Research on the Physico-Chemical and Microbiological Quality of Traditional Pork Meat Products

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Abstract

Traditional pork meat products are considered healthy, with superior sensory and nutritional characteristics compared to those obtained through conventional methods, which is why they are highly appreciated by consumers.

Therefore, the physico-chemical and microbiological examination of pork products is used to assess the safety and hygiene of these products, employing principles and methods based on laboratory analyses.

This study presents the results of the physico-chemical and microbiological examination of five types of specialty pork products: smoked pork tenderloin, baked and smoked pork pastrami, smoked pork belly, smoked pork loin, and smoked and baked pork neck, within their shelf life. The products are made in small processing units, following authentic, traditional recipes.

It was found that the analyzed samples meet the microbiological standards and are safe for human consumption. The physico-chemical indicators comply with the current legal requirements, being noted for their low water content and higher protein levels. The quality of the raw materials is fundamental to a safe finished product.

Keywords: safety, traditional products, hygiene.

1. Introduction

A traditional meat product is understood as a product made from high-quality raw meat, whose chemical composition is reflected through a specific traditional technological process. Traditional recipes are distinguished by a unique blend of spices that define the flavor of the products, as well as by a specific preservation technique. Generally, traditional products have a lower salt content compared to those produced industrially and are notable for their valuable protein content due to the quality of the raw materials. Preservation technologies provide the products with outstanding sensory qualities, without requiring additional thermal processing, which makes them highly appreciated by consumers [1].

The physico-chemical quality of pork meat products obtained through traditional technologies is determined by a set of analyses, including water content, dry matter content, fats, proteins, and mineral substances.

The microbiological quality is evaluated based on the presence of microorganisms that can alter or spoil the product or make it unsafe [2].

Thus, the presence of bacteria such as *Salmonella spp.* and *Listeria monocytogenes* was analyzed, as they are significant pathogens associated with pork products, and their monitoring is essential to ensure food safety [3].

Thus, the presence of bacteria such as *Salmonella* and *Listeria monocytogenes* was analyzed. The aim of this study was to evaluate the physico-chemical and hygienic quality of pork products made from traditional recipes.

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2. Materials and methods

Five types of pork meat products were subjected to physico-chemical and microbiological analysis: pork tenderloin, pork pastrami, pork belly, pork loin, and pork neck, all obtained from traditional recipes by local producers.

For each type of pork product, three samples were analyzed, each determined in triplicate. The reduced number of samples was established considering the exploratory nature of the study, the specificity of traditional production, and the uniformity of the raw materials used. Since the products originate from small-scale processing units with standardized recipes and limited batches, this sample is considered representative of the typology of the analyzed products [4, 5]. The experimental design aimed to obtain a comparative overview between varieties and local producers, while ensuring data reproducibility by analyzing each sample in triplicate. This methodological approach is consistent with practices applied in descriptive studies on the quality of traditional products, allowing statistical interpretation of the results through mean values and standard deviations (SD).

The physicochemical determinations targeted the following parameters: salt, protein, fat, and moisture content, using classical laboratory methods validated by reference standards to ensure the accuracy and reproducibility of the results. The salt content (NaCl) was determined using the Mohr method, which consists of titrating the chlorides in the sample with a 0.1 N standard silver nitrate solution in the presence of potassium chromate as an indicator [6-8]. The results were expressed as percentages (%). The protein content was determined by the Kjeldahl method, which involves the acid digestion of the samples followed by distillation and titration, with the crude protein content calculated by multiplying the total nitrogen by the factor 6.25 [9-11]. The fat content was determined using the Soxhlet method, based on the extraction of lipid substances with petroleum ether, and the results were expressed as percentages (%).

The moisture content was determined using the gravimetric method, which consists of drying the samples at 105°C until a constant weight is reached, in accordance with ISO 1442:1997.

The microbiological analyses aimed to determine the presence of pathogenic microorganisms specific to meat products, namely *Salmonella spp.* and *Listeria monocytogenes*, in accordance with Regulation (EC) No. 2073/2005. Isolation was performed on selective media (XLD for *Salmonella*, ALOA for *Listeria*), followed by biochemical identification, and the results were expressed qualitatively (absent/present in 25 g). Samples were aseptically collected, transported at 4±1°C, and analyzed within a maximum of 24 hours. Statistical analysis was performed using Microsoft Excel, and the values were expressed as mean±standard deviation (SD), with significance set at $p<0.05$ [12]. The obtained data were subjected to a basic statistical analysis, calculating the arithmetic mean and standard deviation (SD) for each analyzed parameter. Differences between samples were considered significant at a probability level of $p<0.05$ [13, 14].

The microbiological analyses were based on the guidelines set out in Regulation 2073/2005.

3. Results and discussion

The determined values were expressed as mean ± standard deviation (SD), and the differences between samples were statistically evaluated and considered significant at $p < 0.05$.

The first type of pork product analyzed from a physico-chemical perspective was smoked pork tenderloin from three different local producers. The salt content ranged between 2.15% and 2.5%. Product 1 had a salt content of 2.5%, product 2 had 2.2%, and product 3 had 2.15% salt.

In terms of protein content, the range was between 18.5% and 22%, with product 3 being the highest in protein. The fat content ranged from 8.95% to 12.5%, with product 3 having the lowest fat content, while product 1 had the highest.

The water content in the pork meat products ranged from 65% to 66.9%. Figure 1 presents a graphical representation of the salt, protein, fat, and water content for smoked pork tenderloin.

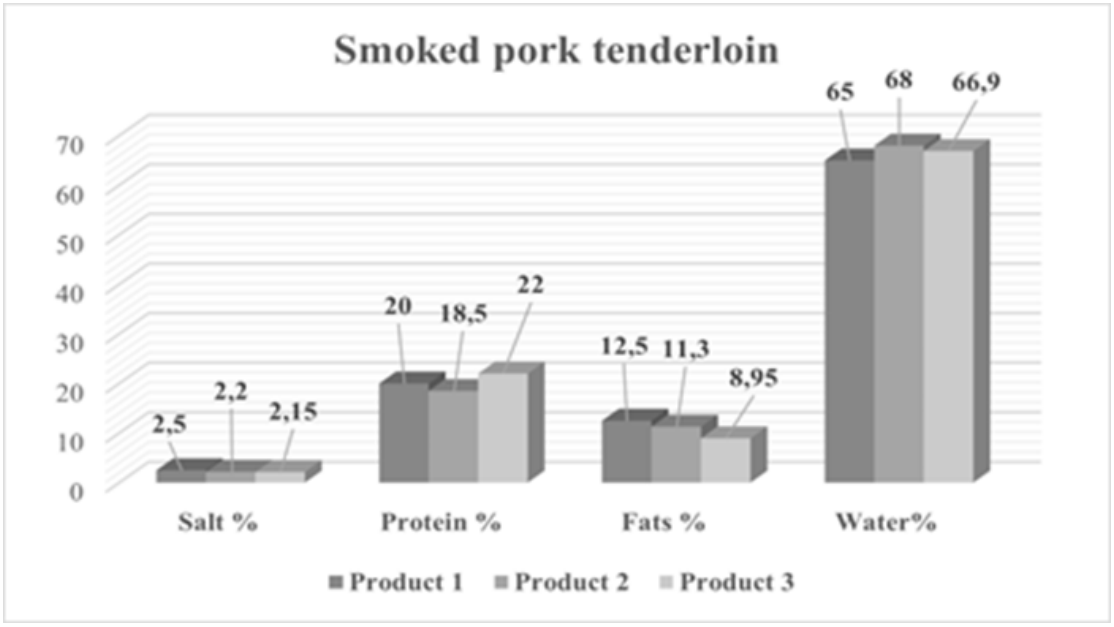

Figure 1. Physico-chemical analysis of the three smoked pork tenderloin products

The second product analyzed was baked pork pastrami. The analysis showed that the pork pastrami contains between 2.45% and 2.50% salt, 15% to 18.4% protein, 12.5% to 15.2% fat, and 64% to 70% water. Product 1 has the highest amount of salt and water. Product 3, on the other hand, ranks first in terms of protein and fat content. Graphically, the water, salt, fat, and protein content of the pork pastrami are expressed in percentages in Figure 2.

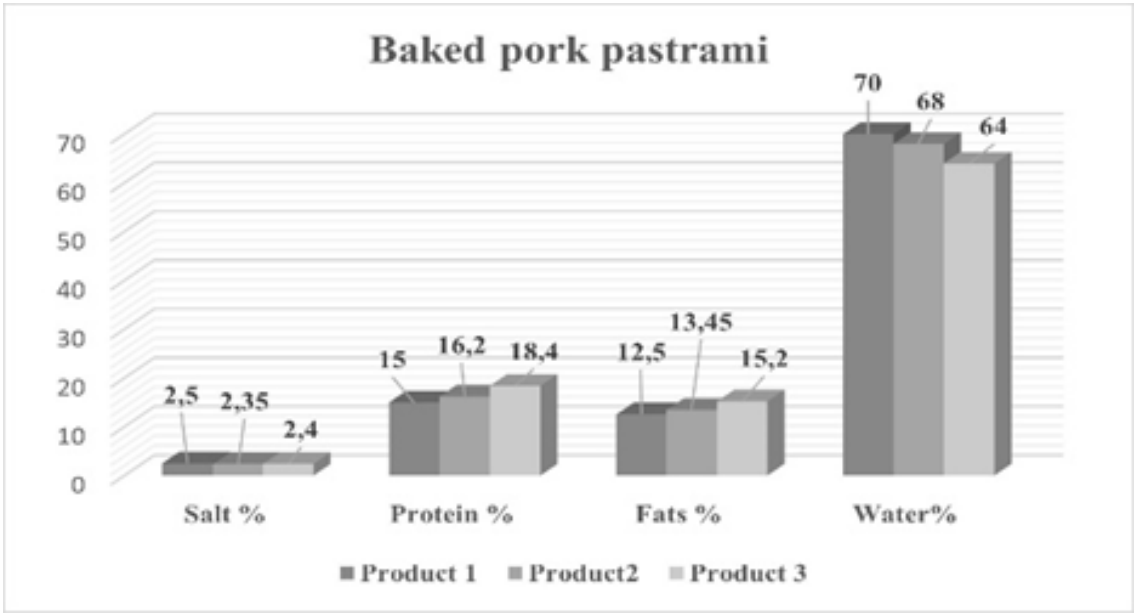

Figure 2. Physico-chemical analysis of the three types of baked and smoked pork pastrami

Smoked pork belly recorded a salt content ranging from 3.0% to 3.3%, protein content between 17.2% and 18.3%, fat content between 16.5% and 18.7%, and water content between 60.5% and 63%. Product 2 had the highest protein and fat content, while product 1 had the highest salt and water content. Figure 3 graphically presents the percentage of protein substances in smoked pork belly.

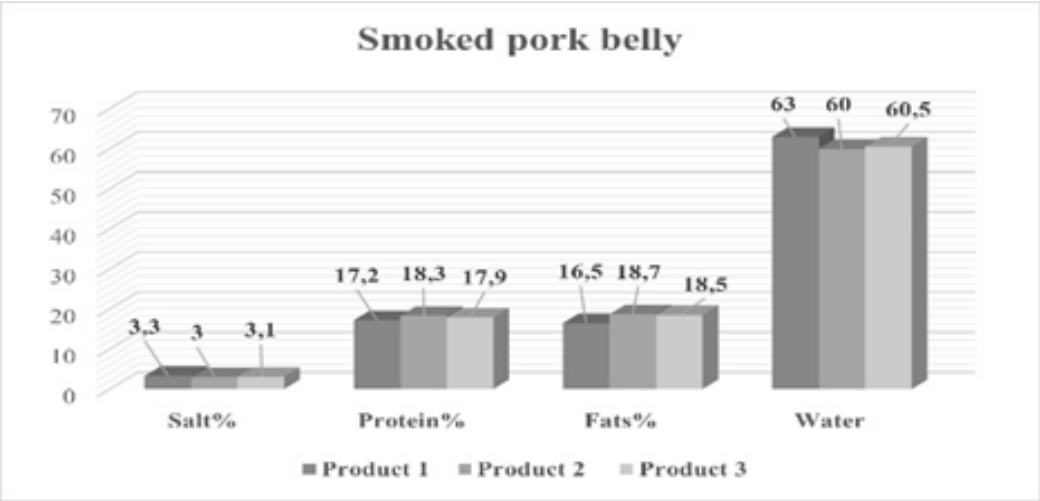

Figure 3. Physico-chemical analysis of the three types of smoked pork belly.

The physico-chemical analysis of smoked pork loin showed a salt content ranging from 2.3% to 2.7%, protein content between 16.8% and 18.3%, fat content from 12% to 17.6%, and water content between 63.0% and 68.2%. Product 3 contains the highest amount of water and the lowest content of fat and salt, while product 1 has the lowest water content and the highest amounts of salt and fat. Product 2 ranks first in terms of protein content.
Figure 4 shows the amounts of water, salt, fat, and protein in the three types of smoked pork loin.

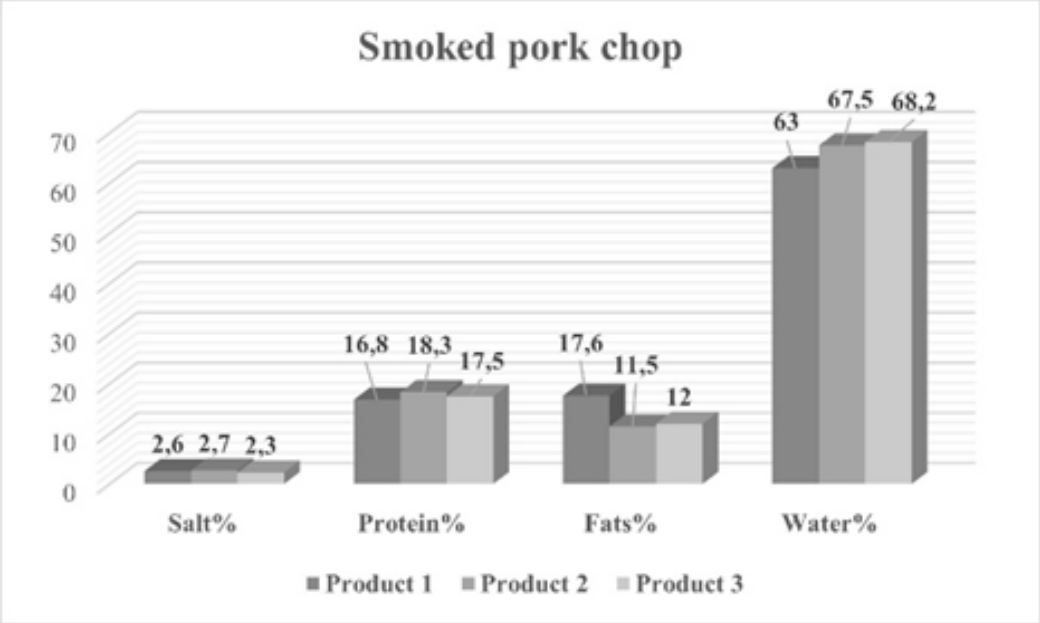

Figure 4. Physico-chemical analysis of the three types of smoked pork loin

The last type of product subjected to physico-chemical analysis was smoked and baked pork neck. Product 3 contains the highest amount of salt, followed by product 2. Product 1 has the highest content of protein and water, while product 3 has the lowest proportion of protein.
The fat content is higher in product 3 compared to product 2 and product 1. Figure 5 shows the data obtained from the physico-chemical analysis for smoked and baked pork neck.

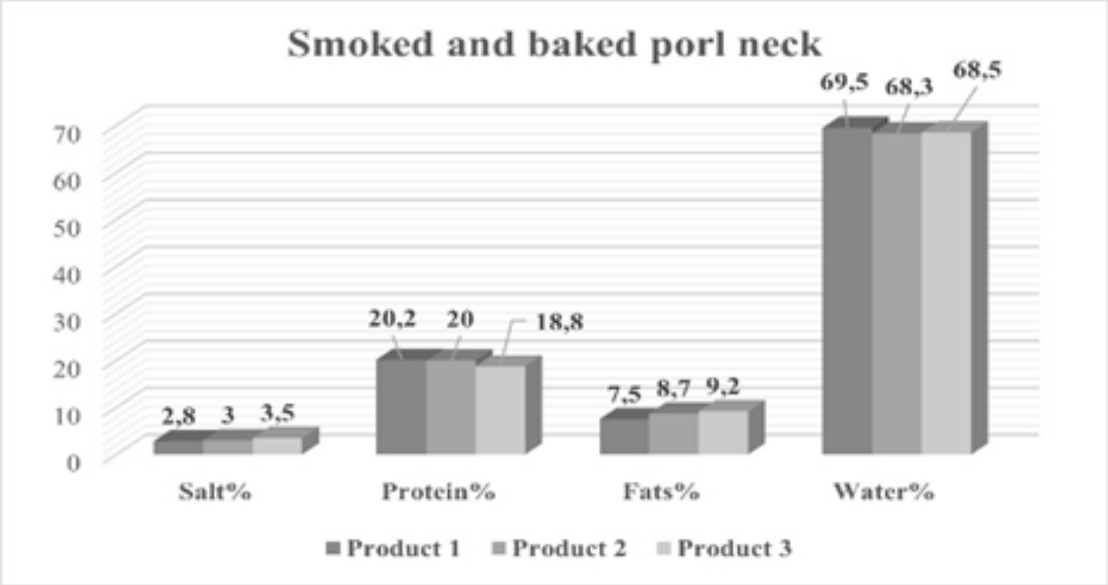

Figure 5. Physico-chemical analysis of the three types of smoked and baked pork neck

The five types of pork products analyzed meet the microbiological standards. They comply with the microbiological parameters imposed by the current legislation, namely, for *Salmonella* – absent/25g of product and *Listeria monocytogenes* – absent/25g of product.

The determined values were expressed as mean±standard deviation (SD), and the differences between samples were statistically evaluated, being considered significant at $p<0.05$. The obtained results are in accordance with data reported by other authors, who identified similar values for traditional pork products. This confirms the role of raw material quality and traditional technology in maintaining the safety parameters and nutritional quality of the finished products.

Microbiological analyses were performed to determine the presence of pathogenic microorganisms specific to meat products, namely *Salmonella spp.* and *Listeria monocytogenes*. The tests were carried out in accordance with EC Regulation No. 2073/2005 on microbiological criteria for foodstuffs, through isolation on selective media (XLD for *Salmonella* and ALOA for *Listeria*), followed by biochemical identification.

4. Conclusion

The obtained results highlighted that the analyzed traditional pork products have an appropriate physicochemical quality and are safe for human consumption. The samples fell within the limits stipulated by the current legislation, both in terms of composition and microbiological parameters, which reflects compliance with hygiene standards and traditional processing technologies.

The microbiological analyses confirmed the absence of pathogenic microorganisms (*Salmonella spp.* and *Listeria monocytogenes*) in all tested samples, demonstrating the products' conformity with the requirements of EC Regulation No. 2073/2005. From a physicochemical standpoint, the water, protein, fat, and salt content remained within optimal limits, which confirms the technological balance of the production process and the quality of the raw materials used.

The results are consistent with data reported in the specialized literature, emphasizing that traditional processing methods contribute to obtaining safe, stable products with high nutritional value. The statistical determinations (mean±SD) showed good uniformity among the product types, with the observed differences not being significant at $p<0.05$

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