

## USE OF SENSORY ANALYSIS IN ASSESSING THE QUALITY OF BAKERY PRODUCTS

Liviu MARCUTA, Agatha POPESCU, Letitia PURDOIU, Serban PURDOIU,  
Marilena STOIAN, Alina MARCUTA

University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Mobile:+40723 2923 41, Emails: liviumarcuta@yahoo.com, agatha\_popescu@yahoo.com, purdoius@yahoo.com, letitiapurdoiu@yahoo.com, stoian.maria@managusamv.ro, alinamarcuta@yahoo.com

**Corresponding author:** alinamarcuta@yahoo.com

### Abstract

*The food industry today faces many challenges as a result of changes in legislation in this area, due to the use of distribution chains that are increasingly complex or the emergence of no ice ingredients tend to replace traditional products. The success of a food company depends on its ability to provide its customers with safe, quality products that meet their expectations, but also respecting specific legislation. In addition to their role in human nutrition due to their nutritional value and the need to cover energy needs, food must also contribute to ensuring psychosensory satisfaction as a result of consumption, in close connection with the structure of the product, its chemical composition and its properties. The way in which the food products satisfy from the sensory point of view the exigencies of the consumers, represents an important condition in the realization of some salable products and therefore, the producers in the food industry must pay due attention to these aspects. This can be achieved through sensory analysis which is also a component of the concept of quality, being a method of examining food using the basic senses: sight, hearing, taste, smell and touch. Through this paper we aimed to analyze consumers' perception of the quality of bakery products using subjective methods, ie assessment methods for consumers and not specialists, namely: the hedonic test and the Likert scale, which were applied to a semi-trained panel of 45 tasters, represented by the students of the Faculty of Management and Rural Development. Based on the study, conclusions were formulated regarding the way in which consumers appreciated the quality of bakery products, resulting in the fact that they orient their purchase of bakery products according to taste and appearance.*

**Key words:** sensory analysis, quality, consumer, bread, bakery products

### INTRODUCTION

Because at one point information on the microbiological and physico-chemical aspects of food could no longer be sufficient in making decisions about their production and marketing, new solutions were sought to help improve these issues. And because the production of new products starts from the study of consumer preferences, we came to study the perception they have about the products they consume, this is done through sensory analysis [6]. Given the fact that the organoleptic properties of food products are for the buyer the most important criterion taken into account in assessing quality, even if they have a fairly high degree of subjectivity, the launch of new products is based on information provided by sensory analysis,

which can "characterize and estimate the magnitude of changes in a product due to the addition of certain ingredients, the interactions of several ingredients and their ratios, as well as different technological approaches" [3]. Also, sensory analysis is used in monitoring the life of products and in off-flavor detection, finding that its use can detect those changes that underlie the shelf life of products [7]. By using sensory analysis, it is possible to achieve an easy, fast and cheap control of both the quality of raw materials and products sold [1].

A Puratos survey called Taste Tomorrow and which collects the answers of over 17,000 respondents from 40 countries, highlights the fact that unlike 2015, when the most important aspect taken into account in

assessing product quality was freshness, at the level of the year 2019 the taste was the most important aspect that consumers follow when choosing pastries, bakery and chocolate [11]. In terms of bread, taste ranks 2nd in the ranking after freshness, but before the price. Texture also occupies an important place in consumer choices [11].

"Sensory value is expressed by attributive quality characteristics that in some situations cannot be determined by objective means. That is why it appeals to the consumer's perception which, although it has a high degree of subjectivity, allows us to determine the sensory profile" as affirmed [9].

Bread is one of the main products in Romanian food, the market of bakery products in Romania being a conventional market. Bread consumption has decreased in the last ten years from 9.2 kg / month to 8 kg/month in 2018. At the level of 2019, the consumption was 95 kg/capita/year, compared to the European average which was 60 kg/capita/year. The quantity consumed is decreasing compared to previous years (96.5 kg/capita/year in 2018 and 98.4 kg/capita/year in 2017) [8], finding at the same time an increase in consumer preferences towards healthier bread assortments, ie assortments containing different cereal seeds, bread made from wholemeal flour assortments or artisanal bread assortments.

The Packaged Food in Romania report published in 2016 by Euromonitor shows that in 2015 the bakery products market had a volume of 1,775,700 tons, estimating a decrease of 4% for 2020, ie 1,698,550 tons [4].

The way in which the consumption of bread in Romania has decreased in the last 8 years is presented in Fig. 1.

Eurostat data show that Romania has the lowest price of bread in the EU, followed by Bulgaria and Poland. In Romania, the price of bread in 2019 was 47% lower than the average calculated in the EU, while Denmark had a price of bread of 151% compared to the same average.

Along with Romania are Bulgaria with a 31% lower price and Poland with a 30% lower

bread price, and along with Denmark are Austria with a bread price of 133% compared to the European average and Luxembourg with 125% [5].

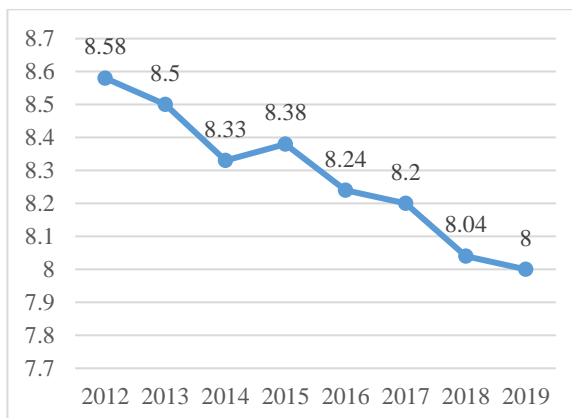


Fig. 1. The situation of bread consumption in Romania kg/capita

Source: Own calculation.

## MATERIALS AND METHODS

The case study involved performing the sensory analysis of 4 varieties of bread. The panel consisted of semi-trained tasters represented by students of the Faculty of Management and Rural Development, participants in the practical work carried out in the discipline Sensory analysis of food products and familiar with the identification of sensory attributes.

The preparation for tasting involved cutting the bread into slices of equal thickness which were then transferred to plates whose color is white. The samples were numbered, each taster having to appreciate: the general appearance, the smell, the taste, the texture and the general acceptability.

During the tasting, all conditions regarding temperature (23°), humidity (47%) were observed, the test environment was noiseless, the color of the walls was neutral (white), the lighting was natural, there was no communication between evaluators and no disruptors. The tasting was done in groups of 10-12 tasters, between the hours of 10-11; 11-12 and 14-15.

The appreciation of the products was done using the Likert scale, the hedonic test and the rank ordering method, due to the fact that these were the methods applied by the

students in the appreciation of the bakery products.

The Likert scale is a method used in the analysis of the questions asked in the survey of respondents in marketing studies, questions that refer to the characteristics of the analyzed product in order to measure consumer satisfaction. The advantage of the method is that it can measure the degree of difference, but it cannot measure the specific difference between the sizes.

Thus, each feature of the product is assessed based on a set of questions with favorable or unfavorable answers, generally having 5 values (but 7 or 9 values can be used). Each characteristic is calculated a score, and finally the overall score is established.

The scores assigned to the scale levels are between 2 and - 2, and the calculation of the score assigned to each characteristic is determined based on the following formula:

$$\text{Score}_{\text{characteristic}} = (\text{No. of attribute opinions 1} \times (+2) + \text{No. of opinions attribute 2} \times (+1) + \text{No. of attribute opinions 3} \times 0 + \text{No. of attribute opinions 4} \times (-1) + \text{No. of attribute opinions 5} \times (-2)) / \text{No. respondents}$$

To determine the overall score, the formula is used:

$$\text{Overall score} = \text{Score}_{\text{characteristic}} / \text{no. characteristics.}$$

The hedonic test aims to assess the taste qualities of food products by giving grades between 1-9 to each sample.

The objective of the method is to follow the degree to which a product is rated positively or negatively by tasters, by completing an evaluation form in which preferences are classified as follows: extremely unpleasant, completely unpleasant, semi-pleasant, slightly unpleasant, indifferent, poorly liked, pleasant, very pleasant, extremely pleasant.

Of the 9 levels, the first four (1-4) reflect the positive sensations, and the last four (6-9) reflect negative feelings.

Based on the answers, a "I don't like" percentage is calculated, and the results, through the correspondence made, are analyzed and interpreted statistically.

The overall score is determined as follows:

$$\text{Global score} = (N \times 9 + N \times 8 + N \times 7 + N \times 6 + N \times 5 + N \times 4 + N \times 4 + N \times 3 + N \times 2 + N \times 1) / \text{ND},$$

where:

N - the number of tasters with the same appreciation

ND - total number of tasters

The method of ordering the ranks is used in assessing the complex characteristics of a product. Respondents are asked to make a hierarchy of products analyzed in relation to the criteria that were evaluated [12]. This results in a number of ranks equal to the number of products under analysis, ranks to which values are attached. The weighting factors used were 1 for appearance, 0.5 for color, 0.75 for consistency and 2 for taste. To determine the overall score, the arithmetic mean of the scores calculated for each of the analyzed products is calculated [2].

## RESULTS AND DISCUSSIONS

To establish consumers' perception of the quality of bakery products, the study involved analyzing four varieties of bread: white bread, graham bread, multigrain bread and rye bread. The data published in 2019 show that white bread is at the top of consumption, representing 78% of bread consumed in urban areas and 77% of bread consumed in rural areas, being appreciated by traditional consumers. Graham bread is consumed daily by 14% of urban consumers and 7% of rural consumers. Multi-grain bread is consumed daily by 5% of urban consumers and rarely by 57% of them, while 24% of rural residents consume multi-grain bread. Rye bread is consumed daily by 4% of urban consumers and 2% of rural consumers, while 61% of urban consumers rarely consume this category of bread, compared to 26% of rural consumers [Rompan] [10].

The characteristics pursued in assessing the quality of the bread were: appearance, smell and taste. The Likert scale used in assessing quality had 5 levels of agreement or disagreement, namely: total disagreement, disagreement, indifference, agreement and total agreement.

Characteristics of the first bread assortment, toast bread, were analyzed based on the opinions centralized in Table 1.

Table 1. Distribution of subjects' appreciation for white bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	14	19	7	5	0
Appearance	14	20	4	7	0
Taste	12	17	7	7	2

Source: Own calculation.

The data in Table 1 show the respondents' answers regarding smell, appearance and taste. The scores calculated for each of the above characteristics were 0.93 for odor, 0.91 for appearance and 0.67 for taste. The overall score determined as the ratio between the scores of the 3 characteristics is 0.84.

The second bakery product under analysis was graham bread. The three characteristics

and the way of their appreciation by the respondents are presented in Table 2.

The following scores were obtained by processing the data: 0.58 for smell, 0.62 for appearance and 0.31 for taste, resulting in an overall score of 0.50. For multigrain bread the determined scores are presented in Table 3.

Table 2. Distribution of subjects' appreciation for graham bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	10	13	11	5	1
Appearance	12	14	10	8	1
Taste	8	9	19	7	2

Source: Own calculation.

Table 3. Distribution of subjects' appreciation for multigrain bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	12	15	9	6	0
Appearance	14	14	11	6	0
Taste	11	16	13	5	0

Source: Own calculation.

It is thus found that for the smell and taste a score of 0.73 was registered, and for the appearance the score was 0.80. The average score for multigrain bread was 0.80. The assessments regarding rye bread are presented

in Table 4. The calculation of the scores resulted in a value of 0.71 for smell, 0.67 for appearance and 0.73 for taste, the average score being 0.70.

Table 4. Distribution of subjects' appreciation for rye bread

The product	Total agreement	Agreement	Indifferent	Disagreement	Total disagreement
Smell	14	10	15	6	0
Appearance	13	11	14	7	0
Taste	12	14	14	5	0

Source: Own calculation.

From the affected analysis regarding the consumers' perception regarding the four products, it is found that the highest overall score was obtained by multigrain bread, followed by white bread, rye bread and graham bread (Table 5).

In terms of smell, the highest score was obtained by white bread, followed by multigrain bread, rye bread and graham bread. In terms of taste, the ranking had the following order: white bread took first place, followed by rye bread and multigrain bread which took second place, with the same score, followed by graham bread. In terms of appearance, the ranking has in the first place the multigrain bread, followed by the white bread and the rye bread with the same score, and on the last place is the graham bread.

The second method used in the sensory analysis of bakery products was the hedonic test.

Based on the calculations performed, it is found that the average score of 6.56 placed

white bread on the first place, followed by rye bread with an average score of 6.51, multigrain bread with a score of 6.20, on the last place being graham bread with a score of 5.76 (Fig. 2).

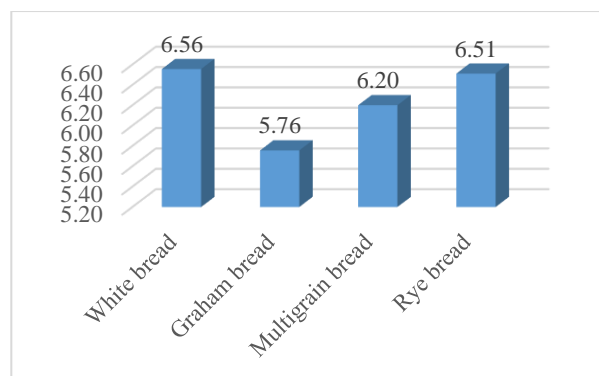


Fig. 2. Overall score (hedonic scale)  
 Source: Own calculation.

The rank ordering method allows the panel to make a comparison between the analyzed products and their ordering.

Table 5. Degree of appreciation

Degree	White bread	Graham bread	Multigrain bread	Rye bread
Extremely nice (9)	0	0	0	0
Very nice (8)	10	2	9	12
Nice (7)	21	15	19	16
Least liked (6)	4	14	3	3
Indifferent (5)	7	9	7	8
Slightly Unpleasant (4)	0	0	0	0
Half nice (3)	3	5	7	5
Completely Unpleasant (2)	0	0	0	0
Extremely Unpleasant (1)	0	0	0	0
Average	6.56	5.76	6.20	6.51

Source: Own calculation.

The samples were presented simultaneously, and the products were ordered according to rank, appreciating taking into account the appearance, color, consistency and taste.

The way in which the assessment scores of the four characteristics were given by the 45 evaluators are presented in Table 6.

Next, the average scores and the weighted average scores for the four varieties of bread were determined (Table 7).

It is found that based on the information collected from the evaluator, the highest

average score for white bread was for taste, followed by appearance and color. The lowest score was given for consistency. The weighted average score held by taste was the highest, followed by appearance. The consistency of the white bread rose from the fourth position to the third position.

For graham bread, the average scores, in descending order, were given for: color, appearance, taste and consistency (Table 8).

Regarding the weighted average score for multigrain bread, the sensory characteristics

were ranked first in taste, appearance, consistency and color (Table 9). For the third assortment of bread, rye bread, the scores were high for the four characteristics.

The most appreciated characteristic after applying the weighting factor was the taste, appearance, consistency and color (Table 10).

Table 6. Frequency of awarding points for bakery products

Characteristic	Points	White bread	Graham bread	Multigrain bread	Rye bread
Appearance	4	12	10	12	13
	3	14	14	15	11
	2	11	12	12	14
	1	7	8	6	7
	0	1	1	0	0
Color	4	11	11	13	12
	3	12	14	16	14
	2	14	14	9	13
	1	8	6	7	6
	0	0	0	0	0
Consistency	4	6	7	12	11
	3	11	8	19	15
	2	12	16	11	15
	1	6	11	3	4
	0	0	3	0	0
Taste	4	12	8	11	12
	3	17	9	16	14
	2	8	17	13	14
	1	6	9	5	5
	0	0	2	0	0

Source: Own calculation.

Table 7. Weighted average score for white bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.64	2.64
Color	0.5	2.58	1.29
Consistency	0.75	1.93	1.45
Taste	2	2.69	5.38

Source: Own calculation.

Table 8. Weighted average score for graham bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.53	2.53
Color	0.5	2.67	1.33
Consistency	0.75	2.11	1.58
Taste	2	2.27	4.53

Source: Own calculation.

Table 9. Weighted average score for multigrain bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.29	2.29
Color	0.5	2.78	1.39
Consistency	0.75	2.44	1.83
Taste	2	2.73	5.47

Source: Own calculation.

Table 10. Weighted average score for rye bread

Characteristic sensory	Factor of weighting	Average score	Average score weighted
Appearance	1	2.67	2.67
Color	0.5	2.71	1.36
Consistency	0.75	2.73	2.05
Taste	2	2.51	5.02

Source: Own calculation.

The scores obtained for rye bread, highlight the fact that the most appreciated characteristics were the consistency and the color. However, the weighting factors brought taste and appearance in the first two places, which, as the studies regarding the characteristics that influence the decision to buy bakery products show, are in the first places in the consumers' choice.

Following the three categories of applied tests, the results obtained are confirmed, the variations between the four assortments being reduced.

## CONCLUSIONS

The sensory characteristics of a product are extremely important in the choices made by consumers, being decisive for the choices made. The establishment of the quality classes for the analyzed products was made on the basis of the centralized sheets in which individual scores were registered which were the basis for determining the average scores.

The assessments made by the evaluators who were part of the panel highlighted the following aspects:

- The white bread obtained the highest scores, being appreciated both for appearance and taste
- Graham bread, from the evaluators' point of view, was appreciated for its color and appearance

- Multigrain bread was appreciated by evaluators for color and taste
- Rye bread was appreciated by evaluators for its consistency and color.

In conclusion, taste and appearance are the characteristics according to which consumers shop. The guidance of bakery manufacturers must take these characteristics into account when launching new products.

Sensory analysis is a way to improve the marketing activity of any company, no matter what it produces.

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