

Instrumental textural properties of plain helva kept at different temperatures

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Abstract

Traditional plain helva samples were stored at different temperatures (4 ± 1 °C, 22 ± 2 °C or 35 ± 1 °C) and their textural properties were determined by conducting texture profile analysis. Also the general chemical composition of the samples was determined. According to the data obtained, total sugar content of samples was 41.56 g/100 g, whereas average protein, water and fat amounts were 18.63 g/100 g, 0.29 g/100 g and 37.84 g/100 g, respectively. It was determined that storage at different temperatures significantly affected the instrumental textural attributes of plain helva samples ($P<0.05$). Hardness of plain helva kept at 4 ± 1 °C was 4.33 N, whereas it was 4.26 N and 9.10 N for the samples kept at ambient temperature (22 ± 2 °C) and 35 ± 1 °C, respectively. Temperature also significantly affected the chewiness, gumminess and cohesiveness scores of the samples ($P<0.05$).

Keywords: instrumental textural attributes, plain helva, sesame, textural quality, texture profile analysis

1. Introduction

Helva is a widely consumed traditional confectionary product of Turkey and Middle Eastern countries. It is a well-known cereal based dessert made in many countries in the region. It is made from crushed sesame seeds and syrup (Şengün *et al.*, 2004). Helva is also known as tahin helva because paste made from crushed sesame seeds are also named as tahin in Turkey. For manufacturing plain helva, sesame seeds and syrup are kneaded together and citric or tartaric acids. Also, cacao, nuts, dried fruits and milk powder can be added into helva to obtain different flavours (TSE, 1997).

For manufacturing plain helva, the sesame seeds are dehulled, roasted and then crushed and grounded. Concentrated sugar syrup is added to the ground sesame seeds and they are kneaded together. *Saponaria officinalis* root extract is also used in the formulation (Var *et al.*, 2007). While kneading, additional materials like dried fruits, nuts and cacao can be included. After manufacturing, helva is packaged by using moisture-proof materials. Helva is generally eaten by Turkish consumers at breakfast or as a dessert after eating fish plates.

Helva can be kept at either ambient temperature or in a refrigerator during marketing. However, generally it is kept at ambient temperature at markets with changing temperature values in different seasons. In summer because of high ambient temperatures the emulsion can break down and the helva losses important amounts of its fat content into the package. This is known to be an important technological problem of the sector and it affects the choice of the consumers adversely.

In this study it was aimed to determine the effect of storage temperature on the instrumental textural attributes of plain helva. To our knowledge, there is not any literature available regarding the determination of instrumental textural attributes of helva.

2. Materials and methods

Plain helva samples were obtained from a local plant in Manisa, Turkey. A typical formulation of the manufacturer was used in production of this plain helva. All additives and raw materials were provided by the manufacturer. Analyses were repeated two times during the research.

One batch of plain helva samples was kept in a refrigerator (4 ± 1 °C; LTH), one batch was kept at ambient temperature (22 ± 2 °C; ATH) and the last batch was kept at 35 ± 1 °C (HTH) for 3 days.

The moisture content of the samples was determined by a vacuum oven drying method at 65 ± 1 °C under a vacuum of 650 mmHg. The total sugar content was determined by the Lane-Eynon method according to Cemeroglu (1992). Protein and ash levels in the samples were determined according to AOAC (1990).

For the determination of texture profile analysis scores of plain helva samples a TA.XT II Plus Texture Analyser (Stable Micro Systems Ltd., Godalming, UK) was used. The thickness of the samples was 25 mm. The probe used with the texture analyser was the P-2 (a cylindrical probe having a diameter of 2 mm; Stable Micro Systems Ltd.). The pre-test speed, test speed and post-test speed were set at 1.5 mm/sec, 2 mm/sec and 10 mm/sec, respectively. Compression was applied with a distance mode of 5 mm. The load was 50 kg. Two compressions in a row were applied to the samples. Six measurements were performed for each sample. According to the graph obtained, instrumental textural profile attributes of the samples were determined according to Szczesniak (1963, 1966) and Bourne (1978). Hardness, cohesiveness, chewiness, adhesiveness, springiness and gumminess values of the samples were determined.

Hardness is the maximum height of the first peak on the first compression; cohesiveness is the ratio of the second compression to the first compression positive areas; gumminess is the product of hardness and cohesiveness (strength required to chew); springiness is measured by dividing the distance of the detected height of the product on the second compression by the original compression distance; and chewiness is the product of gumminess and springiness (a measure of the energy spent in the chewing process) (Cardoso *et al.*, 2009). Adhesiveness describes the work for overcoming the force of attraction between the area of food and other solids coming into contact with each other (Domagala, 2011). The findings obtained from the analyses were evaluated by the GLM procedure of the SAS statistical analyses programme according to the

completely randomised design (SAS, 2001). Duncan analysis was applied on the results found statistically significant ($P<0.05$) (Sante and Fernandez, 2000; Ergönül, 2013).

3. Results and discussion

The average chemical composition of plain helva samples is given in Table 1. The total sugar content of samples was 41.56 g/100 g, whereas average water, protein, fat and ash contents of the samples were 0.29, 18.63, 37.84 and 1.70 g/100 g, respectively.

Instrumental textural attributes of the samples are given in Table 2. Hardness, adhesiveness, chewiness, gumminess, cohesiveness and springiness values of the samples were determined.

Hardness values for the LTH, ATH and HTH samples were determined as 4.33, 4.26 and 9.1 N, respectively. The statistical analysis revealed that hardness of the HTH samples, which were kept at 35 ± 1 °C, was significantly higher than of the other samples ($P<0.05$). There was no significant difference observed between the hardness values of the samples kept at 22 ± 2 °C and at 4 ± 1 °C ($P>0.05$). Date paste is a similar product when compared to our material and Razavi and Karazhiyan (2012) reported that hardness values of date paste samples made from different types of date were between 2.07 and 2.27 N.

Adhesiveness scores of the samples were between the values 0.01 and 0.03 N.s. Average adhesiveness values of LTH and ATH samples were 0.03 N.s though it was found

Table 1. Average chemical composition of plain helva.

Ingredients	Amount (g/100 g)
Water	0.29 $\pm$ 0.06
Fat	37.84 $\pm$ 1.2
Protein	18.63 $\pm$ 0.5
Sugar	41.56 $\pm$ 0.7
Ash	1.70 $\pm$ 0.1

Table 2. Instrumental textural attributes of plain helva samples (mean $\pm$ standard deviation) kept at different temperatures.

Sample	Hardness (N)	Adhesiveness (N.s)	Cohesiveness (A_2/A_1)	Springiness	Gumminess (N)	Chewiness (N)
LTH	4.33 $\pm$ 0.8b	0.03 $\pm$ 0.01	0.55 $\pm$ 0.07ab	1.32 $\pm$ 0.27	3.24 $\pm$ 0.2b	2.93 $\pm$ 0.81b
ATH	4.26 $\pm$ 0.8b	0.03 $\pm$ 0.01	0.52 $\pm$ 0.03b	1.1 $\pm$ 0.04	2.25 $\pm$ 0.4b	2.63 $\pm$ 0.5b
HTH	9.1 $\pm$ 2.2a	0.01 $\pm$ 0.005	0.81 $\pm$ 0.12a	1.29 $\pm$ 0.06	6.71 $\pm$ 0.7a	9.54 $\pm$ 0.7a

ATH = ambient temperature (22 ± 2 °C); HTH = high temperature (35 ± 1 °C); LTH = low temperature (4 ± 1 °C).
Values with different letters in a column are significantly different ($P<0.05$).

to be 0.01 N.s for HTH samples. On the other hand, it was determined that there were no significant differences between the adhesiveness values of the samples ($P>0.05$). Also a negative and important correlation was observed between the hardness and adhesiveness scores of the samples ($P<0.05$, $r^2=0.85$)

Cohesiveness scores for the samples were as given in Table 2. As can be seen, the average cohesiveness scores of LTH, ATH and HTH samples were 0.55, 0.52 and 0.81, respectively. When the results of the statistical analysis were taken into account, it was seen that the cohesiveness value of the HTH samples, which was kept at high ambient temperature (35 ± 1 °C), was significantly higher than the average cohesiveness values of the other samples ($P<0.05$). It is thought that this is because of fat loss at high ambient temperature and that the surface of the plain helva samples became cohesive and thus higher cohesiveness scores were obtained. According to Razavi and Karazhiyan (2012), the cohesiveness of date palm samples were between 0.74 and 0.75.

The gumminess scores of the samples were between 2.25 N and 6.71 N. The highest gumminess score (6.71 N) was obtained for the HTH samples, which were kept at higher ambient temperature. A positive and high correlation was observed between gumminess and adhesiveness ($P<0.05$, $r^2=0.95$), between gumminess and cohesiveness ($P<0.05$, $r^2=0.82$) and chewiness and gumminess scores ($P<0.05$, $r^2=0.97$) of plain helva samples. On the other hand, a negative and important correlation was found between the adhesiveness and gumminess scores of the samples ($P<0.05$, $r^2=0.84$).

Chewiness is known as a function of hardness (Miguel *et al.*, 2001). As can be seen from Table 2, the chewiness scores of LTH, ATH and HTH samples were 2.93, 2.63 and 9.54 N, respectively. It was found that storage temperature significantly affected the chewiness scores of the samples ($P<0.05$) and the chewiness score of the HTH samples was significantly higher than of the other samples ($P<0.05$). A positive and high correlation was observed between the chewiness and hardness scores of plain helva samples ($P<0.05$, $r^2=0.93$). It is thought that fat loss at the higher ambient temperature might have occurred and this might affected the average chewiness score of the HTH samples.

4. Conclusions

In conclusion, storage temperature is an important factor affecting the textural attributes of plain helva samples. Due to its high fat content, when kept at higher ambient temperatures such as 35 ± 1 °C, higher hardness, chewiness and gumminess scores were obtained. Also, high and positive correlations were observed between hardness and chewiness, gumminess and adhesiveness scores.

The textural attributes are significant parameters for semi-solid products, such as date pastes. These parameters are very important for determining the overall quality and consumer acceptability of such products. These parameters would help the process industries to design new food products, machinery and quality control.

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