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Texture profile analysis (TPA) of Omani halwa while replacing ghee with vegetable oils

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ABSTRACT

Omani halwa is a popular confection in domestic and other gulf countries. Around 10 to 15% (by weight) ghee, clarified butter is added in Omani halwa to obtain desired texture and taste. Ghee contains higher amount of saturated fats (60 to 65%). Health organizations around the world have been insisting to lower the intake of saturated fatty acids as a mean of preventing cardiovascular and other associated diseases. In Oman, the halwa consumption per person could reach even 500 g per day during special occasions. Under these circumstances, the saturated fat intake from just one serving of halwa exceeds the maximum recommended daily limit for saturated fat. Therefore availability of halwa with healthy vegetable oils and acceptable taste would be highly beneficial for the consumers. The objective of this study was to determine the textural qualities of Omani halwa while replacing ghee with healthy vegetable oils. Two vegetable oils (olive and sunflower) halwa (100% replacement for ghee) and ghee halwa (control) were produced at the commercial production facility of Barka Factory for Omani Sweets. The texture parameters of the prepared halwa were analyzed using a texture analyzer. There were no significant differences in cohesiveness, springiness, chewiness and gumminess between olive oil, sunflower oil and ghee halwa samples. The hardness of olive oil halwa was the highest and sunflower oil halwa was the lowest among three tested samples. The adhesiveness of the olive oil halwa was the lowest whereas no significant difference was observed between sunflower oil and ghee halwa samples.

Keywords: Omani halwa, instrumental texture, ghee, olive oil, sunflower oil

INTRODUCTION

Omani halwa is a popular confection in the Gulf countries as a symbol of traditional Oman hospitality. There are about 10,000 industries in Oman producing halwa commercially. The common ingredients for Omani halwa are starch, egg, sugar, water, ghee, saffron, cardamom, nuts, and rose water (Ministry of Information 2002). Around 10 to 15% of ghee (by weight) is added in halwa preparation to improve the keeping quality, and obtain multiple sensory perceptions such as

aroma, pleasant, enjoyable and lingering taste in mouth. Ghee lipids contain both saturated fatty acids and cholesterol (Nath and Ramamurthy 1988). The saturated fat content of ghee is about 60 to 65%.

Health organizations around the world have been insisting to lower the intake of total dietary fat, particularly saturated fatty acids and cholesterol as a mean of preventing cardiovascular heart diseases (AHA 1986; NCEP 1988; Muguerza et al. 2002). World Health Organization recommends taking 15 to 30% of total energy from total fat and less than 10% of energy from saturated fat due to their health effects in obesity, cardiovascular diseases and diabetes (World Health Organization 2002; Nishida et al. 2004).

The halwa is consumed regularly, and the quantity of intake varies based on the occasion. In special occasions, halwa consumption per person could reach even 500 g per day. In a 2000 calorie diet, the general recommendation, from health authorities, for total fat intake is 65 g, and the maximum saturated fat intake is 20 g (USDA 2005). While consuming 500 g halwa/day, the total fat consumption is 75 g ($500 \text{ g} \times 15\%$ ghee in halwa) and saturated fat consumption is 49 g ($75 \times 65\%$ of saturated fat in ghee). In both cases, the daily limit is exceeded from just one serving of halwa. Therefore, reducing the total fat and saturated fat content in Omani halwa will have a greater impact in health of the regular consumers of Omani halwa. Replacing saturated fats in diet with unsaturated fats is a safe, proven, and delicious way to cut the rates of heart disease (Willett and Skerrett 2005).

Olive and sunflower oils contain higher amount of unsaturated fat and lower amount of saturated fats. Unsaturated fats (mono and poly) lower bad cholesterol and raise the good cholesterol. It can also ease inflammation, stabilize heart rhythms and play a number of other beneficial roles in human health. Olive oil contains 56 to 87% of monounsaturated fatty acid, 8 to 25% of saturated fatty acids and 8 to 22% of polyunsaturated fatty acids (IOOC 1984; Koutsopoulos et al. 2008). The consumption of olive oil might be linked to reduced risk of heart disease and breast cancer (Kayaardi and Gok 2003).

Healthy vegetable oils such as olive and sunflower oils have been widely used to substitute animal fat in meat products (Yilmaz et al. 2002; Muguerza et al. 2002; Severini et al. 2003). However the research on replacement of ghee with vegetable oils in halwa or any other confections is scarce. The selection and acceptance of a new product, especially a product with modified formulation of the existing product, by a consumer depends on many factors including the textural attributes (Shepherd and Sparks 1989). The textural attributes of the modified healthy product should be comparable with the tradition product. The objective of this study was to determine textural attributes of Omani halwa with healthy vegetable oils using a texture analyzer.

MATERIALS AND METHODS

Halwa Preparation

The Omani halwa was prepared at the Barka Factory for Omani Sweets, the largest halwa company in Oman. Each company has their own formula for preparation, and protocols are kept confidential. The ingredients used to make the products in this study were: sugar (6 kg), water (175 l), saffron (16 g), cardamom powder (30 g), corn starch (2 kg), rose water (3 lit) and oil (2 kg). Each batch produced approximately 20 kg of finished product (halwa). The approximate total preparation time was 2 h. Three products were prepared using same protocols and ingredients except oil type. The oils used were: 1. Ghee (control) 2. Olive oil and 3. Sunflower oil. The products were kept at room temperature (22°C) for 24 h and then texture study was conducted.

Texture Analysis

A texture analyzer (Model TA XT2i, Stable Micro Systems, Surrey, England) was used to measure the force–time curve using two-cycle compression test as explained by Rahman and Al-Farsi (2005). A plate (diameter 7.5 cm) compressed the halwa cube (10 mm × 10 mm × 10 mm) placed on a mounted fixed table. The load cell was calibrated with a 5 kg weight. The equipment was set to zero automatically lowering the plate until the bottom surface of plate just contacted the table

before each experiment. Then the crosshead was allowed to descend at the rate of 2 mm/s to a total deformation 3 mm (70% compression). When the compression stroke was completed, plunger abruptly reversed direction and started its upward stroke at 5 mm/s. Then a second down and up cycle was run on the same sample. All operations were automatically controlled by the Texture Analyzer. The compression depth was held constant at 3 mm in all experiments. The instrument automatically recorded the force–displacement or force–time curve.

The following attributes were determined from the force – time curve as explained by Rahman and Al-Farsi (2005): hardness, adhesiveness, springiness, cohesiveness, gumminess, and chewiness.

Statistical Analysis

In each textural attribute, the differences within oil type were tested at 95% confidence interval (type I error, $\alpha = 0.05$) by the least significant difference (LSD) method of comparison of means using Statistical Analysis System software (SAS, version 8.02, SAS Institute, Inc., Cary, NC)..

RESULTS AND DISCUSSION

Various textural attribute of modified and control halwa samples are given in Fig. 1. The instrumental hardness of the halwa made with three oils types ranged between 6 and 9 N. The halwa made with olive oil had the highest hardness and sunflower oil had the lowest hardness. While evaluating the effect of partial replacement of pork back fat with olive oil in fermented sausages by Muguerza et al. (2002), it was determined that up to 20% replacement had no effect on firmness. In another study, olive oil replacement (40 and 60% replacement) for beef fat in Turkish soudjouk (sucuk) scored higher values in texture component during sensory study (Kayaardi and Gok 2003). The acceptability of increased hardness (olive oil) and decreased hardness (sunflower oil) in Omani halwa must be studied using sensory evaluation methods.

Cohesiveness is the degree to which the sample deforms (rather than ruptures) (Meilgaard et al 2007). The cohesiveness of the halwa samples was in the range of 0.29 to 0.58. There were no significant differences in cohesiveness between three oil types.

Although chewiness ranged between 1.8 and 4.9 N-m during different replications, it was not significantly different from each other among three oil types.

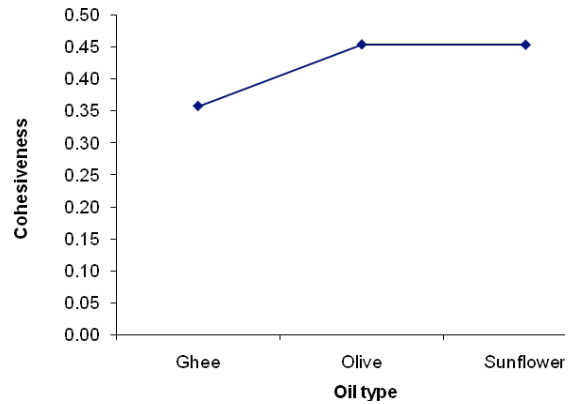
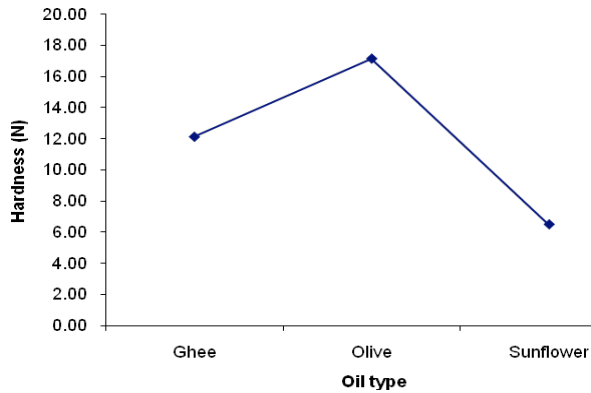
The springiness of the product is the rate of return to original shape after some deformation. It was in the range of 0.38 to 0.85 mm for three halwa samples and not significantly different among three halwa samples.

The gumminess of halwa samples ranged from 3.5 to 9.8 N, however they were not significantly different from each other.

The adhesiveness of the halwa samples varied from -4.8 to -21.6 N-m. There were no differences between sunflower oil and ghee samples. But the adhesiveness of olive oil halwa was significantly lower than other two samples.

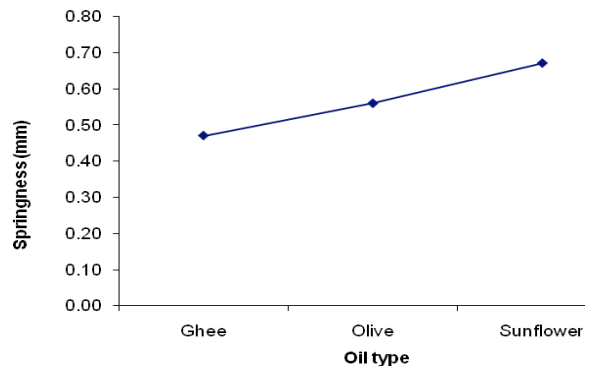
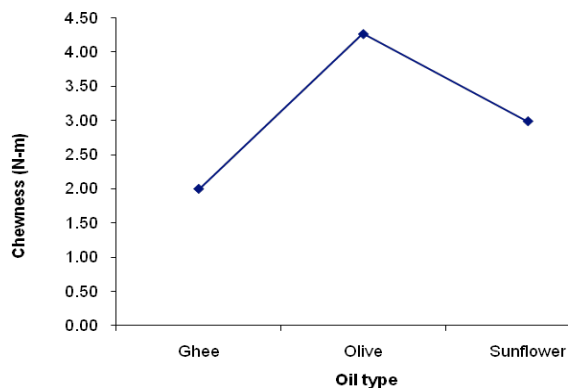
CONCLUSION AND RECOMMENDATION

In general, most of the instrumental textural properties of the olive oil and sunflower oil halwa samples were similar to the control (ghee halwa). The olive oil halwa had higher hardness and lower adhesiveness than ghee halwa. The human perception on the textural attributes of the modified halwa must be evaluated through sensory analysis. There are opportunities to modify this popular halwa with healthy vegetable oils, and educate the people about health benefits of consuming the modified halwa. The shelf life study must be conducted for the modified products as unsaturated fats are unstable at environmental storage while comparing to saturated fats.



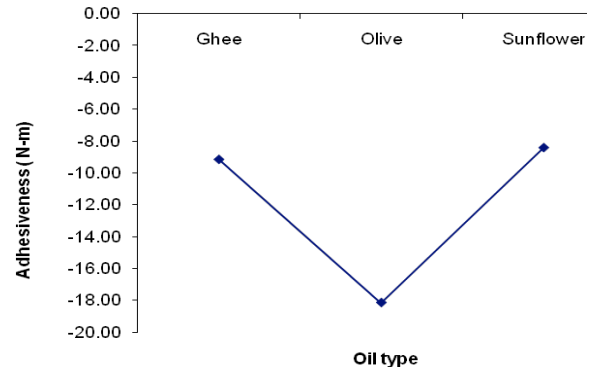
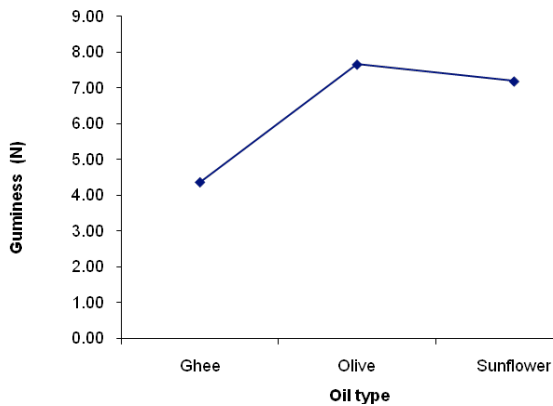
Hardness

Cohesiveness



Chewiness

Springiness



Gumminess

Adhesiveness

Fig 1. Textural properties of Omani-halwa with different oils

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