

Sensory analysis of innovative meat products: “*Snail hamburger*” in artisanal buns with fruit and vegetable juice and flavored butter cream - indicator for quality control

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Abstract

In the present study, a sensory analysis of an innovative product type "*Snail hamburger*" was performed and the results were processed by multivariate statistical analysis PCA (principal component analysis), in order to identify similarities and acceptability of products by consumers. The sensory analysis was performed with the help of a panel consisting of 10 subjects aged 20-24 years (female / male ratio of 6/9) in a space corresponding to such an analysis (in terms of temperature, light, humidity, etc.). According to PCA analysis, the most important characteristics for the acceptability of the "*Snail hamburger*" type product were in particular the appearance and taste.

Keywords: Snail hamburger, sensory analysis, multivariate statistical analysis, PCA

1. Introduction

People in ancient times used various components for their diet, including water or land mollusks. Archaeological excavations and the discovery of mountains of snail shells in caves show that from prehistoric time snail meat was used in food [1-12].

Snails have adapted to those environmental conditions that have helped them reproduce in order to perpetuate their species, grow and have enough food. In Romania, due to the temperate-continental climate, the edible species *Helix pomatia* has developed and adapted. This leading to a seasonal life in which both the active and the sleep period (passive) alternate [3-5,13,14].

Sensory evaluation can directly or indirectly contribute to the company's profit, providing important information with minimal cost of time and money.

The ability to perform a test in one or two hours and the direct approval of the product manager to modify a specific ingredient can significantly improve, without any risk or with minimal risk, the market value. But such an answer cannot occur by

chance; it often comes from organized effort, a company's credibility and responsibility. The ability to anticipate requirements, to discover the right resources, to make new innovations, to be responsible and especially to move from a passive role to an active role in the process of developing a product can only appear if companies pursue these objectives. Some companies and even some professionals appreciate the importance of having a clearly defined organizational structure, with goals and objectives set in the long and short term and with an operational strategy that is consistent with the company's business plans [15,16].

Snail meat, similar to fish meat, is very low in fat (0.5–1.5%) and relatively low in calories (60-80 kcal / 100 g.), Instead it is rich in proteins with high biological value (12-17%), in mineral substances (1.5%) and in nitrogen (2.5%) [1-9].

Fresh or frozen, in the form of semi-prepared or canned food, today no one can dispute the particularly refined and fine taste of snails, a gastronomic product not absent from Western European restaurants, but especially French, Italian, Asian or American [1-9].

2. Materials and Method

2.1. Materials

Snail meat (Orăștie, Romania) containing water, protein, lipids, and carbohydrates (see below), have been used to obtain hamburger products by a classical recipe. The snail meat had the following characteristics (for 100 g):

- 79.2% water
- 16.1% protein
- 1.4% lipids
- 1.3% ash
- 2% carbohydrates

2.2. Sensory analysis for the innovative product "Snail hamburger"

There are several points of view on what sensory assessment is and who it is for. Each of these points may require different aspects (organizational or operational) in terms of testing, reporting, etc. Sensory evaluation serves several groups in a company and interacts and dialogues with each group depending on the issue, how to use the information and what kind of sensory evaluations will participate in the planning process and in the use of results [15,16].

The results of sensory evaluation are of no significance if they are not also analyzed from a statistical point of view.

In addition to the tests, the classic statistical methods (t and F tests, regression analysis, ANOVA - analysis of variance) of real use are the Principal Component Analysis (PCA) and the Design in Latent Structures (PLS - Partial Least Squares). They are also used in the analysis of the results obtained in the sensory analysis of a new assortment of snail meat: "Snail hamburger" - innovative product for the Romanian market [15-17].

2.3. PCA analysis of the "Snail hamburger" product

The sensory analysis was performed for the "Snail hamburger" products obtained with Romanian snail meat. The sample was analyzed by a group of 9 subjects (women and men) indicated by F - women and B - men. The 1-10 scale have been used.

This statistical analysis aimed to establish the importance of the parameters (characteristics) considered in the sensory evaluation of the product, as well as the classification according to these characteristics.

Table 1 gives the results of the sensory analysis for "Snail hamburger" used in the PCA analysis.

Table 1. Sensory analysis results for "Snail hamburger".

Code	Appearance	Flavor	Taste	Consistency	Succulence
"B"	8	7	7	6	8
"B"	8	8	7	7	8
"B"	7	7	8	8	9
"F"	9	8	9	8	9
"F"	9	9	9	8	9
"F"	9	9	9	8	9
"F"	9	9	9	8	9
"F"	9	8	9	8	9
"B"	7	7	8	7	8
"F"	9	9	9	9	9

3. Results and Discussion

Figures 1 and 2 show the loadings for “*Snail hamburger*”, and Figures 3 and 4 show the score graphs for the first three main components PC1, PC2 and PC3.

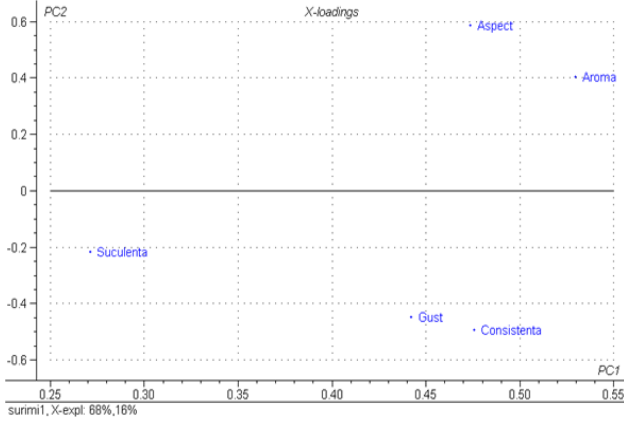


Figure 1. Loading plot for “*Snail hamburger*” for the first two principal components

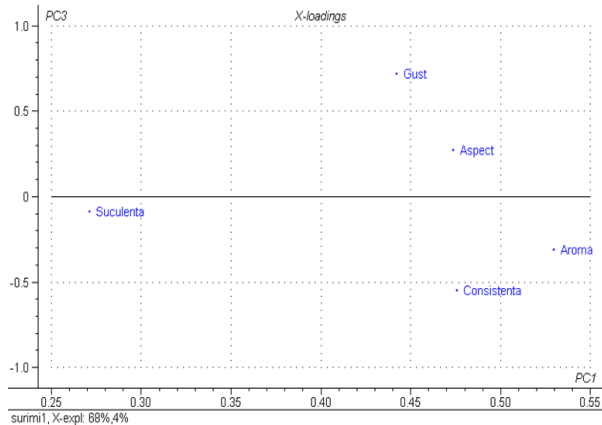


Figure 2. Loading plot for “*Snail hamburger*” for principal components PC1 and PC3

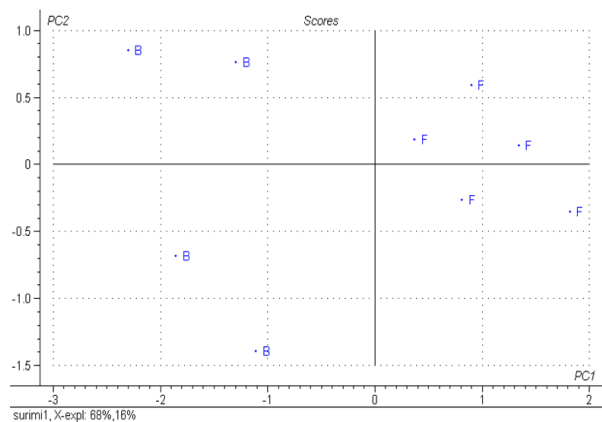


Figure 3. Scores plot for “*Snail hamburger*” for the first two principal components

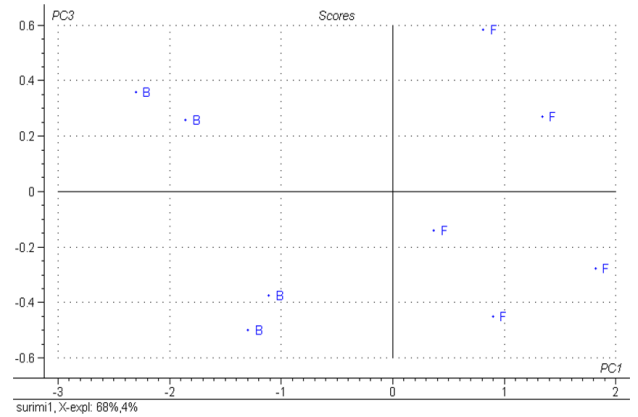


Figure 4. Scores plot for “*Snail hamburger*” for principal components PC1 and PC3

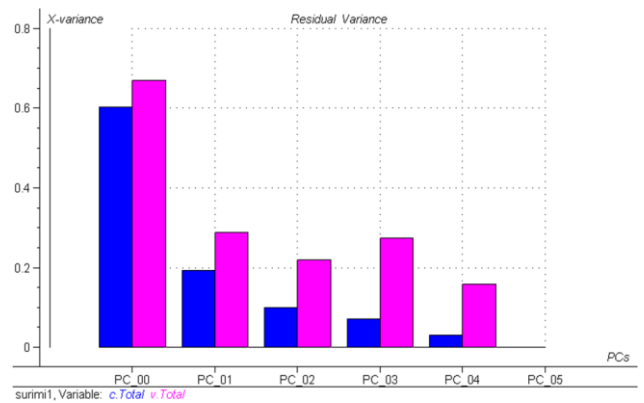


Figure 5. Graph of the residual variance according to the number of the principal components

Figure 5 shows the graph of the residual variance, X, depending on the number of main components, which results in the optimal number of these components, $A = 2$, which are relevant for the variance of the sensory analysis data obtained for “*Snail hamburger*”. Following this analysis, it was found that the first three principal components the explained variance was 84% (68% PC1 and 16% PC2).

From the loading plots it can be seen that the appearance, aroma, taste and consistency of the product “*Snail hamburger*” best explains the variance of the data especially for the first principal component (PC1); on the other hand, succulence has almost no relevance to the variance of the data. From the scores plots it can be seen that the two groups of subjects are separately classified following the multivariate statistical analysis of sensory analysis data.

Figure 6 shows the “leverage” values for this type of analysis. It can be observed that the most

important principal components for explaining the data variance are the first 2-3, in the blue range of the graph.

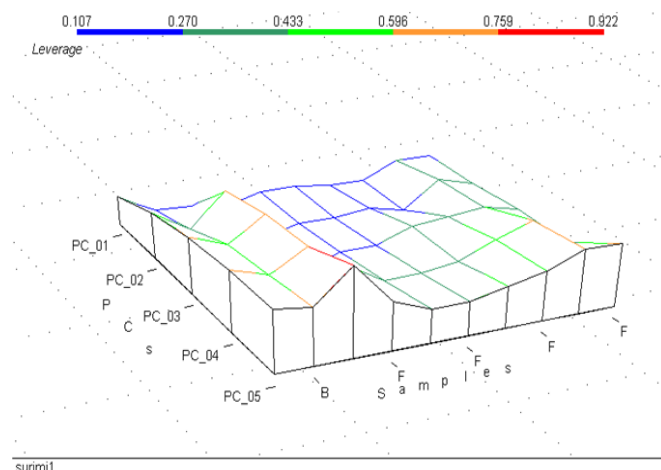


Figure 6. The “leverage” values for the multivariate analysis for the “Snail hamburger” product

4. Conclusion

This statistical analysis aimed to establish the importance of the parameters (characteristics) considered in the sensory evaluation of the product “Snail hamburger”, as well as the classification according to these characteristics.

From the loading and scores plots it is observed that:

- the appearance, aroma, taste and consistency of the product “Snail hamburger” best explain the variance of the data especially for the first principal component (PC1);
- on the other hand, the succulence has almost no relevance for the variance of the data;
- from the loading plots it can be clearly seen that the two groups of subjects are separately classified following the multivariate analysis of the sensory analysis data;
- a very good grouping, with a medium acceptability, was obtained from the subjects coded with “F-women”;
- the most important characteristics for the acceptability of the “Snail hamburger” type product were in particular the appearance and taste;

- PCA analysis is a powerful and useful statistical technique for assessing the acceptability of new products on the market such as “Snail hamburger”.

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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