

COMPARISON OF THREE SUNFLOWER HALVA ASSORTMENTS FROM ROMANIAN MARKET

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Abstract

Sunflower halva is a traditional product characteristic to Eastern European countries, consisting of sunflower seeds tahini, cacao powder or sugared fruit, caramel, water, soapwort root extract and flavours being an important source of energy.

In the current paper sensory profile, fat, protein, sugar, ash and moisture content of sunflower halva assortments from Romanian market were compared. Sunflower halva samples from different producers and countries (Bulgaria, Romania and Ukraine) were purchased from different stores localised in Iași County.

Research revealed a total fat content between 32.4 - 37.95%, proteins ranking between 11.4 - 11.95%, sugars within 26.97-34.43% limits, ash between 1.57 – 1.80% and moisture content ranged between 0.68 - 1.09%. Statistical differences between the three assortments of sunflower halva were insignificant for the sensory analysis in terms of the total score obtained and highly significant in terms of chemical composition. Differences found between the three assortments may be due different technologies, recipes and raw materials used in the country of origin.

Key words: sunflower halva, sensory analysis, total fat, proteins, sugar

INTRODUCTION

Halva is one of the most popular foods in countries of the Middle East and North Africa (Mureșan V. 2012) being a homogeneous mixture consisting of sunflower seeds tahini, cacao powder or sugared fruit, caramel, water, soapwort root extract and flavours, being an important source of energy (Banu C. et al, 2013). Characteristic to Eastern European countries is the replacement of sesame from the halva recipe with sunflower seeds due to the high availability of sunflower in this region (Mureșan V. et al, 2012, 2013, Racolța E. et al, 2010).

Regarding nutritional value of halva, it has a high content of vitamin E and zinc. Halva proteins are of plant origin, derived from sunflower seed with great biological value. Lipids are represented by the oils contained of sunflower seed subjected to processing, cholesterol-free as well as other natural vegetable fats. Carbohydrates present in halva are represented by the sugar and glucose with rapid absorption and high glycemic index (Muste S. 2008, Racolța E. et al, 2008 a, b, 2011).

Concerning the quality of halva we found limited information in literature (Damir A.A. 1984; Damir A.A. and Abdel-Nabey A.A, 1990; Mureșan V. et al, 2010, 2012; Racolța E. et al, 2010, 2011), so our study

will provide new information about the quality of sunflower halva assortments from the Romanian market.

MATERIAL AND METHOD

Sunflower halva samples from different producers and countries Bulgaria, Romania, Ukraine, coded (HB, HR and HU) were purchased from different stores localised in Iași County. All sunflower halva samples were gathered in original package and transferred to the analysis laboratory.

Sensory evaluation was performed by a team of fifteen members, persons who are familiar with sunflower halva. Sensory analysis was performed in a tasting room, complying with the technical requirements necessary to perform this operation. Respecting a modern working method (Banu C. et al, 2007) each of the board members received three coded samples, corresponding for each type of sunflower halva. After the manner of presentation of the samples, they are classified as fractionated products, of rectangular shape, with the weight of about 20g/per sample. Sensory appreciation of the samples was performed using the analytical method of assessing the quality by scoring, using a 30-point system scale for sugar products (Banu C. et al, 2007). The criteria used for sensory evaluation were overall and section appearance, colour, smell, taste, texture, and packaging. Based on the results of sensory evaluation, total average score was calculated for each of the three types of samples. The obtained results are interpreted based on the scoring scale for quality evaluation (Banu C. et al, 2007). Thus, for the sensory feature colour, maximum points that could be given was 6, for appearance was 4, for smell was 4, for taste was 8, for texture was 5, and for packing maximum points that could be given was 3.

The moisture content was determined by oven method in according with standard STAS 2213/4-68.

Determination of total fat was performed by Lindner method in according with standard STAS 2257-67, result being expressed on percentage of fat (%) using the formula:

$$\% \text{ Fat} = \frac{(V_1 - 1) m_1}{(V - 1.1 m_1) m} \cdot 100,$$

where:

m_1 - fat weight (g);

m - sample weight (g);

V - volume of petroleum ether used (ml);

V_1 - volume of petroleum ether and fat taken (ml);

$1.1 = 1/d$ - volume correction, considering that the fat has a relative density of ~ 0.9 .

Protein content was determined by Kjeldahl method which consists in determination of total nitrogen which, multiplied by the coefficient of

transformation of nitrogen in protein, gives the amount of protein in the sample. The coefficient of transformation of nitrogen for vegetable materials is 5.7.

$$\text{Protein \%} = \frac{(V - V_1) \cdot 0.0014 \cdot 100}{g} \cdot 5.7,$$

where:

V – volume of n/10 sulphuric acid from the Erlenmeyer flask [ml];

V₁ - volume of n/10 sodium hydroxide used in titration of sulphuric acid excess [ml];

0.0014 - the amount of nitrogen in [g] corresponding to 1 ml of sulphuric acid sol. 0.1 n;

g – sample weight taken in for analysis [g];

5.7 - coefficient of nitrogen transformation.

Determination of total sugars content was performed in according with standard STAS 2213/12-70. Total sugars content is expressed in percentages, after following formula:

$$\% \text{ Total sugar} = \frac{c \cdot V \cdot V_i \cdot 100}{V_1 \cdot 100 \cdot 1000 \cdot m},$$

where:

c - sugar content (mg) corresponding to sodium thiosulphate volume used for titration;

V - volume of the homogenized sample (ml);

V_i - volume of the inverted sample (ml);

V₁ - sample volume used for titration (ml);

m - sample weight (g).

Ash was determined by calcinations at 550±20°C in calcinations oven in according with standard STAS 2257-67.

The software used for statistical analysis was SPSS. We calculated the average, standard deviation, coefficient of variation and statistical significance of differences between samples, using Anova Single Factor.

RESULTS AND DISSCUSIONS

Sensory analyses

Sensory evaluation of the three assortments of halva relates to the assessment of colour, appearance, smell, taste, texture, as well as the packaging.

Regarding the mean score for the *colour* feature (table 1), tasters' assessed Romanian halva as being the closest to the colour that a perfect halva must have, obtaining the highest value of the three assortments respectively 5 points from the maximum of 6, and the lowest value was obtained by Ukrainian halva of 4.467 points, with a yellow-gray lighter colour.

Table 1

Results of sensory analysis of the three sunflower assortments

Sensory features	n	HR		HB		HU	
		$\bar{X} \pm S\bar{X}$	V %	$\bar{X} \pm S\bar{X}$	V %	$\bar{X} \pm S\bar{X}$	V %
Colour	15	5.000±0.76	15.12	4.733±0.88	18.67	4.333±1.23	28.49
General appearance	15	3.267±0.46	14.01	3.267±0.70	21.54	3.333±0.72	21.71
Smell	15	3.267±0.70	21.54	3.600±0.51	14.09	3.733±0.59	15.90
Taste	15	6.467±1.25	19.27	5.333±1.23	23.15	7.133±1.06	14.86
Texture	15	3.133±0.64	20.42	3.600±1.18	32.87	3.867±0.99	25.61
Packaging	15	2.933±0.26	8.80	2.933±0.26	8.80	2.133±0.35	16.49
TOTAL	15	24.067±2.09	8.67	23.467±3.23	13.75	24.533±3.70	15.08

Analyzing the data from table 1, it can be observed that both Romanian and Bulgarian assortments obtained for *appearance* feature a score of 3.267 from the maximum of 4, presenting a fibrous structure, more roughly. The highest score was obtained by Ukrainian assortment, respectively 3.333, due to its uniform and smooth structure.

For *smell* feature Ukrainian assortment obtained the highest score of 3.733 points from the maximum of 4, having a pleasant smell, flavoured and well pronounced. The minimum value registered for this feature was obtained by Romanian assortment, respectively 3.267 having a pleasant odour slightly flavoured.

Concerning the *taste* feature, the highest score was obtained again by Ukrainian assortment, respectively 7.133 from a maximum of 8, with a sweet and pleasant taste, characteristic of roasted sunflower seeds. The lowest value was recorded this time for Bulgarian assortment, with a score of 5.333, having a sweet taste, pleasant but poorly flavoured.

Regarding the *texture* feature, assortment of Ukrainian halva obtained a score of 3.867 points from the maximum of 5, these being the highest from all analysed assortments. The lowest score of 3.133 was registered at Romanian assortment, product having a specific texture but slightly crumbly.

Of the three types of sunflower halva assortments, the one produced in Ukraine totalled the highest mean score, respectively 24.533 from the maximum of 30 points. This assortment, along with the Romanian assortment which obtained a total mean score of 24.067, receive mark **Good** being considered to be optimal for consumption. Ranked last because some sensorial attributes didn't fulfil the tasters' desired conditions with the lowest score was the Bulgarian assortment, these one obtained a total mean score of 23.467 points and receives mark **Satisfactory**.

To highlight the potential differences between the three assortments of halva in terms of sensory analysis, we performed tests of statistical significance.

Analysing the data from table 2 it was found that there are significant differences between the assortments of halva originated from Romania and

the Bulgarian ones in terms of *taste* feature. Highly significant differences were found between the Ukrainian and Bulgarian assortments for *taste* and *packaging* features. Also, highly significant differences were recorded for Romanian and Ukrainian assortments for *packaging* feature, while the rest of the differences were insignificant.

Table 2

Statistical significance for sensory features of the studied halva assortments

Specification	Feature	Assortments	F	F _a	Significance level	Statistical significance
Sunflower halva	Colour	HR vs. HU	3.181818	4.195972	0.05	N.S.
		HR vs. HB	0.788732	4.195972	0.05	N.S.
		HU vs. HB	1.041322	4.195972	0.05	N.S.
	General appearance	HR vs. HU	0.090909	4.195972	0.05	N.S.
		HR vs. HB	0.00	4.195972	0.05	N.S.
		HU vs. HB	0.065421	4.195972	0.05	N.S.
	Smell	HR vs. HU	3.853933	4.195972	0.05	N.S.
		HR vs. HB	2.21519	4.195972	0.05	N.S.
		HU vs. HB	0.43750	4.195972	0.05	N.S.
	Taste	HR vs. HU	2.491103	4.195972	0.05	N.S.
		HR vs. HB	6.263158	7.635619	0.01	*
		HU vs. HB	18.35612	15.37931	0.001	***
	Texture	HR vs. HU	5.80137	4.195972	0.05	N.S.
		HR vs. HB	1.805263	4.195972	0.05	N.S.
		HU vs. HB	0.448	4.195972	0.05	N.S.
	Packaging	HR vs. HU	50.40	15.37931	0.001	***
		HR vs. HB	0.00	4.195972	0.05	N.S.
		HU vs. HB	50.40	15.37931	0.001	***
	Total	HR vs. HU	0.181003	4.195972	0.05	N.S.
		HR vs. HB	0.365806	4.195972	0.05	N.S.
		HU vs. HB	0.708021	4.195972	0.05	N.S.

N.S - insignificant *- significant ***- highly significant

Halva assortments from different batches taken in study present a balanced chemical composition, being representative for these types of products. In table 3 are presented the results of chemical composition of the three sunflower assortments taken in study.

In terms of dry matter content, the highest percentage was recorded in the case of Romanian halva assortments, respectively 99.32%, while the lowest value of 98.89% was registered at Bulgarian assortments.

Humidity in the case of all analysed assortments ranged between $0.68 \pm 0.006\%$ for Romanian Halva and $1.09 \pm 0.01\%$ in the case of Bulgarian assortments, values which complies with the products standard but lower than those reported by Racolța E. et al, (2010) ranging between 2.74% and 3.84%.

Oil content of sunflower halva contributes to the initial appearance and aroma of the product, but also strongly influences texture and flavour and thus plays an important role in the sensory quality of the halva (Racolța

E. et al, 2010).

Romanian halva assortment had the highest fat content, respectively 37.95%, while the lowest content was determined in the case of Ukrainian assortment of 32.70%. The obtained results are similar to ones reported in literature by Damir A.A. and Abdel-Nabey A.A. (1990) respectively 34.1% and Racolța E. et al, (2010) between 37.17% and 43.95%.

Table 3

Chemical composition of the sunflower halva assortments

Specification	n	Assortments	$\bar{X} \pm S\bar{X}$	V%	Min.	Max.
Humidity (%)	10	HR	0.68±0.006	2.89	0.64	0.71
		HU	0.75±0.009	3.98	0.70	0.79
		HB	1.09±0.01	2.87	1.06	1.16
Dry matter (%)	10	HR	99.32±0.01	0.02	99.29	99.36
		HU	99.25±0.01	0.03	99.21	99.30
		HB	98.89±0.02	0.07	98.73	98.94
Fat (%)	10	HR	37.95±0.03	0.21	37.84	38.06
		HU	32.40±0.009	0.09	32.36	32.44
		HB	13.44±0.03	0.09	33.39	33.49
Protein (%)	10	HR	11.87±0.006	0.13	14.85	14.91
		HU	11.95±0.07	0.15	15.41	15.49
		HB	11.40±0.008	0.19	13.37	13.45
Sugars (%)	10	HR	34.43±0.004	0.04	34.41	34.45
		HU	29.78±0.003	0.03	29.76	29.79
		HB	26.97±0.004	0.05	26.94	26.98
Ash (%)	10	HR	1.57±0.003	0.72	1.55	1.59
		HU	1.80±0.003	0.54	1.79	1.82
		HB	1.68±0.002	0.44	1.67	1.69

Determination of protein content is not a current procedure in the manufacturing process of traditional halva (Racolța E. et al, 2011), so our research will provide new information for speciality literature.

Maximum protein content was of 11.95%, value determined in the case of the Ukrainian assortment, Romanian assortment registered a mean value of 11.87% and minimum protein content of 11.40% was registered in the case of Bulgarian assortment, data being similar to one reported by Racolța E. et al, (2011) for traditional sunflower halva of 11.60%.

For the three studied assortments of sunflower halva, the highest percentage of total sugar was of 34.43% recorded at Romanian assortment while the minimum value of 26.97% was determined for the Bulgarian assortment, all values being within the limits reported in literature for sunflower halva ranking between 20.40% and 34.40% (Racolța E. et al, 2010).

Maximum ash content was of 1.80% determined for Ukrainian halva assortment, and minimum content was of 1.57% in the case of Romanian halva assortment.

To highlight the potential differences between the three assortments of halva in terms of chemical composition, we performed tests of statistical significance.

Table 4

Statistical significance for chemical composition of halva

Specification	Parameters	Assortments	F	F _a	Significance level	Statistical significance
Halva	Humidity	HR vs. HU	33.96491	15.37931	0.001	***
		HR vs. HB	1252.21	15.37931	0.001	***
		HU vs. HB	613.4821	15.37931	0.001	***
	Dry matter	HR vs. HU	43.08042	15.37931	0.001	***
		HR vs. HB	409.6624	15.37931	0.001	***
		HU vs. HB	253.1773	15.37931	0.001	***
	Fat	HR vs. HU	42649.45	15.37931	0.001	***
		HR vs. HB	27193.21	15.37931	0.001	***
		HU vs. HB	6169.633	15.37931	0.001	***
	Protein	HR vs. HU	3607.401	15.37931	0.001	***
		HR vs. HB	21970.88	15.37931	0.001	***
		HU vs. HB	35279.19	15.37931	0.001	***
	Sugar	HR vs. HU	833066	15.37931	0.001	***
		HR vs. HB	1535570	15.37931	0.001	***
		HU vs. HB	307659.8	15.37931	0.001	***
	Ash	HR vs. HU	2422.08	15.37931	0.001	***
		HR vs. HB	624.4909	15.37931	0.001	***
		HU vs. HB	1057.331	15.37931	0.001	***

Analyzing the data presented in *table 4*, were found highly significant differences between all the sunflower halva assortments for each studied chemical parameter.

CONCLUSIONS

Following the study of the three sunflower halva assortments we found that all fulfil the qualities required by standard regulations.

Total fat, total sugars and protein contents were similar with those reported in the literature, while humidity content registered lower values than the ones reported in the literature.

Regarding the sensory analysis where found significant differences between the assortments of halva originated from Romania and the Bulgarian ones in terms of *taste* feature. Highly significant differences where found between the Ukrainian and Bulgarian assortments for *taste* and *packaging* features. Also, highly significant differences where recorded for Romanian and Ukrainian assortments for *packaging* feature, while the rest of the differences where insignificant.

Analyzing the data obtained after determination of chemical composition, were found highly significant differences between all the sunflower halva assortments for each studied chemical parameter.

Differences found between the three assortments of sunflower halva may be due different technologies, recipes and the quality of raw materials used in the manufacture in the country of origin.

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