Analysis of Quality of Turkey Pâté: Organoleptic, Physicochemical and Microbiological Evaluation

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Abstract
High-quality poultry meat products, characterized by freshness, flavor, and safety, are essential for consumer satisfaction and loyalty in the food industry. The consistent maintenance of quality standards in poultry meat products ensures not only consumer confidence but also contributes to their overall health and well-being. This paper aims to assess and verify the quality of turkey liver pate cans obtained within a poultry meat processing unit in the Moldova region, through organoleptic, physico-chemical, and microbiological analyses. The analysis of the chemical composition showed a content of 1.35% NaCl, protein content with an average value of 8.76%, and fat content with an average value of 24.6%. Also, microbiological analysis of the cans demonstrated the absence of pathogenic bacteria from the genera *Salmonella* and *Escherichia coli*. In conclusion, quality assurance of canned meat is achieved through the implementation of total supervision through the correct and impartial evaluation of all risk factors for the health of the final consumer. Hygiene must be ensured in all stages of production, starting from hygiene on the technological flow of canning, the hygiene of the storage space and the sale of preparations.

Keywords: food safety, meat quality analysis, poultry meat products, turkey pâté

1. Introduction

Turkey pâté stands as a delicacy revered for its rich flavor, texture, and culinary versatility. However, ensuring its quality demands a multidimensional evaluation encompassing organoleptic, physicochemical, and microbiological assessments. This comprehensive analysis serves as a crucial endeavor, offering insights into the intricate interplay of sensory attributes, chemical composition, and microbial presence within this esteemed gastronomic delight [1-3].

Within the realm of organoleptic evaluation, the sensory experience unfolds as a narrative of taste, aroma, texture, and visual appeal. Delving into these perceptual dimensions unveils the nuances that distinguish exceptional pâté from its counterparts. Furthermore, understanding the physico-chemical composition provides a scientific lens, examining parameters such as moisture content, pH levels, lipid oxidation, and protein denaturation. These metrics not only elucidate the product's stability and authenticity but also contribute to its nutritional profile and shelf-life estimation [1, 3-6].
Beyond sensory and chemical realms, the microbiological landscape of turkey pâté demands meticulous scrutiny. Microbial contaminants pose inherent risks to food safety and consumer health, necessitating vigilant monitoring and control measures. By scrutinizing microbial populations,

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including bacteria, yeasts, and molds, this analysis safeguards against potential hazards, ensuring compliance with stringent quality standards and regulatory requirements [7, 8].
In synthesizing these multifaceted evaluations, a comprehensive understanding of turkey pâté quality emerges. This knowledge not only empowers producers to refine their processes and formulations but also enables consumers to make informed choices, fostering trust and satisfaction in the gastronomic landscape. Thus, this analysis serves as a beacon, illuminating the path towards excellence in turkey pâté production and consumption, where quality reigns supreme [9-12].

2. Materials and methods

The study material for this research paper consists of turkey pâté obtained through the processing of turkey meat, raw material, in a processing unit located in the Moldova region. To assess the quality of the samples, a series of sensory, physico-chemical, and microbiological analyses were conducted.
The turkey liver pâté under analysis is commercialized packaged in metal cans, with a net weight of 120 grams.
During the sensory analysis to assess quality, aspects such as consistency, content, exterior and interior appearance of the container, color, smell, and taste of the analyzed product were monitored. Sensory analysis was performed using the scoring scale method. The determination of sodium chloride (NaCl) was conducted through the titrimetric method using silver nitrate ($AgNO_3$) as the principal reagent. The moisture content was determined through the oven-drying method, protein content was determined using the Kjeldahl method, and fat content was determined using the Soxhlet method. Microbiological analysis involved screening for *Salmonella* and *Escherichia coli (E. coli)*, isolating the relevant microorganisms, inoculating the samples on specific culture media, incubating them, and subsequently analyzing the results under a microscope.
For the analysed product, microbiological analyses were conducted to detect aerobic bacteria from the Enterobacteriaceae class, as well as Salmonella and Escherichia coli. Samples were collected and processed under sterile conditions, using specific media for the growth of aerobic microorganisms.
To detect the presence of Salmonella bacteria, five stages were followed, including four types of specific agglutinations with different sera (anti-Salmonella serum, type O; anti-Vi serum; type H serum; and type O group serum). Finally, control agglutination of the specific strain was performed in physiological serum, thus eliminating nonspecific agglutinations.
In the case of microbiological examination for the detection of Escherichia coli bacteria, for the isolation of microorganisms from the coliform class, inoculations were made on lactose gelatine with sodium deoxycholate, in Petri dishes, then incubated at a temperature of 37°C for 18-21 hours.
To identify the isolated strains, morphological and biochemical characteristics are utilized. However, to highlight strains that are declared to be pathogenic, agglutination reactions are performed on slides and in tubes using anti-Escherichia coli agglutinating serum.
The results obtained from the laboratory analyses were statistically interpreted using calculation parameters from the Microsoft Excel program (XLSTAT).

3. Results and discussion

The sensory analysis of the turkey liver pâté cans was conducted by a total of 12 individuals, and it is detailed in Table 1.
Each evaluator received an individual sensory analysis form for the product and was instructed to assign a score to each sensory parameter listed in the respective form. According to the working instructions, the maximum score that could be assigned to each parameter was four.
The determination environment for the observed sensory characteristics was the preservation laboratory, under optimal conditions.
From Table 1, it can be observed that the minimum score obtained for this product was 14 points, assigned by 2 out of the total 12 evaluators, while the maximum score given by 3 evaluators was 17 points, resulting in an average score of 15.66. By calculating and interpreting the data regarding the sensory analysis of the product, we have reached the final conclusion that, according to the specialized literature, it receives a rating of *"good"*.

Table 1. Evaluation by points of canned turkey Pâté

No. assessor	External appearance of the cans	Color	Taste	Consistency	Pack	Score
Assessor 1	3	3	3	3	4	16
Assessor 2	3	3	4	3	4	17
Assessor 3	2	3	3	3	4	15
Assessor 4	3	2	4	3	4	16
Assessor 5	3	2	3	3	4	15
Assessor 6	3	3	4	3	4	17
Assessor 7	3	3	4	3	4	17
Assessor 8	3	3	3	3	4	16
Assessor 9	2	3	3	3	4	15
Assessor 10	3	3	3	2	4	15
Assessor 11	2	2	3	3	4	14
Assessor 12	3	3	2	2	4	14
$(\overline{X} \pm s_{\overline{X}})^1$	2.75±0.47	2.75±0.41	3.16±0.55	3,00±0.55	4.00±0.28	-
C.V.% [2]	16.64	12.58	17.52	19.50	7.06	
Average score			**15.58**			

$(\overline{X} \pm s_{\overline{X}})^1$ = average ± standard deviation; [2]C.V.% = the coefficient of variation

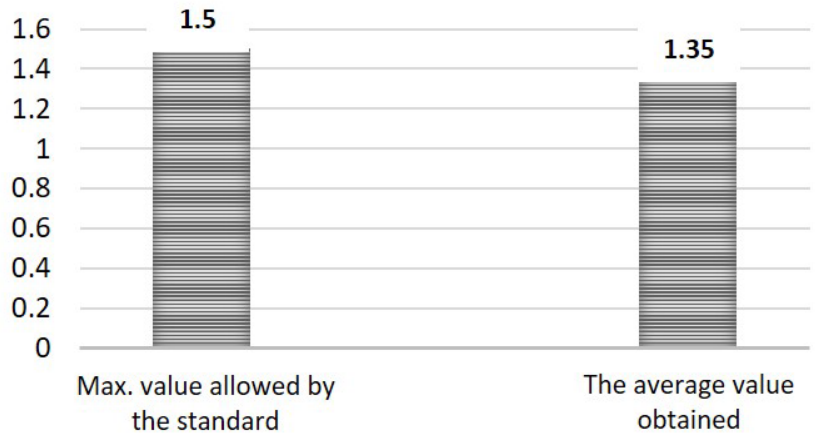

Figure 1. Comparison between the mean value and the standard value of the NaCl content

Thus, the homogeneity of the values and the very small variations in the NaCl content in the turkey liver pâté cans can be observed. The difference between the reference value, which is 1.5% NaCl, and the average value of 1.35% NaCl is only 0.15 percentage points [13]. A study on pork liver pâté found NaCl content around 1.4% when using curing salts, slightly higher than the results in this research but within a similar range. This study highlighted the role of NaCl in preserving the sensory and microbiological qualities of the pâté [14]. Another study found that different formulations of liver pâté, including those with reduced sodium content, maintained NaCl levels between 1.2% and 1.5%. The study emphasized that small reductions in NaCl can still ensure product stability and sensory acceptability [15]. Regarding the water content of the "Turkey Liver Pâté" product, the range of values falls within the interval of 63.82 to 70.04, with an average of 65.32. The standard deviation has a value of 1.82, while the standard error of the mean reaches a value of 0.58, with a coefficient of variation of 2.79. A study by Horiba (2023) reported water content in chicken liver pâté ranging from 64% to 70%, aligning closely with your turkey liver pâté values, suggesting similar processing and formulation standards across different types of liver pâté [16]. Figure 2 illustrates a comparison between the obtained average value and the value predicted by the standard [13].

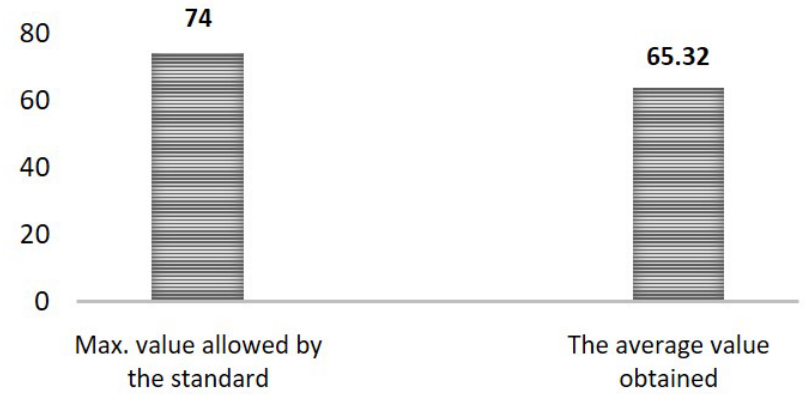

Figure 2. Comparison between the average value and the standard value of the water content

The graph above depicts a comparative analysis between the maximum standard allowed for moisture in turkey liver pâté cans and the respective average value obtained for the same analysed product. The difference between these two values is 8.68 percentage points. In Figure 3, the results obtained regarding the protein content of the "turkey liver pâté" product are presented.

The protein content for turkey liver pâté cans has an average value of 8.76%, a value close to the reference value of 9% [13]. The range of values ranges from a minimum value of 8.44 to a maximum value of 9.04%. Polášek et al., 2023, found that the protein content in turkey liver pâté was around 9%, aligning closely with our results [14].

Figure 3. Comparison between the average value and the standard value of the protein content

The graph above illustrates a comparison between the average value obtained for the protein content and the reference value, with a difference of 0.24. Thus, the average value (8.76) closely approximates the reference value (9.00) [13]. In Figure 4, the results obtained regarding the fat content of the "turkey liver pâté" product are presented.

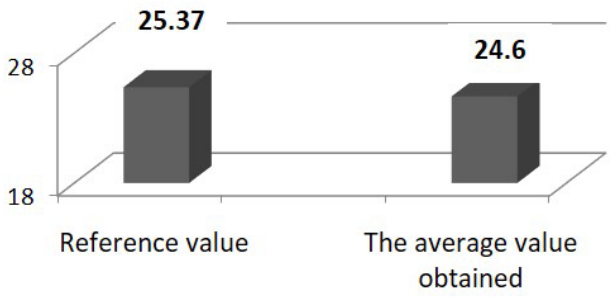

Figure 4. Comparison between the average value and the standard value of the fat content

For the fat content in the samples of turkey liver pâté, a range of values was obtained from 24.12 to 25.12%, with an average of 24.66%. The coefficient of variation has a value of 1.36. Generation and release of lipid-derived volatiles might be affected by fat content because increases from 20% to 26% of fat in pâtés caused higher amounts of volatiles to be detected. A higher increase (from 26% to 31%) resulted in a decrease of total volatiles detected [17]. From the graph, we observe that the obtained average value (24.66) closely approximates the value specified in the specialized standard (25.37), with a difference of only 0.71 [13].

Table 2 presents the results obtained from the microbiological analyses for the detection of Salmonella and Escherichia coli bacteria, according to the specific standard [18, 19].

Table 2. The results of the microbiological analysis for Salmonella and E. coli bacteria

Microbial agent	Leak	*Salmonella* / 25 g sample	*E.coli* / g sample
STAS Reference	-	SR EN ISO 6579-1:2017 SR EN ISO 16649-2:2001	
Sample no.			
1	Suitable	absent	absent
2	Suitable	absent	absent
3	Suitable	absent	absent
4	Suitable	absent	absent
5	Suitable	absent	absent

From the table above, we observe that the studied product is not contaminated with pathogenic bacteria, *Salmonella* and *E. coli*, as the results for each of the 5 determinations are negative. Therefore, the cans have been properly sterilized, stored, and delivered under safe conditions, making them safe for human consumption.

4. Conclusions

In conclusion, the turkey liver pâté cans exhibit a high amount of fat, thus providing a significantly higher energy content. Additionally, the protein content is relatively high, accompanied by a high digestibility coefficient.

From a microbiological standpoint, the product is free from pathogenic bacteria: Salmonella and E. coli.

In conclusion, ensuring the quality of canned meat products is achieved through the implementation of total surveillance, known as "from farm to table," by correctly and impartially assessing all risk factors for the health of the final consumer. Hygiene must be ensured at all stages of production, starting from hygiene in the technological flow of canned food manufacturing, to hygiene in storage and commercialization spaces for the products.

A recommendation for this unit is to use different types of packaging for products, aiming to attract consumers' attention, especially considering that packaging plays a decisive role in the acceptance or rejection of the product. An example in this regard is the creation of new packaging that arouses the interest of children.

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