

Comparative studies on quality indicators of some types of sausages

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Abstract

Sausages are currently the most popular products both nationally and worldwide. In the case of the Romanian people, the manufacture of sausages is one of the methods of storing meat products. We find sausages in a wide variety, under different tastes and flavors, depending on the region or country. This paper addresses comparative and statistical analyzes in terms of the quality indicators studied (water, fat, protein, ash and sodium chloride) for nine samples of sausages of different types. Following the Principal Component Analysis (PCA), the samples were grouped according to the class they belong to. The first group includes the sausage samples 1, 2, and 3, the second group includes the pork sausage samples 1, 2, and 3, and the third group includes the Frankfurt sausage samples 1, 2, and 3. The formation of these groups is due to the independent variables given by the value of the indicators of quality, fat, water and even sodium chloride in the case of the PC₂ component, followed by protein and ash in the case of the PC₁ component.

Keywords: sausages, quality indicators, Principal Component Analysis (PCA)

1. Introduction

Nutrition is most important environmental factor that influences the body (Pavlov) [1]. It is said that "you do not live on what you eat, but on what you digest." Sausages are considered to be one of the oldest forms of meat processing.

Although it is not known exactly when the first sausage was made, the evidence shows that it existed for at least several thousand years. The process of making sausages probably started when people found out that salt is a very good preservative [2].

Anthropologists estimate that three millennia ago, processing and production of minced meat sausages was a custom specific to the Mediterranean region. Over time, it has spread everywhere. From the point of view of specialists, salami is similar to sausages as a hot dog.

So did his relative, the modest hot dog. Of course, the "national" food, the mititei also falling into the category of sausages [3]. Terms „sausages” refers to preparations that use fluffy meat and membranes or refer to a simple mixture. Shape is usually cylindrical and the mixture is drawn into a membrane [4].

Sausages, according to the established model, use natural membranes (matte) and rarely synthetic materials. They are thermally processed in several ways (pan, grill, scalded, etc.). It is possible that after the heat treatment, the membrane will be removed [4]. In recent years, the production of healthier meat products is one of the most important goals of processors. It is important to find techniques to improve quality of these products [5]. Consumer demand for healthier meat and meat products, fierce competition in food industry are most important drivers of research topics. However, fat is an important source of energy, essential fatty acids and fat-soluble vitamins that are present in meat products. In addition, fat plays an important role in stabilizing meat emulsions, reducing cooking losses, improving texture, sensitivity and juiciness. However, the success of any food product depends on its organoleptic, textural and nutritional qualities. Stability in storage, cooking efficiency and production cost are also important in this regard. The association of fat with a variety of pathologies has led the food industry to invest in research into new products [6].

2. Material and Methods

In order to make comparisons in terms of quality indicators (water, fat, protein, ash and sodium chloride), the results obtained for 3 types of sausages and 3 samples for each assortment were studied.

The samples discussed were the following: Frankfurt sausages - sample 1; Frankfurt sausages - sample 2; Frankfurt sausages - sample 3; sausages - sample 1; sausages - sample 2; sausages - sample 3;

Pork sausages - sample 1, Pork sausages - sample 2 and Pork sausages - sample 3.

The values obtained for the 9 sausage samples were compared with the values prescribed in product standards. The same values of the quality indicators were used as input data for analysis (PCA - *Principal Component Analysis*).

3. Results and discussions

Table 1 shows the results obtained from the study performed for the [7] sausage samples

Table 1. Results of the study on the quality indicators for the 9 sausage samples [8-10]

Analyzed samples	Caracteristici fizico – chimice probe de cârnați				
	Water (%)	Fats (%)	Protein (%)	Ash (%)	NaCl (%)
Frankfurt sausages – sample 1	57,22	22,25	10,49	0,22	2,87
Frankfurt sausages – sample 2	56,86	23,62	10,71	0,44	2,51
Frankfurt sausages – sample 3	58,69	21,06	10,50	0,79	1,69
Sausages - sample 1	55,84	27,01	12,05	2,94	2,36
Sausages - sample 2	55,44	27,44	11,81	2,86	1,94
Sausages - sample 3	53,69	28,63	12,35	2,99	2,75
Pork sausages - sample 1	62,34	22,81	13,51	3,06	3,38
Pork sausages - sample 2	62,01	21,63	13,92	3,17	2,51
Pork sausages - sample 3	58	25,1	13,02	3,21	2,1
STANDARD [11-15]	max. 67	max. 30	min. 10	max. 3	max. 3

3.1. Water evaluation from sausage samples

Water evaluation from sausage samples led to following results: Pork sausages – sample 1 and Pork sausages - sample 2 are registered highest water content with values of 62.34% and 62.01% respectively. Approximate values were recorded in case Frankfurt sausages – sample 3 - 58,69% and Pork sausages – sample 3 - 58%. Frankfurt sausages – sample 1, Frankfurt sausages – sample 2, Sausages – sample 1 and Sausages – sample 2 were recorded values for this analysis in range 57,22% - 55,44%. Lowest water content was determined in case Sausages – sample 1 – 53,69%.

3.2. Fat evaluation in sausage samples

Fat evaluation in sausage samples led to following results: Pork sausages - sample 1 recorded the highest fat content - 28.63%. Sausages - sample 1 and sample 2 showed a fat content with very close values, 27.01% and 27.44%. Frankfurt sausages - samples 1 and 2, Pork sausages - samples 1 and 3 showed a fat content with values in range 22.81% - 25.1%. Lowest fat content was recorded for Frankfurt sausages - sample 3 - 21.06% and Pork sausages - sample 2 - 21.63%.

3.3. Protein evaluation in sausage samples

Protein evaluation in sausage samples led to the following results: Pork sausages - sample 1, 2 and 3 recorded the highest values in range 13.02% - 13.92%. Sausages - samples 1 and 3 recorded a protein content with values very close to 12.05% and 12.35%. Lowest protein content was determined in samples 1, 2 and 3 - Frankfurt sausages with values in range 10.49% - 10.71%.

3.4. Ash content evaluation (total mineral content) in sausage samples

Ash content evaluation in sausage samples led to the following results: Pork sausages - samples 1, 2 and 3 recorded the highest values in range 3.06% - 3.21%. Pork sausages - samples 1, 2 and 3 recorded highest values, located in range 3.06% - 3.21%. Sausages - samples 1, 2 and 3 recorded a protein content with values in range 2.86% - 2.99%. Lowest amount of ash was recorded in samples 1, 2 and 3 Frankfurt sausages with values in range 0.22% - 0.79%.

3.5. NaCl evaluation in sausage samples

NaCl evaluation in sausage samples led to the following results: Pork sausages - sample 1, recorded highest value, in case of this analysis -

3.38%. Frankfurdt sausages - samples 1 and 2, Sausages - samples 1 and 3, Pork sausages - samples 2 and 3 recorded salt content with values in range 2.1% - 2.87%. Lowest salt content was recorded for Frankfurdt sausages - sample 3 - 1.69% and Sausages - sample 2 - 1.94%.

3.6. Statistical results obtained after Principal Component Analysis (PCA) for nine sausage samples

Input data for PCA analysis were represented by the values obtained from the study performed on the quality indicators of the nine sausage samples. Following PCA analysis, samples were grouped according to the class they belong to. First group includes sausages samples of 1, 2, and 3, second group, Pork sausages samples 1, 2, and 3, and group three includes Frankfurdt sausages samples of 1, 2, and 3, (Figure 1).

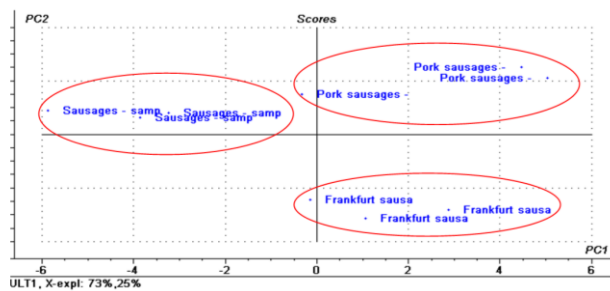


Figure 1. Scores graph of PC₂ versus PC₁ for PCA analysis using all data from study on the value of quality indicators (water, fat, protein, ash and NaCl) for nine sausage samples

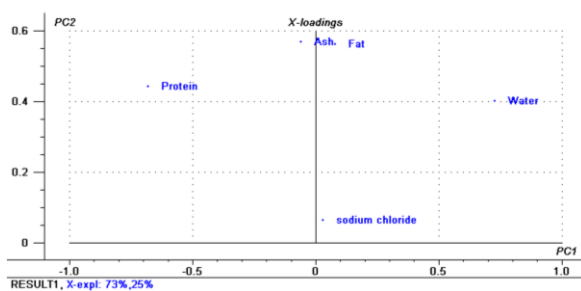


Figure 2. Records graph of PC₂ versus PC₁ for PCA analysis using all data from study on value of quality indicators (water, fat, protein, ash and NaCl) for nine sausage samples

Responsible for these groups are independent variables given by value of indicators of quality, fat, water even NaCl in case of PC₂ component, protein and ash in case of PC₁ component, (Figure 2). Variance of data being explained in proportion of 98% by first two principal components (25% PC₁ and 73% PC₂).

Figure 3 shows residual variance of data for PCA analysis of data obtained from study performed in terms of value of quality indicators (water, fat, protein, ash and NaCl) of nine samples of sausages.

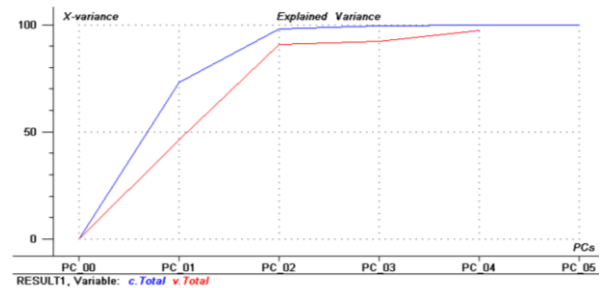


Figure 3. Residual variance for PCA analysis using all data from study on value of quality indicators (water, fat, protein, ash and NaCl) for nine sausage samples

4. Conclusion

Following the study realized, comparisons and statistical analysis of PCA performed, in terms of quality indicators (water, fat, protein and ash) of nine samples meat products (fresh), following conclusions were drawn:

- Values obtained in terms of water content were located in range 53.69% - 62.01% below limit provided by product STANDARD - max. 67%;
- Values obtained in terms of fat content were in range 21.06% - 28.63% below limit provided by product STANDARD - max. 30%;
- Values obtained in terms of protein content were in range 10.49% - 13.02% above the limit provided by product STANDARD - min. 10%;
- Evaluations performed to determine amount of ash in case of Frankfurdt sausages samples 1, 2 and 3 and Sausages 1, 2 and 3 recorded values in range 0.22% - 2.99% below the limit provided by product STANDARD - max. 3%. Pork sausage samples 1, 2 and 3 recorded values in range 3.06% - 3.21% exceeding limit provided by product STANDARD - max. 3%;
- In case of NaCl, eight samples showed values in range (1.69% - 2.87%), below the limit provided by the product STANDARD - max 3%. Pork sausages sample 1 showed a NaCl content of 3.38% exceeding limit provided by product STANDARD - max 3%.

Following PCA analysis, samples were grouped according to class they belong to. First group includes sausage samples 1, 2, and 3, the second group includes pork sausage samples 1, 2, and 3, and group three includes Frankfurdt sausage samples

1, 2, and 3. Responsible for these groups are independent variables given by value of indicators quality, fat, water and even NaCl in case of PC₂ component, protein and ash in case of PC₁ component.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

Acknowledgements: This work was supported by proving the equipment's of the Faculty of Food Engineering Timișoara – “Food Science”- Research Center.

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