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QUALITY ASSESSMENT OF SELECTED MEAT PRODUCTS FROM A LEADING ROMANIAN PRODUCER

Camelia HODOȘAN, Lucica NISTOR, Sorin Iulius BĂRBUICĂ, Ana-Maria NEGULEI, Raluca Ioana HODOȘAN, Anca ROȘCA

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Marasti Blvd, District 1, Bucharest, Romania

Corresponding author email: sorin.barbuica@yahoo.com

Abstract

This study aims to evaluate the quality parameters of selected meat products, specifically Bănățean Salami and Chicken Breast Frankfurters, produced by a meat processing company in Romania. The research includes a comprehensive assessment of the technological, physicochemical, microbiological, and sensory characteristics of these products. Standard laboratory methods were used to determine moisture, protein, fat, salt content, acidity, and microbial safety. Sensory evaluations were also conducted to assess consumer acceptability. The results revealed significant differences in composition and textural attributes between the two products, influenced by their distinct processing methods. Bănățean Salami exhibited a higher fat content and intense aroma, while Chicken Breast Frankfurters had a lower fat percentage and a more delicate texture. The study confirms the compliance of these meat products with national and European quality standards, highlighting the importance of optimizing production techniques for enhanced consumer satisfaction.

Key words*: food quality control, meat processing, meat products, microbiological safety, physicochemical analysis.*

INTRODUCTION

Meat and meat products play a crucial role in human nutrition, providing essential proteins, vitamins, and minerals necessary for a balanced diet. The meat processing industry has evolved significantly to ensure the safety, quality, and sensory appeal of its products (Georgescu & Banu, 2000). Quality assurance in meat production is critical, as it directly impacts consumer health and market competitiveness (Malos & Malos, 2016). Processed meat products have undergone significant improvements in production techniques, ingredient formulation, and preservation methods to meet increasing consumer demand for high-quality, nutritious, and safe food products (Malos & Malos, 2020). The growing awareness of food safety, sustainability, and health concerns has also influenced consumer choices, prompting the industry to explore new methods for improving product quality while maintaining affordability and taste. It is essential to continuously educate consumers about potentially harmful ingredients added to food, encouraging them to read labels carefully to make informed purchasing decisions and prioritize food safety (Posan et al., 2022).

This study focuses on the quality assessment of two widely consumed products: Bănățean Salami, a cured and fermented meat product, and Chicken Breast Frankfurters, a processed poultry-based product. The objective is to evaluate their physicochemical, microbiological, and sensory attributes to determine compliance with quality standards and consumer preferences (Ianițchi et al., 2023). Understanding the differences between these two products will provide insights into the impact of processing techniques on the final product quality and consumer acceptance, helping manufacturers refine their techniques for optimal results (Ianitchi et al., 2014).

MATERIALS AND METHODS

The selected products, Bănățean Salami and Chicken Breast Frankfurters, were analyzed based on their technological production stages and quality parameters. The production processes of both products involve carefully monitored steps to maintain hygiene, consistency, and overall quality. Each stage of the processing chain, from raw material selection to final packaging, was documented to ensure a comprehensive evaluation.

Bănățean Salami is a cured and fermented meat product, requiring high-quality raw materials to ensure a consistent texture and flavor. The production process begins with the selection of pork and beef cuts, which are then trimmed to remove excess connective tissue and fat. The meat is ground to a specific particle size, ensuring uniform distribution of fat and lean content. A precise blend of curing agents, salt, spices, and starter cultures is added to facilitate fermentation and enhance the characteristic taste. These ingredients not only contribute to the taste but also play a crucial role in inhibiting bacterial growth and improving shelf life (Popa & Stănescu, 1995).

After mixing, the meat is stuffed into casings and left to ferment under controlled temperature and humidity conditions. This fermentation stage is crucial for flavor development and preservation. During fermentation, lactic acid bacteria lower the pH, creating an environment unfavorable for pathogenic bacteria while developing a distinct tangy flavor. The duration and conditions of fermentation significantly impact the final taste and texture of the salami. Following fermentation, the salami undergoes a drying and maturation process, which lasts several weeks, allowing for moisture reduction and texture enhancement. Finally, the product is smoked using natural wood smoke to impart its distinctive aroma and color, contributing to its extended shelf life and reinforcing the traditional taste profile associated with fermented meats (Malos & Malos, 2020).

Chicken Breast Frankfurters are finely emulsified meat products that undergo rigorous processing to achieve a smooth and uniform consistency. The process begins with selecting lean chicken breast meat, which is finely ground and mixed with water, salt, stabilizers, and seasonings. Unlike Bănățean Salami, which undergoes fermentation, Chicken Breast Frankfurters rely on thermal processing to ensure safety and uniform texture. Stabilizers and emulsifiers play a crucial role in maintaining consistency and preventing phase separation during cooking.

The finely emulsified meat mixture is then filled into casings and subjected to a two-step thermal treatment: steaming and boiling. This process eliminates potential microbial contaminants while achieving the desired firmness and cohesiveness. Heat treatment plays a critical role in ensuring microbial inactivation and protein gelation, contributing to the final product's structure and stability. After thermal processing, the frankfurters are rapidly cooled to prevent excessive moisture loss and maintain product quality. The final product is vacuum-sealed to enhance shelf stability and maintain freshness during storage and distribution. The combination of thermal treatment and vacuum-sealing helps prevent oxidation and microbial spoilage, extending the shelf life of the product.

The physicochemical composition of the meat products was analyzed using standard laboratory techniques.

Moisture content was determined through oven-drying at 105°C until a constant weight was achieved.

Protein content was measured using the Kjeldahl method, which quantifies nitrogen content and calculates total protein concentration.

Fat content was analyzed via Soxhlet extraction, a method that isolates lipids from the sample. Salt content was measured using Mohr's titration, while acidity was evaluated through titration to assess product stability and shelf life.

A trained panel conducted sensory evaluations to assess key attributes, including color, texture, taste, and aroma. Each product was rated on a standardized scoring system to determine overall consumer acceptability.

The chemical quality indicators of meat products are:

- Composition and nutritional value indicators: total protein content (%), collagen content (%), the collagen/total protein percentage ratio, fat content (%), water content (%);
- Preservation indicators: nitrite content (mg NO_2/100 g product) and NaCl content (%).

For each meat product, 5 samples were collected to undergo organoleptic, microbiological and physicochemical examination. The organoleptic examination consisted of analyzing the organoleptic parameters: shape, appearance, consistency, taste, and smell. The microbiological examination was made to determine *Salmonella*, *Listeria* and *E. coli* presence. The physicochemical examination consisted of determining: moisture, total protein substances, total fat, sodium chloride, nitrites, easily hydrolyzable nitrogen, and the Kreiss reaction.

Technique for the Isolation and Identification of Bacteria from the Genus *Salmonella* Using the Horizontal Method

Stage I: Pre-enrichment in Non-selective Liquid Media. Buffered peptone water is inoculated at room temperature with the sample for analysis, then incubated at 37°C ± 1°C for 18 h ± 2 h.

Stage II: Enrichment in Selective Liquid Media. Rappaport-Vassiliadis soya broth (RVS broth) and Muller-Kauffmann tetrathionate/ novobiocin broth (MKTTn broth) are inoculated with the culture obtained in the buffered peptone water. RVS broth is incubated at 41.5°C ± 1°C for 24 h ± 3 h, and MKTTn broth is incubated at 37°C ± 1°C for 24 h ± 3 h.

Stage III: Isolation and Identification. From the obtained cultures, two selective solid media are inoculated: Xylose lysine deoxycholate agar (XLD agar); Rambach agar (chromogenic medium), recommended for the isolation and identification of Salmonella spp., including lactose-positive strains and the serotypes Salmonella typhi and Salmonella paratyphi, according to the manufacturer's instructions. Both media (XLD and Rambach agar) are incubated at 37°C ± 1°C and examined after 24 h ± 3 h.

Stage IV: Confirmation of Identity. Isolated colonies, presumed to be *Salmonella*, are subjected to confirmation through biochemical and serological tests (Şuler A. et al., 2019).

Procedure for Determining *Listeria*

Pre-enrichment: 25 grams of the sample are mixed with 225 milliliters of Demi-Fraser broth. Incubation is carried out at 30°C for 24 hours.

Selective Enrichment: 1 milliliter of the culture obtained from resuscitation and pre-enrichment is inoculated into 100 milliliters of Demi-Fraser broth. Incubation is carried out at 30°C for 24 hours.

Transfer to Selective Isolation Medium: 0.1 milliliters of the culture, either directly or from a mixture of 0.5 milliliters culture + 4.5 milliliters KOH, is streaked onto the surface of Palcam agar. Incubation is performed at 35°C for 24-48 hours.

Isolation of Characteristic Colonies: Five typical colonies are selected and subcultured on Petri dishes with nutrient agar (or TSYEA agar). Incubation is carried out at 35-37°C for 18-24 hours. Identification and Confirmation are performed using specific biochemical tests (Şuler et al., 2021).

MUG Method for the Rapid Enumeration of *E. coli* in Refrigerated or Frozen Foods

This test is based on the determination of glucuronidase, an enzyme possessed by most *E. coli* strains, unlike other intestinal bacteria. The MUG substrate (4-methylumbelliferyl-β-D-glucuronide) is incorporated into LT broth. Inoculated tubes are incubated under specific conditions and examined under UV light for the presence of a fluorogenic glucuronidase as the final product. Fluorescence in LT-MUG thermolabile medium indicates the presence of *E. coli*.

Determination of moisture content

The water content is determined by the method described in the international standard SR ISO 1442:2010. The method involves heating a certain amount of sample to a heat source at a temperature of 103˚C ± 2˚C until constant weight is achieved, after forming a homogeneous mixture of the sample to be analyzed, sand, and ethanol. The weight loss, calculated as a percentage, represents the water content. It is recommended that the determination be performed in duplicate for each sample taken for analysis.

Apparatus and glassware used: Common laboratory apparatus; Mechanical or electric homogenizer capable of homogenizing the sample for analysis (This includes a high-speed rotating knife or a meat grinder with a sieve whose hole diameter does not exceed 4.0 mm); Weighing flasks with lids made of porcelain or metal (e.g., nickel, aluminum, stainless steel) with a diameter of at least 60 mm and a height of approximately 40 mm; Glass rod; Drying oven, electrically heated, capable of being maintained at a temperature of 103˚C ± 2˚C; Desiccator containing an effective drying agent, such as silica gel; Analytical balance, capable of weighing with an accuracy of ± 0.001 g; clean sand, acid-washed, with a granulation such that it can pass through a sieve with a hole size of 1.4 mm but not through a sieve with a hole size of 250 μm. The sand, before use, is dried at a temperature of 150-160ºC and stored in a tightly sealed bottle.

It is important to take a truly representative sample that has not been damaged or altered during transport or storage. The laboratory sample mass must not be less than 200 g. The laboratory sample is homogenized using appropriate equipment. If a meat grinder is used, the sample is passed through the grinder at least twice. The homogenized sample is placed in an appropriate container, sealed tightly, and filled completely. The container is closed and stored in such a way as to prevent degradation or changes in its composition. Care must be taken to ensure that the sample temperature does not exceed 25ºC. The sample should be analyzed as quickly as possible, but always within 24 hours of homogenization. Transfer a quantity of sand, three or four times the mass of the sample being worked with, into a weighing flask along with a glass rod, and place it in the drying oven for 30 minutes at a temperature of 103ºC. The flask, along with the contents and rod, is then cooled to room temperature in a desiccator and weighed using the analytical balance with an accuracy of 0.001 g (m_0). Weigh a sample with a mass between 5 g and 8 g, in an empty weighing flask along with sand and the glass rod with an accuracy of 0.001 g (m_1). A homogeneous mixture of the sample and sand is formed with the help of the glass rod. If difficulties arise in homogenizing the sample, ethanol may be added. In this case, the ethanol must evaporate before the sample is placed in the drying oven. Heat the flask containing the sample and glass rod for 2 hours in the oven at a temperature of 103ºC. After the specified time, remove the flask from the oven and place it in a desiccator to cool to room temperature, then weigh it with an accuracy of 0.001 g. The heating, cooling, and weighing operations are repeated until the results of two consecutive weighings, separated by one hour of heating, do not differ by more than 0.1% of the sample mass for analysis (m_2). The moisture content of the sample is calculated using the following formula:

$$w\ \% = \frac{m_1 - m_2}{m_1 - m_0} \times 100$$

where:

m_0 is mass of the flask with the glass rod and sand, in grams;

m_1 – mass of the flask with the glass rod, sand, and sample, before drying, in grams;

m_2 – mass of the flask with the glass rod, sand, and sample, after drying, in grams.

The result is rounded to one decimal place.

Determination of total fat (Soxhlet)

The determination of free fat content in meat and meat products is carried out using the standard SR ISO 1444:2008.

Free fat substances are extracted until exhaustion from the dried sample using an organic solvent (n-hexane or petroleum ether) with the Soxhlet apparatus. After the solvent is removed by evaporation, the extract is dried and weighed, and the result is expressed as a percentage. The water content is removed by the method described in the international standard SR ISO 1442:2010.

Apparatus and glassware used: Homogenization equipment, mechanical or electric, capable of homogenizing the sample for analysis. This includes a high-speed rotating knife or a meat grinder with a sieve with hole diameters of up to 4.5 mm; Extraction cartridge, made of filter paper and degreased; Degreased beaker; Continuous or semi-continuous extraction apparatus, e.g., Soxhlet type; Sand bath or water bath, electrically heated, or a similar appropriate apparatus; Electric drying oven, capable of being maintained at 103 ± 2˚C; Desiccator containing an effective drying agent, such as silica gel; Analytical balance, capable of weighing with an accuracy of ± 0.001 g;

Common laboratory glassware

Reagents: Extraction solvent, n-hexane or alternatively petroleum ether with a distillation range between 40˚C and 60˚C, having a bromine index of less than 1. For both solvents, the residue upon complete evaporation should not exceed 0.002 g/100 mL. Porcelain pieces for boiling.

It is important to take a truly representative sample that has not been damaged or altered during transport or storage. The laboratory sample mass must not be less than 200 g. The sample should be stored in such a way as to prevent degradation or modification of its composition. The sample is homogenized for analysis using appropriate equipment. Care should be taken to ensure that the sample temperature does not exceed 25˚C. If a meat grinder is used, the sample should be passed

through it at least twice. A suitable airtight container is filled with the prepared sample. The container is sealed and stored to prevent degradation and alteration of its composition. The sample should be analyzed as soon as possible, but always within 24 hours of homogenization. A known mass of 5 g to 8 g, weighed with an accuracy of 0.001 g (m_0) from the prepared sample, is dried using the method described in the international standard SR ISO 1442:2010. If desired, the dried sample from the moisture content determination can be used for the free fat determination. For reliable measurements, the minimum fat content present in the sample for analysis must be 0.05 g. The flask of the extraction apparatus, containing some porcelain pieces for boiling, is dried for one hour in the drying oven set at 103˚C. The flask is allowed to cool to room temperature in a desiccator and weighed with an accuracy of 0.001 g (m_1). The last traces of the dried sample from the drying flask are transferred using cotton wool moistened with extraction solvent, and the cotton wool is also transferred to the cartridge. The cartridge is placed in the extractor of the apparatus. Extraction solvent is poured into the flask of the extraction apparatus; the amount of solvent should be at least one and a half to two times the capacity of the apparatus extractor. The flask is attached to the extraction apparatus. The flask is heated for at least 6 hours in a sand bath or water bath, according to the extraction rate of the apparatus used. After extraction, the flask containing the liquid is removed from the extraction apparatus, and the solvent is removed by distillation using, for example, a sand bath or water bath. The last traces of solvent are evaporated by blowing air if desired. The flask is dried for 1 hour in the drying oven set at 103˚C, and after cooling to room temperature in a desiccator, it is weighed with an accuracy of 0.001 g. The heating, cooling, and weighing operations are repeated until the results of two consecutive weighings, separated by one hour of heating, do not differ by more than 0.1% of the sample mass for analysis (m1). The completion of the extraction is verified by taking a second extraction flask and extracting for another hour with a fresh portion of solvent. The increase in mass should not exceed 0.1% of the mass of the sample for analysis. The free fat content (w_f), as a percentage by mass, is calculated using the following equation:

$$w_f = \frac{m_2 - m_1}{m_0} \times 100\%$$

where:
m_0 is mass of the sample for analysis taken for drying, in grams;
m_1 – mass of the extraction flask with porcelain pieces for boiling, in grams;
m_2 – mass of the flask and porcelain pieces with fat after drying, in grams. The result is reported rounded to one decimal place.

Determination of total protein substances (Kjeldhal method)

The Kjeldahl method is used for determining the nitrogen content (which represents total protein substances) in meat and meat products. It is based on digesting the sample in a concentrated acidic medium, which converts organic nitrogen into ammonium ions. Afterward, ammonia is distilled using a boric acid solution and titrated with hydrochloric acid to calculate the nitrogen content in the sample.

Equipment and Glassware Used: Mechanical meat grinder with a sieve with holes no larger than 4 mm; Sulfurized paper (9 cm x 6 cm); 50 ml burette; Kjeldahl flasks (maximum 800 ml) with a piriform glass stopper, if necessary; Distillation apparatus or vapor distillation apparatus; Heating device; Vapor extraction device for acid vapors; Analytical balance; General laboratory glassware (beakers, graduated flasks, graduated cylinders, pipettes, burettes).

All reagents must be of recognized analytical grade: Sulfuric acid (H_2SO_4): density 1.84 g/ml; Copper sulfate ($CuSO_4 \cdot 5H_2O$); Potassium sulfate (K_2SO_4) anhydrous; Sodium hydroxide (NaOH), decarbonated solution with approximately 33 g NaOH per 100 ml of solution; Boric acid (H_3BO_3), solution with 40 g per liter of water; Hydrochloric acid (HCl) 0.1 N; Indicator solution: mixed methyl red and methylene blue; Boiling regulators: glass beads, silica carbide, or porcelain fragments.

Start with a representative sample of at least 200 g. Homogenize the sample by passing it through the meat grinder at least twice. Store the homogenized sample in an airtight container and analyze it within 24 hours. Add some boiling regulators into the Kjeldahl flask. Add 15 g of

anhydrous potassium sulfate and 0.5 g of copper sulfate (II). Weigh 2 g (or 1.5 g for fatty samples) of the sample on sulfurized paper.
Add 25 ml of concentrated sulfuric acid (H_2SO_4) to the Kjeldahl flask, mix gently, and heat slowly at a 40° angle to the vertical until the liquid becomes clear and has a blue-green tint.
The digestion should last at least 2 hours, ensuring that no sulfuric acid is lost due to overheating.
After cooling the flask, add water and transfer the solution into a conical flask with 50 ml of boric acid solution and a few drops of indicator solution. Add 100 ml of NaOH and distill the ammonia. Collect at least 150 ml of distillate.
Titrate the distillate with 0.1 N hydrochloric acid solution using a burette. Record the volume of acid required for the titration. Perform two determinations on the same sample and a control sample.
The nitrogen content is expressed as a mass percentage using the formula:

$$X_{NH3} = 0.0014 \times (V_1 - V_0) \times 100/m$$

where:
V_1 is the volume of 0.1 N HCl used for the determination of the sample;
V_0 – the volume of 0.1 N HCl used for the control sample;
m – the mass of the sample being tested (in grams).
To express the result as total protein, multiply the total nitrogen value by a factor of 6.25.

Quantitative determination of easily hydrolyzable nitrogen (titration with HCl)
The method is based on the fact that easily hydrolyzable nitrogen, released with magnesium oxide in the form of ammonia, is distilled with water vapor and captured in a boric acid solution, which is then dosed by titration with hydrochloric acid.
Reagents: Perchloric acid solutions: 6 g/100 ml; Caustic soda solutions: 20 g/100 ml; Standard HCl solutions: 0.05 mol; Boric acid solutions: 3 g/100 ml; Silicone antifoam agent; Phenolphthalein solution: 1 g/100 ml ethyl alcohol; Indicator solution (Tashiro Mixed Indicator): Dissolve 2 g methyl red and 1 g methylene blue in 1000 ml of 95% ethanol.
When handling perchloric acid, necessary safety precautions should be taken as for other highly corrosive substances. The samples should be processed as soon as they arrive in the laboratory.
Carefully cut the sample, weigh 10 g (with an error of at most ± 0.1 g) into an appropriate container, and mix with 90 ml of perchloric acid solution. Homogenize the mixture for 2 minutes in a mixer, then filter through filter paper.
The resulting extract can be stored for at least 7 days at a temperature between 2°C and 6°C.
Transfer 50 ml of the obtained extract into a vapor distillation apparatus.
To ensure that the extract has sufficient alkalinity, add a few drops of the silicone antifoam agent and 6.5 ml of caustic soda solution, then immediately start the distillation by vapor induction. Adjust the distillation rate so that 100 ml of distillate is obtained in 10 minutes. The distillate outlet tube is submerged in a container containing 100 ml of boric acid solution, to which 3-5 drops of the indicator solution are added. After 10 minutes, the distillation is completed. Raise the tube and wash it with water. Determine the content of volatile bases in the distillate solution by titration with the standard HCl solution. The final pH should be 5.0 (with an error of ± 0.1).
The analysis must be performed in duplicate. The analysis is considered correct if the difference between the two results does not exceed 2 mg/100 g. The titration is done with a standard HCl solution of 0.01 mol/l (0.01 N).
A control sample is also performed: instead of the extract, use 50.0 ml of perchloric acid solution. The content of easily hydrolyzable nitrogen (mg/100 g sample) is calculated using the following equation:

$$\text{Easily Hydrolyzable Nitrogen (mg/100g sample)} = (V1-V0) \times 0.14 \times 2 \times 100/M$$

where:
V_1 is volume of 0.01 M HCl solution (ml) used to titrate the sample;
V_0 – volume of 0.01 M HCl solution (ml) used to titrate the control sample;
M – mass of the sample (g).

Determination of sodium chloride (Mohr's Method)
Sodium chloride is added to food products to enhance flavor, increase preservation capacity, and, in meat products, as an agent to aid in the maturation (tenderizing) of meat during

production. In the aqueous extract obtained from the product under analysis, chloride ions are directly titrated with a silver nitrate solution in the presence of potassium chromate as an indicator. The chloride content is then calculated and expressed as sodium chloride equivalent.
Reagents: Silver nitrate 0.1 N; Potassium chromate, saturated solution (indicator).
Prepare the aqueous extract as per previous instructions. For dry products, the extraction time is longer (about 1 hour). To aid extraction, the flasks may be kept for about 30 minutes in a water bath at moderate temperature (55-60°C).
From the filtered aqueous extract, measure 10 ml into a 100 ml Erlenmeyer flask, add a few drops of potassium chromate, and titrate with 0.1 N silver nitrate solution while continuously stirring. The endpoint of the titration is considered when the color changes abruptly from light yellow to persistent orange. From this point onward, a drop of excess silver nitrate causes the color to shift to brick-red.
The total chloride content, expressed as sodium chloride %, is calculated using the following formula:

$$NaCl\ \% = (0.00585 \times V \times 10)/m \times 100$$

where:
V is volume of 0.1N silver nitrate solution (ml);
0.00585 – amount of sodium chloride (g) corresponding to 1 ml of 0.1 N silver nitrate;
10 – the ratio between the total volume of the aqueous extract (100 ml) and the volume of extract taken for analysis (10 ml);
M – mass of the sample (g) taken for analysis.
For easier calculation, instead of using 0.1 N silver nitrate solution, you can use a 2.906% silver nitrate solution. In this case, 1 ml of the silver nitrate solution corresponds to 0.1 g of sodium chloride, provided the procedure is followed exactly as described.

Determination of nitrites content (Griess Method)
Sodium or potassium nitrites are commonly used in meat product technology due to their ability to combine with the natural pigment of meat (myoglobin) to form a red complex that stabilizes with heat. Nitrites also combine with the natural pigment of blood (hemoglobin) to form a similar complex. Along with other curing agents (sodium chloride, nitrates, phosphates, ascorbates), nitrites play a positive role in improving the preservation capacity of meat products by inhibiting the growth of spoilage bacteria. However, free nitrites are considered potentially carcinogenic because they can combine with certain amines formed during the meat maturation process or during gastrointestinal digestion, forming nitrosamines, substances known for their carcinogenic effect. Nitrites can combine in an acidic medium with a primary aromatic amine to form a diazonium salt. If this salt is condensed or coupled with another primary aromatic amine, a colored complex is formed, which follows Beer's law.
Apparatus and reagents: Photocolorimeter or spectrophotometer; Acetilic solution of alpha-naphthylamine; Acetilic solution of sulfanilic acid; Saturated aqueous solution of mercuric chloride; Standard scale for comparison.
Take 12 uniformly calibrated, clean, and colorless test tubes and number them from 1 to 12. In each test tube, introduce an amount of $NaNO_2$ standard solution equivalent to the test tube's number (1 ml up to 12 ml). Then add 1 ml of the Griess complex reagent, followed by 0.5 ml of Griess A reagent, and then 0.5 ml of Griess B reagent. Complete the test tube to a final total volume of 13 ml.
Take 10 g of the sample to be analyzed, finely chop it, and place it into a Berzelius beaker. Add 100 ml of distilled water and leave it at room temperature for 30 minutes. Then filter it. In a test tube, take 1 ml of the filtered solution, 1 ml of Griess reagent, and 11 ml of distilled water. Homogenize the contents of the test tube and after 20 minutes, compare the obtained color with the standard scale.
The nitrite content of the sample, expressed as mg%, is equal to the number of the test tube on the standard scale corresponding to the observed color. If the color of the solution in the examined test tube is more intense than the color of the last test tube on the scale, dilute the extract 1/1 and reassess. The nitrite content will be the scale value multiplied by two.
In case of dispute, nitrite determination is done using the modified Griess method, which uses a spectrophotometer (Spekol) to read the color extinction.

Kreis reaction

The Kreis reaction qualitatively determines the oxidation stage of fat in meat and meat products, as well as in animal fats. The method's principle is based on the extraction of fat from the product and its treatment with fluoroglucine in the presence of hydrochloric acid. The oxidation degree is assessed by the intensity of the color obtained.

Reagents: Fluoroglucine; Hydrochloric acid; Ethyl ether. Place 10 g of fat into a test tube and heat at 105°C for 10-20 minutes until it melts. Mix 1 ml of the melted fat with 1 ml of HCl and 1 ml of fluoroglucine. Homogenize and observe the color of the liquid. Negative reaction: when the liquid remains colorless; Slightly positive reaction: appearance of a pink color of varying intensities; Positive reaction: appearance of a red color with a purplish hue (Banu, 2009).

RESULTS AND DISCUSSIONS

The analysis revealed significant physico-chemical differences between Bănățean Salami and Chicken Breast Frankfurters, influenced by their processing methods. Bănățean Salami had a moisture content of 40-45%, significantly lower than Chicken Breast Frankfurters, which exhibited a moisture percentage of 55-60%. The lower moisture content in Bănățean Salami is a result of fermentation and drying, contributing to its firm texture and extended shelf life.

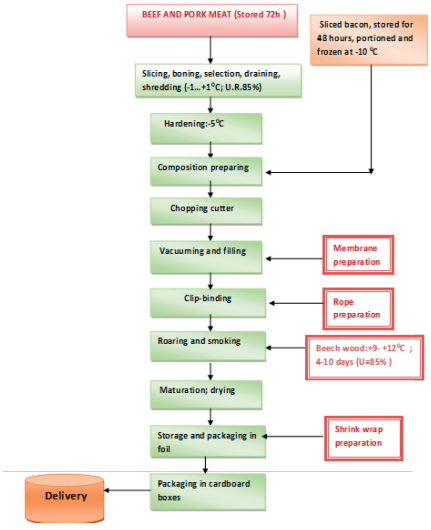

Figure 1. Technological flux for Bănățean Salami

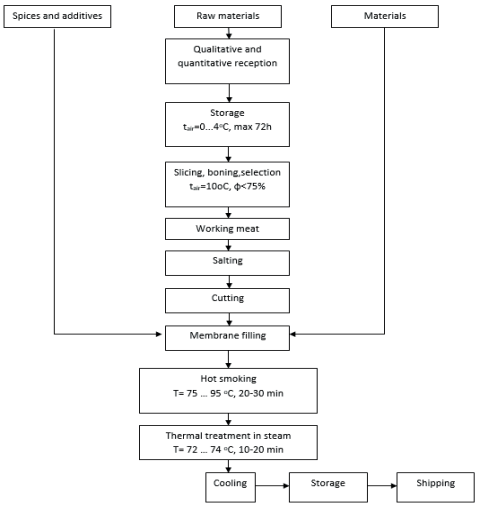

Figure 2. Technological flux for Chicken Breast Frankfurters

Conversely, the higher moisture content in Frankfurters enhances its softness and ease of consumption. The increased water retention in frankfurters contributes to their juiciness, an essential quality aspect preferred by many consumers, particularly for quick meals and fast-food applications. Moisture levels also influence microbiological stability, with drier products like salami being less prone to spoilage.

The fat content varied significantly, with Bănățean Salami containing 25-30%, whereas Chicken Breast Frankfurters had a much lower fat percentage (8-12%). This difference affects both texture and flavor, as the higher fat content in Bănățean Salami contributes to its rich mouthfeel and intense taste. The protein content was relatively high in both products, with Bănățean Salami containing 22-24% and Chicken Breast Frankfurters 18-20%, confirming their nutritional value. The higher fat content in salami also contributes to its distinct marbling, which plays a role in sensory perception, particularly in terms of tenderness and juiciness.For the products Salam Bănățean and Chicken Breast Sausages, the physico-chemical analyses of technological interest that were determined include: moisture, salt content, protein content, total fat, easily hydrolyzable nitrogen, and nitrite content. Based on the analysis of these characteristics, it can be stated that, from an organoleptic standpoint, all the

types of salami included in the study comply with the admissibility limits. Therefore, the products are manufactured according to the recipe and working instructions, and the raw materials, auxiliary ingredients, additives, and casings meet the requirements set by Regulation No. 825/2004/EC, Regulation No. 853/2004/EC, Directive 2002/99/EC, and Order 560/08.01.2007.

Table 1. Organoleptic characteristics of Bănățean Salami and Chicken Breast Frankfurters

Sortiment	Characteristics			
	Shape and size	**Aspect**	**Taste and smell**	**Texture**
Bănățean Salami	***Cylindrical sticks, 50-60 cm long and 40-70 mm in diameter***	Dry surface with small wrinkles, red-brown color, with rare (permitted) mold or good-quality yeast spots, composition with pieces of meat, fat, and rare mustard seeds	***Pleasant taste and smell of raw matured product, spices, and additives***	***Elastic to very firm***
Chicken Breast Frankfurters	Cylindrical pieces, 22-24 mm in diameter and 140-160 mm in length, twisted in strings	Clean surface, non-sticky, without water or fat accumulation at the ends or under the casing, continuous and undamaged casing, pale pink color	Pleasant, slightly salty, characteristic of the spices used, without foreign tastes or smells	Elastic

Table 2. Salt and water content of the meats analysed

PROBES	**Chemical parameter**			
	Experimentally determined values		***Permitted values***	
	Apa (%)	**NaCl (%)**	**Apa (%)**	**NaCl(%)**
Bănățean Salami	**25,5±0,2**	**3,30±0,1**	**Max.30**	**Max. 3,6-5,5**
Chicken breast Frankfurters	**62,70±0,1**	**2,10±0,15**	**Max.70**	**Max. 3**

Based on the analysis of these values, it is observed that the highest water content is found in the Chicken Sausages, while the lowest is in the Bănăţean Salami, and this correlates positively with the manufacturing technology (Bănăţean Salami is a dry-cured product). From a physico-chemical standpoint, both types of products analyzed met the admissibility conditions specified by the applicable Orders and Regulations. The same conclusions are drawn from the graphical analysis of the moisture and sodium chloride content in the analyzed product types.

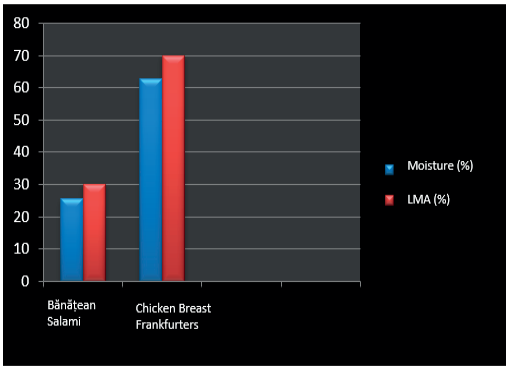

Figure 3. Variation of moisture in the analysed products

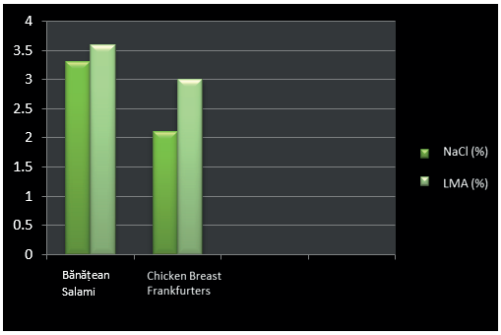

Figure 4. Variation of salt in the analysed products

It is well known that the nutritional value of cooked and smoked meat products is primarily determined by their protein and fat content.

Table 3. Protein and fat contents of the analysed products

PROBES	**Chemical parameter**			
	Experimentally determined values		***Permitted values***	
	Total Proteins (%)	**Fat (%)**	**Total proteins (%)**	**Fat (%)**
Bănățean Salami	**29,1±0,10**	**32,3±0,10**	**Min.11**	**Max.40**
Chicken Breast Frankfurters	**12,70 ±0,10**	**24,3 ±0,10**	**Min. 10**	**Max. 26**

The analysis of these values shows that Banat Salami has the highest protein content (29.1% compared to 12.7% for the Sausages), with both

products falling within the minimum admissibility limits (min. 11% for Salami and min. 10% for Sausages). This confirms that Banat Salami contains high-quality meat with a high biological value.
Regarding fat content, Banat Salami is also superior to the Sausages. Moreover, the manufacturing technology for Banat Salami involves the inclusion of beef and pork (in a 1:2 ratio) and the addition of fat.
The same conclusions can be drawn from the graphical analysis of the fat and protein content in the analyzed meat product samples (Figure 5).

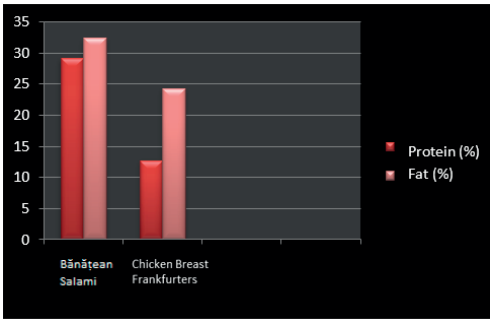

Figure 5. Variation of protein and fat content in the analysed products

In meat products (ham, salami, sausages), nitrites and nitrates are commonly used to maintain a pinkish-red color and for their bacteriostatic effects and flavor development in theproducts.To ensure even distribution throughout the meat mass, nitrates and nitrites are added to salt or brine. Under the action of reducing microorganisms in the brine and meat, nitrates are converted into nitrites. These nitrites oxidize myoglobin and hemoglobin in the blood into nitrosomyoglobin and nitrosohemoglobin, which maintain their red color during the meat treatment process. Without them, boiled or scalded salamis would turn a grayish color.In Romania, the concentration of nitrites in finished products is limited to a maximum of 70 mg/kg, while in some countries, it can be as high as 200 mg/kg.Based on these considerations, we aimed to determine the nitrite content in the two analyzed varieties, compared to their freshness, assessed by the Kreis reaction (Table 4).
From the perspective of nitrite content, it falls within the admissibility limits for all analyzed varieties, and according to the Kreis reaction, all productswere fresh.For the products included in the study, samples were sent to the laboratory for microbiological examination.

Table 4. Nitrites contents and Kreis reaction

PROBES	Chemical parameter		
	Experimentally determined values		*Permitted values*
	Nitrites (mg/100g)	Kreis Reaction	Nitrites (mg/100g)
Bănățean Salami	2,50±0,2	Negative	Max.7
Chicken Breast Salami	4,10 ±0,10	Negative	Max.7

The microbiological examination of the studied products included the following determinations: *Escherichia coli*, *Salmonella*, and *Listeria*, according to Regulation (EC) No. 2073/2005 on microbiological criteria for foodstuffs, amended by Commission Regulation (EC) No. 1441/2007 of December 5, 2007, and the self-control program developed based on this Regulation.
The following indicators were determined: the number of *E. coli* bacteria, the presence of *Salmonella* germs, and the presence of *Listeria* germs, using the methods provided by the official standards in force.For determining the *Salmonella* bacteria in the analyzed products, 5 samples were collected and analyzed (one sample for each product), totaling 20 samples (5 x 0.5 kg for each sample) during the above-mentioned period. The same number of samples was collected for the determination of *Listeria monocytogenes* and *Escherichia coli*. All the results obtained were summarized in Table 5 (Banu C., 2009).

Table 5. Microbiological analysis of the chosen products

ANALYSED PRODUCT	VALUES		
	E. coli	*Listeria*	*Salmonella*
BĂNĂȚEAN SALAMI	<10	Absent	Absent
CHICKEN BREAST FRANKFURTERS	<10	Absent	Absent

Of all the samples analyzed, 100% showed results that were in compliance with Regulation (EC) No. 2073/2005 on microbiological criteria

for foodstuffs, as amended by Regulation (EC) No. 1441/2007.

CONCLUSIONS

This study successfully evaluated the technological, physicochemical, microbiological, and sensory characteristics of Bănățean Salami and Chicken Breast Frankfurters. The findings confirmed that both products adhere to industry quality standards and consumer expectations. Understanding the differences between traditionally fermented meat products and emulsified, thermally processed alternatives can help both manufacturers and consumers make informed choices. Future research should explore alternative preservation techniques and ingredient modifications to further enhance the nutritional profile and safety of processed meat products, particularly in response to changing dietary trends and consumer health concerns.

REFERENCES

Banu, C. (coord.) (2009). *Food Industry Treaty – Food Technologies* (Vol. 2). Bucharest, RO: ASAB Publishing House

Georgescu, G., & Banu, C. (2000). *Treated the production, processing and valorization of meat*. Bucharest, RO: Ceres Publishing House.

Ianiţchi, D., Nistor, L., Urdes, L., Vlad, I., Malos, G. I., & Nicolae, C. (2014). Influence of enzymatic treatment and mixing on hardness and cooking losses for pork muscle. *Scientific Papers. Series D. Animal Science*, 57, 241–244.

Ianiţchi, D., Nistor, L., Urdes, L., Vlad, I., Malos, G. I., & Nicolae, C. (2023). The effect of protein derivatives and starch addition on some quality characteristics of beef emulsions and gels. *Agriculture, 13*(4).

Malos, G., & Malos, G. I. (2020). Security of pork meat affected by African swine fever and its impact on the state budget and E.U. budget. *Scientific Papers-Series D. Animal Science, 63*(2), 320–324.

Malos, G., & Malos, I. G. (2016). Quality product – History or reality. *Scientific Papers. Series D. Animal Science*, 59, 299–301.

Malos, G., & Malos, I. G. (2022). Research on the safety and resilience of the meat and meat products sector in Romania. *Scientific Papers. Series D. Animal Science, 65*(1), 500–504.

Popa, G., & Stănescu, V. (1995). Sanitary and veterinary control of food. Bucharest, RO: Didactică și Pedagogică Publishing House.

Posan, P., Olteanu, L., Suler, A., Nistor, L., Hodosan, C., & Sovarel, E. (2022). Remarks on consumer awareness of food additives in children food products. *Scientific Papers. Series D. Animal Science, 65*(1), 548–553.

Suler, A., Bahaciu, G., Nistor, L., Posan, P., Tudorache, M., Diniță, G., & Nistor, L. (2019). Isolation and identification of some pathogenic strains from raw and processed meat samples. *Scientific Papers. Series D. Animal Science, 62*(1).

Suler, A., Tudorache, M., Bahaciu, G., Posan, P., Nistor, L., Custura, I., & Maftei, M. (2021). Study on some food product contamination rate with bacteria from *Listeria* genus. *Scientific Papers-Series D. Animal Science*, *64*(1), 494–498.