

## RESEARCH REGARDING THE SENSORIAL AND CHEMICAL FEATURES OF SOME TURKISH DELIGHT ASSORTMENTS SOLD ON IAȘI CITY MARKET

### CERCETĂRI PRIVIND CARACTERISTICILE SENZORIALE ȘI CHIMICE ALE UNOR SORTIMENTE DE RAHAT COMERCIALIZAT PE PIAȚA MUNICIPIULUI IAȘI

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**Abstract.** Lokum is a gelled product prepared by boiling a mixture of sugar, glucose and starch with the addition of flavors and dyes. To complete the current study were achieved three Turkish delight assortments (strawberry flavoured, lemon flavoured and mint flavoured), five for each studied assortment, and were bought from different stores localised in Iași City. The criteria used for sensory evaluation were overall appearance and colour, aspect, smell, taste and texture. Chemical analysis consists in determination of moisture and dry matter content, total sugar and directly reducing sugar content. It was observed distinctly significant differences between all three types of lokum in terms of colour, general and section aspect and total average score. Very significant differences were registered for the smell and taste features. The only feature in which the differences were insignificant was the one regarding texture. Percentage of moisture presented a value of 17.23% in the case of the three lokum assortments, dry substance recorded an average value of 82.77%, percentage of total sugar had a value of 73.76%, and percentage of directly reducing sugar was 17.87%.

**Key words:** Turkish delight, assortments, quality features

**Rezumat.** Rahatul este un produs preparat prin fierberea unui amestec de zahăr, glucoză și amidon cu adăugarea unor arome și culori. Pentru realizarea studiului s-au achiziționat trei sortimente de rahat cu diferite arome (de căpșuni, lămâie și mentă), pentru fiecare sortiment fiind achiziționate câte cinci probe din diferite magazine localizate în municipiul Iași. În vederea stabilirii caracteristicilor senzoriale produsele au fost analizate prin aprecierea globală precum și prin aprecierea culorii, aspectului, mirosului, gustului și texturii. Analizele chimice au vizat determinarea procentului de umiditate și substanță uscată, precum și procentul de zahăr total și de zahăr direct reducător. S-au observat existența diferențelor distinct semnificative între cele trei tipuri de rahat în ceea ce privește culoarea, aspectul general și în secțiune. Diferențe foarte semnificative s-au înregistrat pentru miros și gust. Singura caracteristică la care diferențele au fost nesemnificative a fost textura. Conținutul de umiditate a fost de 17,23%; substanța uscată a avut valoarea de 82,77%; procentul de zahăr total a fost de 73,76% iar conținutul de zahăr direct reducător a avut o valoare de 17,87% pentru toate cele trei tipuri de rahat analizate.

**Cuvinte cheie:** rahat, sortimente, caracteristici de calitate

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## INTRODUCTION

Lokum is a sugar-based jelly-like confection containing starch with a gel former (Gögüs *et al.*, 1998). Lokum had also started being known by the name of Turkish delight through British travelers in Europe in the 18<sup>th</sup> century (Doyuran *et al.*, 2004; Gönül, 1985).

Lokum is a gelled product prepared by boiling a mixture of sugar, glucose and starch with the addition of flavors and dyes. Cocoa powder, candied fruit jam, concentrated honey juice, nuts can also be added to the composition (Nistor and Hoha, 2017).

Lokum manufacturers have different opinions on the quality features such as color and texture of lokum. But they agreed that appearance, structure and taste are the quality criteria for lokum. Sugar powder should remain dry by itself (Batu, 2006; Batu and Kirmaci, 2006).

## MATERIAL AND METHOD

To complete the current study were achieved 3 Turkish delight assortments (strawberry flavoured, lemon flavoured and mint flavoured), 5 for each studied assortment, and were bought from different stores localised in Iași City. Samples were gathered in original package and transferred to the analysis laboratory.

Sensory evaluation of lokum assortments was conducted by a team of fifteen assessors. Respecting a modern working method (Banu *et al.*, 2002; 2007) each of the board members received three coded samples, corresponding for each type of lokum assortment. Sensory appreciation of the samples was performed using the analytical method of assessing the quality by scoring, using a 30-point system scale for sugary products.

The criteria used for sensory evaluation were overall appearance and colour, aspect, smell, taste and texture. The obtained results are interpreted based on the scoring scale for quality evaluation (Banu *et al.*, 2002; 2007).

Chemical analysis consists in determination of moisture and dry matter content, total sugar and directly reducing sugar content.

## RESULTS AND DISCUSSIONS

The sensory properties of the three lokum assortments taken in study refer to the evaluation, by an assessor's team, of colour, appearance, smell, taste and texture. In the case of first assortment, strawberry flavoured lokum, after calculating the score for each sensory feature, result from the analysis of the 15 individual sensory analysis sheets, the obtained results are presented in table 1. Also, the total average score was calculated, adding up the scores of all the analyzed attributes in order to classify the lokum assortments in a quality class.

Analyzing the data presented in table 1, it is noted that the values of the coefficient of variability for all the characteristics had a medium degree of variability, which means that the marks given after the analysis by the team of assessors were average homogeneous. The minimum recorded by the assortment of strawberry-flavoured lokum was 23 points and the maximum obtained by the

analysis by the assessors was 27 points.

Table 1

**The results of the sensory analysis for the assortment of strawberry-flavoured lokum**

Sensorial features	n	$\bar{X} \pm s_{\bar{X}}$	V%	Min.	Max.
Colour	15	5.15±0.64	12.31	4.00	6.00
Aspect	15	4.62±0.65	10.40	3.00	5.00
Smell	15	3.24±0.70	14.51	2.00	4.00
Taste	15	6.36±1.52	17.82	4.00	8.00
Texture	15	6.33±0.46	14.25	4.00	7.00
<b>TOTAL</b>	15	25.61±1.09	17.88	23.00	27.00

The results of the sensory analysis obtained in the case of the lokum assortment with lemon flavour are presented in table 2.

Table 2

**The results of the sensory analysis for the assortment of lemon-flavoured lokum**

Sensorial features	n	$\bar{X} \pm s_{\bar{X}}$	V%	Min.	Max.
Colour	15	5.54±0.76	15.13	4.00	6.00
Aspect	15	4.82±0.46	14.13	3.00	5.00
Smell	15	3.62±0.74	11.41	2.00	4.00
Taste	15	6.62±1.25	14.31	4.00	8.00
Texture	15	6.31±0.64	14.14	4.00	7.00
<b>TOTAL</b>	15	27.01±2.09	18.63	24.00	28.00

Analyzing the data from table 2, it is noted that the values of the coefficient of variability for all sensory features had an average degree of variability between 14 and 19%, which means that the marks given after the sensory analysis by the team of assessors were average homogeneous. The minimum recorded by the lokum assortment with lemon flavour was 24 points and the maximum obtained by the analysis by the assessors was 28 points.

The results of the sensory analysis obtained in the case of the lokum assortment with mint flavour are presented in table 3.

Table 3

**The results of the sensory analysis for the assortment of mint-flavoured lokum**

Sensorial features	n	$\bar{X} \pm s_{\bar{X}}$	V%	Min.	Max.
Colour	15	4.53±1.23	18.94	4.00	6.00
Aspect	15	4.13±0.72	11.11	3.00	5.00
Smell	15	3.73±0.59	15.09	2.00	4.00
Taste	15	6.93±1.06	14.68	4.00	8.00
Texture	15	6.33±0.99	15.16	4.00	7.00
<b>TOTAL</b>	15	25.88±3.70	15.83	22.00	26.00

Analyzing the data presented in table 3, it is noted that the values of the coefficient of variability for all the sensory attributes had an average degree of variability between 15 and 20%, which means that the marks given after the sensory analysis by the team of assessors were average homogeneous. The minimum recorded by the assortment of lemon-flavoured lokum was 21 points and the maximum obtained by the analysis by the assessors was 26 points.

In order to highlight the qualitative differences of the three assortments of lokum studied according to the flavour and colour used in their manufacture, we analyzed each sensory attribute separately.

Regarding the average scores obtained from the sensory analysis regarding the colour attribute, the assessors appreciated the assortment of lemon-flavoured lokum as being closest to the colour that the assortment should present in correlation with the used addition, registering the highest value respectively 5.54 points out of the three assortments out of a maximum possible of 6 points. The assortment of strawberry-flavoured lokum recorded an average score of 5.15 points for the colour attribute following the centralization of the marks given by the team of assessors. At the opposite pole the lowest average score was obtained by the assortment of mint flavoured lokum, respectively 4.53 points, the assessors appreciating that the assortment presented a lighter green-gray colour which led to the awarding of lower ratings compared to the other assortments analyzed.

Regarding the average scores obtained from the sensory analysis regarding the general aspect attribute and in the cross-section, the assessors appreciated the assortment of lemon-flavoured lokum as being closest to the aspect that the assortment should present in correlation with the used addition. during the technological process of manufacture, registering the highest value respectively 4.82 points out of the three assortments out of a maximum possible of 5 points that could be granted. The assortment of strawberry-flavoured lokum registered an average score of 4.62 points for the attribute of the general aspect and in cross-section following the centralization of the marks given by the team of assessors, being in second place. At the opposite pole the lowest average score was obtained by the assortment of mint flavoured lokum, respectively 4.13 points, the assessors appreciating the fact that the assortment had a general appearance and in the cross section less attractive fact which led to the awarding of some lower marks than the other assortments analyzed.

After studying the marks given on the average score obtained from the sensory analysis regarding the smell feature, the assessors appreciated this time that the assortment of mint-flavoured lokum was closest to the odour that the assortment should present. in correlation with the flavour used during the manufacturing process, registering the highest value respectively 3.73 points out of the three assortments out of a maximum possible of 4 points. The assessors revealed the strong mint smell detected after tasting this assortment. The lemon-flavoured lokum assortment achieved an average score of 3.62 points for the smell feature following the centralization of the marks given by the team of assessors, which characterized the smell as being the medium highlighted. At the

opposite pole the lowest average score was obtained by the assortment of strawberry flavoured lokum, respectively 3.24 points, the assessors appreciating that the assortment had a slightly lower smell compared to the flavour used which led to the awarding of lower marks compared to the other analyzed assortments.

After studying the marks given on the average score obtained from the sensory analysis regarding the taste attribute, the assessors also appreciated that this time, the assortment of mint-flavoured lokum was closest to the taste it should present the assortment in correlation with the flavour used during the manufacturing process, registering the highest value respectively 6.93 points out of the three assortments out of a maximum possible of 8 points. The assessors highlighted the strong peppermint taste detected after tasting this assortment, the results being in agreement with those recorded after the appreciation of the smell feature, knowing that the aroma is composed of the smell and taste attributes. The lemon-flavoured lokum assortment had an average score of 6.51 points for the taste feature as a result of the centralization of the marks given by the team of assessors, which characterized the taste as being average evidenced by the tasting. At the opposite pole, the lowest average score was obtained by the assortment of strawberry-flavoured lokum, respectively 6.36 points, the assessors appreciating that the assortment had a less pronounced taste compared to the flavour used, which led to the awarding of lower marks compared to the other assortments analyzed.

After studying the marks given on the average score obtained from the sensory analysis regarding the consistency attribute, it can be observed that the values recorded for the three types of lokum are very close, ranging from 6.31 to 6.33 points. Thus, one can draw the conclusion that the manufacturing process for the three types of lokum is the same, the only differences being conferred by the flavours and dyes used in the technological flow of manufacture, and these do not decisively influence the final consistency of the types of lokum.

The total average scores obtained after analyzing and centralizing the data recorded for all the analyzed features are depicted in figure 1.

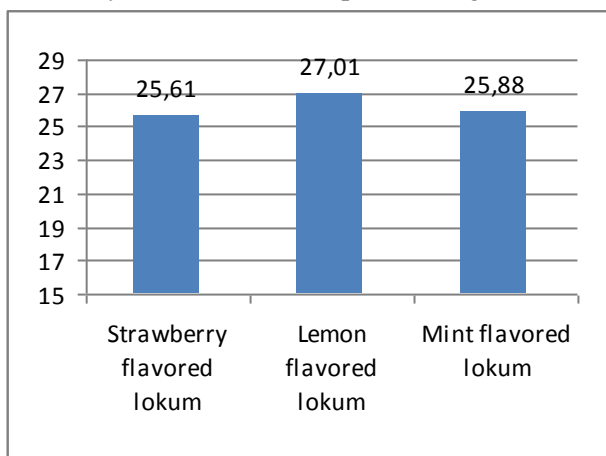


Fig. 1. The total average scores for all lokum assortments

Following the centralization of the marks for all the sensory features, the total average scores obtained from the sensory analysis for the three studied lokum assortments, ranged from 25.61 to 27.01 points, so that we can fit all the assortments in the class of “Good” quality.

In order to underline the differences that have emerged between the three types of lokum, following the sensory analysis we also performed the statistical significance test for their sensory attributes.

Analyzing the data presented in table 4, there are distinctly significant differences between all three types of lokum in terms of colour, general and section aspect and total average score. Very significant differences were registered for the smell and taste features. The only feature in which the differences were insignificant was the one regarding texture.

*Table 4*

**Significance of statistical differences for the sensory features of the studied lokum assortments**

Specification	Feature	Batches	Statistical significance
Turkish delight	Colour	RL vs. RM	**
		RL vs. RS	**
		RM vs. RS	**
	Aspect	RL vs. RM	**
		RL vs. RS	**
		RM vs. RS	**
	Smell	RL vs. RM	***
		RL vs. RS	***
		RM vs. RS	***
	Taste	RL vs. RM	***
		RL vs. RS	***
		RM vs. RS	***
	Texture	RL vs. RM	N.S.
		RL vs. RS	N.S.
		RM vs. RS	N.S.
Total	RL vs. RM	**	
	RL vs. RS	**	
	RM vs. RS	**	

\*Note: RS - Strawberry flavoured, RL - Lemon flavoured, RM - Mint flavoured  
N.S.- insignificant \*\*- distinctly significant \*\*\*- highly significant

The Turkish delight assortments taken in study have the same chemical composition, due to the fact that the three assortments are manufactured according to the same technological flow, the only differentiation during it being conferred by the aroma and the colour used, these not significantly altering the final chemical composition.

In table 5 are presented the results obtained from the chemical analyzes for the three studied *lokum* assortments.

Table 5

**Chemical composition of the analysed lokum assortments**

Characteristics	Strawberry flavoured lokum	Lemon flavoured lokum	Mint flavoured lokum
Humidity (%)	17.23	17.23	17.23
Dry matter (%)	82.77	82.77	82.77
Total sugar (%)	73.76	73.76	73.76
Directly reducing sugar (%)	9.01	9.01	9.01

Thus, in the case of the percentage of moisture it presented a value of 17.23% in the case of the three lokum assortments, the dry substance recorded an average value of 82.77%, the percentage of total sugar had a value of 73.76%, and the percentage of directly reducing sugar registered a value of 17.87%.

## CONCLUSIONS

1. Following the centralization of the marks for all the sensory features, the total average scores obtained from the sensory analysis for the three studied lokum assortments, ranged from 25.61 to 27.01 points, so that we can fit all the assortments in the class of “Good” quality.

2. Analyzing the data presented we observed that there are distinctly significant differences between all three types of lokum in terms of colour, general and section aspect and total average score. Very significant differences were registered for the smell and taste features. The only feature in which the differences were insignificant was the one regarding texture.

3. Thus, in the case of the percentage of moisture it presented a value of 17.23% in the case of the three lokum assortments, the dry substance recorded an average value of 82.77%, the percentage of total sugar had a value of 73.76%, and the percentage of directly reducing sugar registered a value of 17.87%.

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