foreign taste and smell.
Physio-chemical characteristics	Fat min. 3.0 ± 0.1 % Total Solids Content min. 12.5% Acidity max. 130 °T Protein substances min. 2.8%
Microbiological characteristics	*Salmonella* spp., *E coli.*, *Enterobacter* spp., *Shigella* spp., *Klebsiella* spp. - absent
Packing method	150 g glass jars closed with metal lids.
Labelling instructions	According to European regulations, the label must contain the following information: - The name of the product - List of ingredients - List of ingredients or technological adjuvants that may cause allergies or intolerance - Net quantity - Minimum period of validity - Storage containers - Manufacturer's name - Manufacturer's address - Country of origin - Instructions for use - Nutritional declaration - Production date
Terms of validity	To be consumed preferably within 20 days from the date of production.
Storage instructions	To be stored in cold rooms at a temperature of 2 - 8 °C, clean, disinfected and well ventilated, without foreign smells.

Table 4. Product intended use

Expected lifetime	20 days
Recommended storage instructions	Preservation methods at the distributor: 2 - 8 °C in refrigerated display cases Ways of conservation for the consumer: 2 - 8 °C in the refrigerator
Instructions for consumption	To be consumed until the expiration of the term written on the package. After opening, store in the refrigerator and consume within 48 hours
The market segment for which the product is intended	The product can be consumed by all segments of the population, except lactose intolerant people

3.2 Product description

The description of our product, Fetească Neagră grape pomace yogurt is presented in Table 3. The information presented rigorously describes the product and contains information such as: raw materials, organoleptic characteristics, physico-chemical and microbiological characteristics, thermal treatments applied, packaging methods and labeling, preservation and storage conditions, allergens.

3.3 Indications for use

Table 4 shows the indications for use of yogurt with the addition of Feteasca Neagra grape peels. This type of product is intended to be consumed by all segments of the population except people who are lactose intolerant. The product contains lactose naturally present in milk.

3.4 Technological flow diagram

The technological flow diagram presented in Figure 2 contains all the stages of the technological process of manufacturing the product from the reception of raw materials to the sale of the product. By means of the technological flow diagram, the CCPs and the allowed limits (production parameters) are represented.

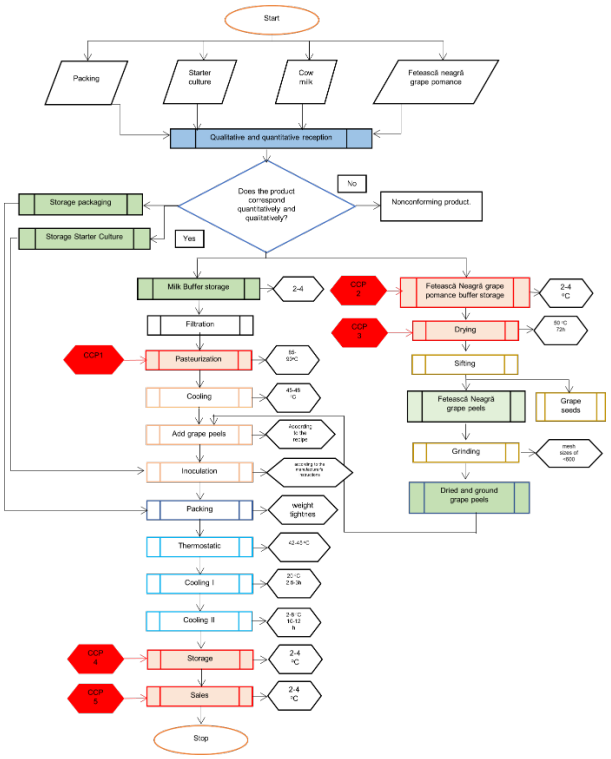

Figure 2. Flow diagram

The technological process flow diagram is used as a tool for structuring the hazard analysis, so its accuracy is of huge importance. After creating the technological flow diagram, the HACCP team checks its accuracy in the technological process area, noting any necessary changes and ensuring that all variations are covered. (Kamboj *et al.*, [9]). After checking the flowchart, it is dated and signed by all HACCP team members who agree that it is valid.

3.5 Hazard identification and determination of acceptance level

After gathering the information collected in the previous step, the HACCP team identifies the hazards associated with the product, assesses the risks for each hazard, identifies the causes of the occurrence of the hazards and identifies preventive measures for each hazard.

Hazard identification consists of determining the types of biological agents, chemical contaminants, and physical agents likely to present a significant hazard (Codex Alimentarius [11]).

Hazard assessment consists of determining the severity (S) on the health of the consumer and the probability (P) that these hazards will occur. The probability of occurrence is determined by history and expertise. Each hazard is given a score between 1 and 3 for likelihood and severity. The hazard rating for each hazard is determined by multiplying the two values. If the result obtained is greater than 3, then the hazard is considered significant (Kamboj *et al.*, [9]) (Table 5).

Table 5. Hazard identification and determination of acceptance level

No.	Stage in the technological process	Potential hazard. Type of hazard: physical, chemical, biological	Is the hazard potentially significant?	Hazard assessement			Cause	Preventive measures/ Control measures
				S	P	HR		
1	**Milk reception**	B: contamination with microorganisms (*Mycobacterium tuberculosis, Salmonella* spp., *E. coli, Staphylococcus aureus, Brucella campylobacter, Listeria monocytogenes, Bacillus cereus, Mycobacterium bovis*)	Yes	3	1	3	Non-compliance with sanitary norms at producers. Non-compliance with the optimal conditions for transport.	- Rejection of raw milk for microbiological reasons. - Checking the milk tankers for transport (temperature, hygienic conditions). - Staff training. - Carrying out supplier audits.
		C: Pesticides, antibiotics, drugs, detergents etc.	Yes	3	1	3	- Contaminated animal feed with fertilizers. - Animals under medical treatment	
		P: Foreign bodies: hair, metallic impurities	No	2	1	2	- Non-compliance with hygiene rules on the farm.	Milk filtration
2	**Milk buffer storage**	B: Development of microflora present in milk	Yes	3	1	3	- Non-compliance with hygiene rules on the farm. - Failure to comply with work procedures.	- Compliance with work procedures. - Staff training.

3	**Feteasca neagra grape peels reception**	B: Contamination with microorganisms	Yes	3	1	3	- Non-compliance with sanitary norms at producers. - Non-compliance with the optimal conditions for transport The batch is old.	- Rejection of the contaminated lot. - Carrying out supplier audits.
		C: Pesticides	Yes	3	1	3	Excessive treatments of grapes culture	
		P: Presence of bunches of grapes	Yes	1	2	2	Removal of the bunches was not done properly.	
3.1	**Buffer storage of pomace**	B: Overfermentation and development of microorganisms	Yes	3	1	3	Storage time until drying too long.	Compliance with work procedures that require the immediate drying of grape peels.
3.2	**Drying Feteasca neagra grape pomance**	B: Contamination with microorganisms	Yes	3	1	3	- Too long buffer storage time of the raw material before drying. - Non-compliance with work parameters. - Too much moisture in the product due to improper drying leads to the development of its own microflora.	- Compliance with work procedures that require the immediate drying of grape peels. - Compliance with work parameters (temperarure and time). - Carrying out machine maintenance periodically and every time it is necessary.
3.3	**Sifting grape seeds**	P: Perforated sieve surfaces	No	2	1	2	Machine maintenance was not done properly.	Maintenance of work equipment and verification of work parameters.
3.4	**Grinding Feteasca Neagra grape peels**	B: Contamination with microorganisms	Yes	3	1	3	Carrying out an improper sanitation of the machines and ustensils	Checking the state of hygiene of the machines by performing periodic sanitation tests and visual examination.
		P: Improper grinding of the products	No	2	1	2	- Shredding of the raw material is not done properly. - The sieves allow the passage of insufficiently crushed pieces of the product. - Periodic maintenance of the machines was not carried out.	Carrying out the maintenance of the equipment periodically and every time it is necessary.
4	**Reception of packages**	B: Contamination with microorganisms	Yes	3	1	3	Non-compliance with sanitary norms at producers	- Rejection of the contaminated lot. - Carrying out supplier audits.
5	**Reception of starter culture**	B: Contamination with microorganism	Yes	3	1	3	Non-compliance with sanitary norms at producers	- Rejection of the contaminated lot. - Carrying out supplier audits.

6	**Milk filtration**	C: Contamination with detergent residues	Yes	2	1	2	Carrying out a non-compliant sanitation	Staff training
		P: Foreign objects (hair, straw)	Yes	2	1	2	- Perforated filtering surface. - Failure to perform machine maintenance on time.	- Staff training - Maintenance of work equipment
7	**Milk Pasteurization**	B: Contamination with: *M. tuberculosis, Brucella* spp., *E. coli.*	Yes	3	1	3	- Carrying out an improper sanitation of the machines. - Non-compliance with work parameters (time and temperature). - Possible technical problem with the pasteurizer. - Sanitizing substances at too low a concentration.	- Checking the state of hygiene of the machines by performing periodic sanitation tests and visual examination. - Staff training. - Maintenance of work equipment and verification of work parameters. - Verification of sanitizing substances. - Carrying out supplier audits for suppliers of sanitizing substances.
		C: Contamination with detergents residues	No	2	1	2	Carrying out an improper sanitation of the machines and ustensils	Staff training
8	**Cooling**	-	-				-	-
9	**Addition fo Feteasca Neagra grape peels**	B: Contamination with microorganism	Yes	3	1	3	Carrying out an improper sanitation of the machines and ustenils	- Checking the state of hygiene of the machines by performing periodic sanitation tests and visual examination. - Staff training.
10	**Inoculation with starter culture**	C: Contamination with detergents	No	2	1	2	Carrying out an improper sanitation of the machines and ustenils	- Checking the state of hygiene of the machines by performing periodic sanitation tests and visual examination. - Staff training.
		P: Presence of foreign bodies in the production space, from the staff, from the utensils	Yes	2	1	2	Improper sanitation of production spaces and equipment - Improper hygiene of staff	- Staff training. - Improving hygiene conditions. - Periodic checking of the health of the staff.

11.	**Packing**	B: Contamination with microorganisms	Yes	3	1	3	Improper sanitation of production spaces and equipment - Improper hygiene of staff	- Improving hygiene conditions. - Checking the state of hygiene of the machines by performing periodic sanitation tests. - Periodic checking of the health of the staff.
		P: Presence of foreign bodies in the production space, from the staff, from the utensils	Yes	3	1	3		- Staff training Improving hygiene conditions. - Periodic checking of the health of the staff.
12	**Thermostating**	-						
13	**Cooling**	-						
14	**Storage**	B: Contamination with: *Salmonella* spp., *E. coli., Enterobacter* spp., *Shigella* spp., *Klebsiella* spp.	Yes	3	1	3	- Non-compliance with the temperature regime required for optimal storage of the product. - Improper sanitation of storage spaces.	- Periodic temperature check. - Improving hygiene conditions. - Staff training.
		C: Contamination with foreign smells and tastes	Yes	2	1	2	Improper sanitation of storage spaces	Improving hygiene conditions
15	**Sale**	B: Contamination with: *Salmonella* spp., *E coli., Enterobacter* spp., *Shigella* spp., *Klebsiella* spp.	Yes	3	1	3	- Non-compliance with the temperature regime required for optimal transportation of the product - Improper sanitation of refrigerated vehicle for transport	- Periodic temperature check. - Improving hygiene conditions. - Staff training.
		C: Contamination with foreign smells and tastes	Yes	2	1	2	Improper sanitation of refrigerated vehicle for transport	Improving hygiene conditions Staff training

Table 6. CP and CCP identification

No:	Process stage	Potential hazards: physical, chemical, biochimical	Question from the decision tree:				CP/ CCP
			Q1	Q2	Q3	Q4	
1.	Milk reception	B, C	Yes	No	No		CP
2.	Milk buffer storage	B	Yes	No	Yes	Yes	CP
3.	Feteasca neagra grape pomance reception	B,C	Yes	No	No		CP
4.	**Feteasca neagră grape pomance buffer storage**	**B**	**Yes**	**Yes**			**CCP1**
3.	**Drying Feteasca neagra grape pomance**	**B**	**Yes**	**No**	**Yes**	**No**	**CCP2**
4.	Grinding Feteasca Neagra grape peels	B	Yes	No	No		CP
5.	Packages reception	B	Yes	No	No		CP
6.	Starter culture reception	B	Yes	No	No		CP
7.	**Milk Pasteurization**	**B**	**Yes**	**Yes**			**CCP3**
9.	Addition fo Feteasca Neagra grape peels	B	Yes	No	No		CP
10.	Inoculation with starter culture	B	Yes	No	No		CP
11.	Packing	B	Yes	No	No		CP
12.	**Storage**	**B**	**Yes**	**No**	**Yes**	**No**	**CCP4**
13.	**Sale**	**B**	**Yes**	**No**	**Yes**	**No**	**CCP5**

3.6 Identification of CCPs

Each operation in the technological process whose danger received a hazard rating ≥ 3 is passed through the decision tree. Thus, for the present case, the following CPs (check points) and CCPs were identified (Table 6).

3.7 Establishing critical limits, monitoring methods and corrective actions for each CCP

After establishing the CCPs, the HACCP team establishes for each CCP the target value that must be reached for the operation to be completed safely and the critical limit that separates the acceptable value from the unacceptable value.

After establishing these values, it is necessary to establish the verification methods for each CCP: how to verify that the parameters do not exceed the maximum/ minimum allowed value, the frequency at which it is verified, who is responsible for the verification and the way in which the verification of the values is recorded , so that the necessary information can be provided in due time about each verified operation in the process.

The corrective action plan includes a number of correlated, predetermined interventions that will be taken when there is a tendency to exceed the critical limits of the parameters in the respective CCP.

Specific actions are needed to manage a potentially unsafe product and bring the process back under control without delay. The effectiveness of the proposed corrective action plan must be verified as it is the last defense mechanism protecting the consumer from receiving a potentially unsafe product if a CCP fails. (Kamboj, Gupta, Bandral, Gandotra, & Anjum, 2020[9]).

Established critical limits, monitoring methods and corrective actions for each CCP are presented in Table 7.

Table 7. Critical limits, monitoring methods and corrective actions

CCP	Target Value	Critical limit	Methods of supervision			Corrective actions
			Methode and Frequency	Responsable	Document	
CCP1 Fetească Neagră grape pomance buffer storage	Temperature: 2 - 4 ^{0}C	4 ^{0}C	- Temperature check every 2 hours. - Microbiological analyses.	Technologist	Monitoring sheet	-
CCP2 Drying Feteasca neagra grape pomance	Temperature: 50 - 55 ^{0}C Time: 70-72 h	Temperature: ≤ 50 ^{0}C Time: ≤ 70 h	- After the drying temperature in the device is reached, check the time and temperature every 10 minutes. - Checking the humidity of the peels at the end of the drying operation.	Technologist	Monitoring sheet	Increasing the drying time
CCP3 Milk Pasteurization	Temperature: 85 - 90 ^{0}C Time: 20 - 30 min.	Temperature: ≤ 85 ^{0}C Time: ≤ 20 min.	- Checking the temperature and time every 2 minutes. - Microbiological analyses.	Technologist	Monitoring sheet	- If the temperature is lower, the pasteurization time is increased. If the temperature is lower than the accepted value, the automatic valve must close the access path to the tank and repeat the pasteurization. - Pasteurization check.
CCP4 Storage	Temperature: 2 - 4 ^{0}C	Temperature: ≥ 4 ^{0}C	Temperature check every 2 hours.	Technologist	Monitoring sheet	The temperature drops to the critical value.
CCP5 Sales	Temperature: 2 - 8 ^{0}C	Temperature: ≥ 4 ^{0}C	Continuous monitoring of the temperature in the refrigerated transport vehicle.	Refrigerator vehicle driver	Monitoring sheet	The temperature drops to the critical value.

3.8 Establishing verification procedures

To demonstrate the validity of the established HACCP plan and to prove its effectiveness, other assessment methods and tests are also applied (Codex Alimentarius [11]):
- Verification of suppliers of raw materials.
- Transport history of Feteasc㠠neagra grape milk and pomace is checked.
- Drinking water supplier is checked.
- State of health of the employees is checked.
- State of hygiene in the work spaces, of the employees, of the work equipment is checked.
- Control points are checked.
- Critical control points are checked.
- Quality of the finished product is checked from the point of view of food safety.
- Maintenance of the machines is checked.
- Calibration of the measuring devices is checked.
- Procedures and the way in which employees are trained are checked.
- Complaints from the distributor and the buyer are checked.

4. Conclusions

-This study can be an example of the use of by-products/ residues from different branches of food, in the present case the processing of grapes to obtain wine, through which a series of environmental problems (waste disposal) can be solved by using these wastes (pomace grapes), after processing and preparation, as a basic material, together with other raw materials in the production of food or food supplements based on the principle of circular economy and sustainability.
- The application of the HACCP study can increase the effectiveness of production by tracking the quality of raw materials and finished products and by ensuring a history and implicitly a traceability of the technological process.
- The application of the decision tree indicates 5 critical control points: pasteurization of milk, storage and drying of Black Virgin Grape pomace, and storage and sale of yogurt. For all these CCPs they have to identify critical limits, methods and frequency of monitoring and corrective actions.

5. References

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