Journal of the Association of Arab Universities for Basic and Applied Sciences (2014) **15**, 61–67

University of Bahrain

Journal of the Association of Arab Universities for Basic and Applied Sciences

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خفض الدهون المشبعة في الأغذية التقليدية من خلال استبدال السمن بزيت الزيتون وزيت عباد الشمس- دراسة حالة للحلوى

مانيكافاسجان أنامالي و جمال بن ناصر الصباحي

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الملخص:

تتزايد الأمراض ذات الصلة بالنظام الغذائي بمعدل ينذر بالخطر في جميع أنحاء العالم .التقييد المتعلق بتناول الدهون المشبعة هو أحد المكونات الرئيسية في نظام غذائي صحي كوسيلة لمنع أمراض القلب والأوعية الدموية والأمراض الأخرى المرتبطة بها. السمن هو أحد الأنواع التي تحتوي على كمية عالية من الدهون المشبعة (حوالي 60% دهون مشبعة) وهو يستهلك جنبا إلى جنب مع العديد من الأطعمة التقليدية الآسيوية. الحلوى هي نموذج للحلويات التقليدية في سلطنة عمان، و تحظى بشعبية محلياً وفي دول الخليج الأخرى، وتم تعديلها عن طريق استبدال السمن بالزيوت النباتية الصحية وعمل اختبار لقبولها. تم إنتاج ثلاثة أنواع من الحلوى باستخدام زيت الزيتون وزيت عباد الشمس والسمن (كعينة مراقبة) وذلك في منشأة الإنتاج التجاري وتم تحديد صفاتهم التكوينية و الحسية. وفي فحوصات الجوانب التكوينية، لم تكن هناك فروق ذات دلالة إحصائية في التماسك والليونة والمضغ والالتصاق بين عينات الحلوى المصنعة باستخدام زيت الزيتون وزيت عباد الشمس او السمن. صلابة الحلوى المصنعة من زيت الزيتون كانت الأعلى والحلوى المصنعة من زيت عباد الشمس كانت الأقل من بين الثلاث عينات التي تم اختبارها. لم يكن هناك اختلاف كبير في القبول العام بين الحلوى المصنعة من السمن او من زيت عباد الشمس. في اختبار الحسية العشوائي اختار 60% من الإناث و80% من الذكور الحلوى المصنعة من زيت عباد الشمس، وفقط 10% من الإناث و 10% من الذكور كانت الحلوى المصنعة من زيت الزيتون اختيارهم الأول من بين الخيارات المعروضة. لكن في حالة الاختبار الحسي المعرف، زاد اختيار الحلوى المصنعة من زيت الزيتون كخيار أول إلى 55 % من الإناث و 30 % من الذكور. حوالي 80 % من المشاركين في علم الاختبار الحسي المعرف كانوا على استعداد لقبول الحلوى الغير محتوية على السمن – التي تم إعدادها أو مع تحسين المنتج. هناك فرص لتعديل الأطعمة التقليدية الغنية بالدهون المشبعة عن طريق الاستبدال بالزيوت الصحية، وتثقيف الناس حول الفوائد الصحية من هذه التعديلات.

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ORIGINAL ARTICLE

Reduction of saturated fat in traditional foods by substitution of ghee with olive and sunflower oils – A case study with halwa

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Received 14 October 2012; revised 30 April 2013; accepted 18 June 2013
Available online 11 July 2013

KEYWORDS

Ghee;
Saturated fat;
Halwa;
Instrumental texture;
Olive oil;
Sunflower oil

Abstract Diet related diseases are increasing at an alarming rate all over the world. Restriction in dietary saturated fat intake is one of the major components in healthy diet as a mean of preventing cardiovascular and other associated diseases. Ghee is one of the high saturated fat types (around 60% saturated fat) which is consumed along with many Asian traditional foods. As a model food, halwa, a traditional confection in Oman, which is popular in domestic and many other gulf countries is modified by replacing ghee with healthy vegetable oils and tested for their acceptability. Three types of halwa, olive oil halwa, sunflower oil halwa and ghee halwa (control) were produced in a commercial production facility and their textural and sensorial attributes were determined. In instrumental texture profiles, 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. In sensory evaluation of developed halwa products, there was no significant difference in the overall acceptability between ghee and sunflower oil halwa. In blind sensory test, 60% of females and 80% of males selected sunflower oil halwa, and only 10% of females and 10% males selected olive oil halwa as their first choice of preferences. But in informed sensory test, the selection of olive oil halwa as the first choice was increased to 55% in females and 30% in males. About 80% of the panelists in informed sensory test were ready to accept non-ghee halwa the way it was prepared or with product improvement. There are opportunities to modify traditional foods which are rich in saturated fat by replacing with healthy oils, and to educate the people about the health benefits of these modifications.

1. Introduction

In many traditional Asian foods, including regular snacks and meals, ghee is added abundantly to improve the taste, flavor, and aroma. Ghee lipids contain both saturated fat and cholesterol (Nath and Ramamurthy, 1988). The saturated fat content

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Peer review under responsibility of University of Bahrain.

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http://dx.doi.org/10.1016/j.jaubas.2013.06.003

of ghee is about 60% (Al-Khalifah and Al-Kah tani, 1993). Higher intake of dietary saturated fat and cholesterol increases the risk of cardiovascular diseases, obesity and diabetes (American Heart Association, 1986; National Cholesterol Education Program, 1988; Muguerza et al., 2002). The World Health Organization advises to consume less than 10% of energy from saturated fat due to its health effects (World Health Organization, 2002; Nishida et al., 2004). The United States Department of Agriculture (USDA) insists to restrict the daily intake of saturated fat to 20 mg. The American Heart Association recommends restricting the intake of saturated fat within 7% of the total calorie consumption (American Heart Association, 2011). The Omani guide to healthy eating suggests choosing oils that contain less than 2 g of saturated fat per tablespoon (The Omani Guide to Healthy eating, 2009).

In spite of all these recommendations, the consumption of dietary saturated fat through ghee and other sources of oil is high in several regions of Asia (The Omani Guide to Healthy eating, 2009; Dietary Guidelines for Indians, 2003). Therefore reduction of saturated fat intake will be highly beneficial to reduce the risk of many related diseases. Instead of educating the people to avoid eating foods which are rich in saturated fat, it will be more practical to modify the traditional food with healthy oil. While developing such products, the acceptability of the modified food should be comparable with the original product. In this study, as model food, halwa, a traditional Asian food which is rich in saturated fat is modified by replacing ghee with healthy vegetable oils and the textural and sensory attributes were investigated.

Omani halwa is a popular confection in the Gulf countries as a symbol of traditional Oman hospitality. The common ingredients of this halwa are starch, egg, sugar, water, ghee, saffron, cardamom, nuts, and rose water (Ministry of Information, 2002). Around 10–15% of ghee (by weight) is added in halwa preparation to improve the keeping quality, and obtain multiple sensory perceptions such as aroma, and pleasant, enjoyable and lingering taste in the mouth.

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 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 g × 15% ghee in halwa) and saturated fat consumption is 45 g (75 × 60% of saturated fat in ghee). In both cases, the daily limit is exceeded from the consumption of halwa alone. Therefore, reducing the total fat and saturated fat content in halwa will have a greater impact on health of the regular consumers of this product. Replacing saturated fats in diet with unsaturated fats is a safe, proven, and delicious way to cut the rates of heart diseases (Willett and Skerrett, 2005).

Olive and sunflower oils contain higher amount of unsaturated fat and lower amount of saturated fat (Table 1). Unsaturated fats (mono and poly) lower bad cholesterol (LDL) and raise the good cholesterol (HDL). They can also ease inflammation, stabilize heart rhythms and play a number of other beneficial roles in human health. Olive oil contains 56–87% of monounsaturated fatty acid, 8–25% of saturated fatty acids and 8–22% of polyunsaturated fatty acids (International Olive Oil Council, 1984; Koutsopoulos et al., 2008). The consumption of olive oil might be linked to reduced risk of heart diseases and some cancers (Kayaardi and Gok, 2004).

Table 1 Fatty acid profiles (%) of ghee, olive and sunflower oils.

	Ghee	Olive oil	Sunflower oil
12:0	3.0		
14:0	10.8		
16:0	35.0	10.7	10.4
18:0	9.8	3.7	3.7
18:1	32.8	76.2	21.1
18:2	2.9	6.8	55.7
18:3		0.7	7.6
Σ Monounsaturated fat	32.8	76.2	21.1
Σ Polyunsaturated fat	2.9	7.5	63.3
Σ Saturated fat	58.6	14.4	14.1

(*Source*: Al-Khalifah and Al-Kahtani, 1993; Quere and Sebedio, 1996).

Healthy vegetable oils such as olive and sunflower oils have been widely used to substitute animal fat in meat products (Muguerza et al., 2002; Yilmaz et al., 2002; Severini et al., 2003). However, the research on fat content or fat type in halwa is not available. The selection and acceptance of a new product, especially a product with modified formulation of the existing product, by a consumer depend on many factors including sensory attributes and it should be comparable with the traditional product (Shepherd and Sparks, 1989). The objectives of this study were: 1. To determine the instrumental textural attributes of Omani halwa with olive and sunflower oils 2. To determine the sensory qualities and acceptability of Omani halwa with olive and sunflower oils.

2. Materials and methods

2.1. 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 powder (16 g), cardamom powder (30 g), corn starch (2 kg), rose water (3 l) 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 types of fat. The fats 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 and sensory studies were conducted.

2.2. Textural attributes

2.2.1. Texture evaluation

A texture analyzer (Model TA XT2i, Stable Micro Systems, Surrey, England) was used to measure the force–time curve using the two-cycle compression test (Bourne, 1978; Friedman et al., 1963; 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 the 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 its direction and started 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 experiment was replicated 5 times in each oil type. 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.

2.3. Sensory attributes

2.3.1. Evaluation sheet

A sensory evaluation sheet was designed and developed. In the first section, the demographic details (gender, age, educational qualification and native place) of the panelists were collected. Then the hedonic sensory scale was explained (1- like extremely, 2 – like very much, 3 – like moderately, 4 – like slightly, 5 – neither like nor dislike, 6 – dislike slightly, 7 – dislike moderately, 8 – dislike very much, 9 – dislike extremely). In the second section, the panelists were asked to test 11 attributes of the products and give a score using the hedonic scale. The attributes were: appearance (color, visible oil), mouth feel and taste (softness, chewiness, solubility, sweetness, desired taste, off-taste), aroma (desired aroma, off-odor) and overall acceptability. At the end of the second section, the panelists were asked to write their comments about the product (optional).

In the last section of the sensory evaluation sheet, the panelists were asked to select their first choice among the given products. In the blind sensory test, as the panelists were not given the product details, they were given 3 product codes (A, B or C) and asked to select one as their first choice. But in the informed sensory evaluation, the actual product names were given to the panelists. Therefore, while selecting the first choice, in addition to the 3 products; two more options were given to the panelists such as: ''I like olive oil halwa but with improvement in product preparation'' and ''I like sunflower oil halwa but with improvement in product preparation''. Thus there were five options for the first choice question in the informed sensory test.

2.3.2. Panel and sensory

The untrained panelists were randomly selected from a pool of undergraduate students at the Sultan Qaboos University ($n = 40$). Two types of sensory tests (informed and blind) were conducted in four batches (10 students in each batch; total 20 males and 20 females). The panelists were within the age range of 19 to 23. For blind sensory evaluation, no product information was provided to the panelists, and coded samples (A, B and C) were given whereas in the informed sensory evaluation, the panelists were explained about the ingredients of three products (oil focus) and facts about the unhealthy effects of saturated fat and health benefits of unsaturated fat, before the test. The actual names (Ghee halwa, Olive oil Halwa and sunflower oil halwa) were given to the samples in informed sensory evaluation. This study was conducted at the ''Sensory and Food Preparation Laboratory'' of the College of Agricultural and Marine Sciences at the Sultan Qaboos University.

2.4. Data 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 mean. Similarly for each sensory attribute, the effect of gender, sensory type and oil type on product quality was studied by analysis of variance (ANOVA) using 3 factorial design models (2 sensory types (blind vs informed) $\times$ 2 gender (male vs female), and 3 oil types (ghee $\times$ olive oil $\times$ sunflower oil)) with the general linear model (GLM) procedure. In all sensory attributes, the differences within the levels under each variable were tested at 95% confidence interval (type I error, $\alpha = 0.05$) using the LSD method of comparison of means. All statistical tests in this study were conducted using Statistical Analysis System software (SAS, version 8.02, SAS Institute, Inc., Cary, NC). Results are presented as mean values of replicates and standard deviation ($\pm$SD).

3. Results and discussion

3.1. Textural attributes

Instrumental textural properties of modified and control halwa samples are given in Fig. 1. The instrumental hardness of the halwa made with three oils types ranged between 6.5 and 17.0 N. The halwa made with olive oil had the highest hardness and sunflower oil had the lowest hardness. The effect of oil change on hardness is dependent on the type of oil, amount of replacement and product type. For example while evaluating the effect of partial replacement of pork back fat with olive oil in fermented sausages Muguerza et al. (2002) determined that up to 20% replacement had no effect on firmness. In another study Luruena-Martinez et al. (2004) determined that olive oil addition produced a decrease in hardness without affecting the overall acceptability of frankfurters. Therefore increase or decrease of hardness and consumer acceptability due to olive oil replacement might be product specific.

Cohesiveness is the degree to which the sample deforms (rather than ruptures) (Meilgaard et al., 2007). The cohesiveness of 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 between each oil types.

The springiness of the product is the rate of return to the 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 them.

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.

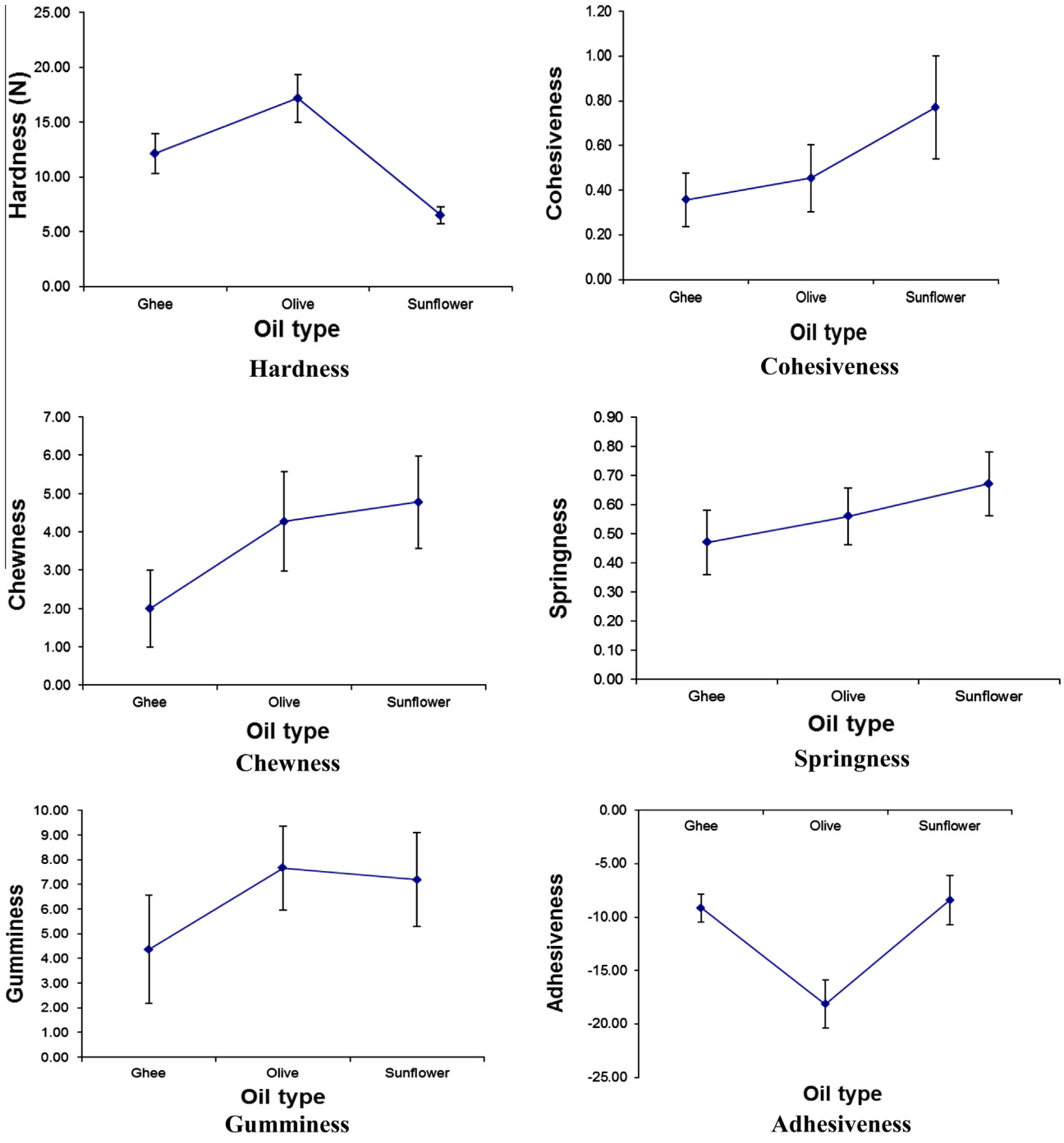

Figure 1 Textural properties of Omani-halwa with different oils (mean ± SD, $n = 5$). Hardness - force to attain a given deformation; cohesiveness – degree to which sample deforms (rather than ruptures); chewiness – number of chews required masticate before swallowing; springiness – rate of return to original shape after some deformation; guminess – being sticky and cohesive; adhesiveness – force required to remove sample from a given surface (Prasert and Suwannaporn, 2009; Meilgaard et al., 2007)

3.2. Sensory attributes

The mean scores for various sensory attributes of three halwa types are shown in Table 2.

3.2.1. Appearance

3.2.1.1. Color. There was no difference between the type of sensory test and genders on the likeness of the color of three halwa products. However, the likeness score for the color of sunflower oil halwa was significantly different from other two samples (no difference between them). In Turkish soudjouk (sucuk) while replacing 20%, 40% and 60% of beef fat with olive oil, it was determined that sausages with 40% replacement received high evaluation from the panel for appearance and texture but no difference between samples in color and general acceptability (Kayaardi and Gok, 2004).

Table 2 Mean sensory score for various quality attributes of halwa.

		Male			Female			Overall		
		Ghee	Olive oil	Sunflower oil	Ghee	Olive oil	Sunflower oil	Ghee	Olive oil	Sunflower oil
Appearance	Color	3.2 ± 1.2	3.9 ± 2.1	2.5 ± 1.2	3.3 ± 1.0	3.7 ± 1.4	2.0 ± 1.6	3.2 ± 1.1	3.8 ± 1.7	2.3 ± 1.4
	Visible oil	3.6 ± 1.5	3.8 ± 1.9	3.7 ± 1.8	3.4 ± 1.6	4.0 ± 1.9	3.5 ± 2.2	3.5 ± 1.5	3.9 ± 1.9	3.6 ± 2.0
Taste and mouth feel	Softness	3.2 ± 2.0	4.9 ± 2.2	2.9 ± 1.8	2.7 ± 1.6	4.2 ± 2.1	2.8 ± 1.7	2.9 ± 1.8	4.5 ± 2.2	2.8 ± 1.7
	Chewiness	2.9 ± 1.7	4.8 ± 2.1	3.2 ± 1.9	3.0 ± 1.5	4.3 ± 1.9	2.9 ± 1.9	2.9 ± 1.6	4.5 ± 2.0	3.0 ± 1.9
	Solubility	3.4 ± 1.9	5.6 ± 2.1	3.2 ± 1.9	2.7 ± 1.1	3.9 ± 1.9	3.1 ± 2.1	3.0 ± 1.6	4.7 ± 2.1	3.1 ± 2.0
	Sweetness	3.2 ± 1.8	4.1 ± 2.3	2.6 ± 1.1	3.0 ± 1.2	3.8 ± 1.9	3.3 ± 1.9	3.1 ± 1.5	3.9 ± 2.1	2.9 ± 1.6
	Desired taste	2.9 ± 1.3	5.0 ± 2.8	2.9 ± 1.9	3.4 ± 1.9	3.8 ± 2.0	3.4 ± 2.3	3.2 ± 1.7	4.4 ± 2.4	3.2 ± 2.1
	Off taste	6.3 ± 2.4	6.5 ± 2.7	5.3 ± 3.0	6.2 ± 2.5	6.7 ± 2.1	6.4 ± 2.7	6.2 ± 2.4	6.6 ± 2.4	5.8 ± 2.8
Aroma	Desired aroma	3.2 ± 2.0	3.9 ± 2.4	2.6 ± 1.5	3.2 ± 1.7	3.6 ± 1.8	3.2 ± 1.8	3.2 ± 1.8	3.8 ± 2.1	2.9 ± 1.7
	Off odor	6.2 ± 2.7	5.1 ± 2.8	6.1 ± 2.8	6.2 ± 2.4	6.9 ± 2.3	6.2 ± 2.7	6.2 ± 2.5	6.0 ± 2.7	6.1 ± 2.7
Overall acceptability		3.1 ± 1.8	4.1 ± 2.6	2.9 ± 2.1	3.3 ± 1.9	4.5 ± 2.4	2.2 ± 1.4	3.2 ± 1.8	4.3 ± 2.5	2.6 ± 1.8

The values are expressed as mean value of (1- like extremely, 2- like very much, 3- like moderately, 4- like slightly, 5- neither like nor dislike, 6- dislike slightly, 7- dislike moderately, 8- dislike very much, 9- dislike extremely) ±SD (n = 40).

3.2.1.2. Visible oil. The average score for the visible oil in three products was between 'like moderately' and 'like slightly' (3 to 4). There were no differences in visible oil perception between sensory type, gender and oil type.

3.2.2. Taste and mouth feel

3.2.2.1. Softness. The softness score given by the panelists was the highest for olive oil halwa (average score = 4.5) compared to other products. There was no difference between the softness of sunflower oil and ghee products. This was in confirmation with the instrumental hardness results. In another study, the flexibility was increased in the sausages supplemented with sunflower oil (Park et al., 1990). One of the panelists in our study mentioned that "normally ghee halwa is microwaved before consumption to make it soft, whereas this sunflower oil halwa has similar softness without microwaving". The sensory test type and gender did not make any difference in the evaluation of softness of halwa products.

3.2.2.2. Chewiness. The olive oil product was rated as hard to chew (average score = 4.5) compared to other two products. There were no differences in chewiness between the sunflower oil and ghee products.

3.2.2.3. Solubility. The solubility of halwa products were liked by female (average score = 3.2) more than male panelists (average score = 4.0). Similarly olive oil halwa had less solubility in mouth (4.7) than sunflower oil (3.1) and ghee (3.0) products.

3.2.2.4. Sweetness. The olive oil halwa was less sweeter than other two products, and there was no difference in sweetness between sunflower and ghee products.

3.2.2.5. Desired taste. The taste is the gustatory perceptions caused by soluble substances in the mouth. Sunflower oil and ghee products had same desired taste (average score = 3.2), however the olive oil product was least preferred (average score = 4.4).

3.2.2.6. Off taste. There were no differences between oil types in the perception of off taste attribute of halwa.

3.2.3. Aroma

3.2.3.1. Desired aroma. Aroma is the volatiles perceived by the olfactory system from food and the amount of volatile escaped is affected by the nature of product and temperature. More volatiles escaped from soft and porous surface than hard and smooth surface (Meilgaard et al., 2007). There was no difference in desired aroma between olive oil and ghee, and ghee and sunflower oil products. But sunflower oil based product has more desired aroma value than olive oil sample.

3.2.3.2. Off odor. There were no differences between oil types in the perception of off odor attribute of halwa.

3.2.3.3. Overall acceptability. Ghee and sunflower oil products had equal and better overall acceptability than olive oil products. There were no differences in the overall acceptability between male and female panelists, and blind and informed sensory types. In several products, sunflower and olive oil

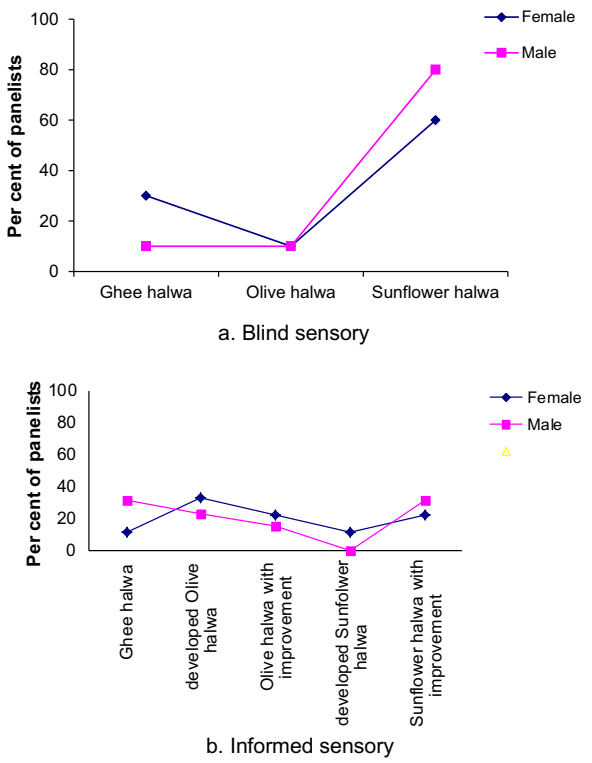

Figure 2 First choice chosen by panelists in blind and informed sensory tests (n = 40 panelists).

replacements (partial or complete) have shown similar or higher acceptability than control. Low-fat sausage supplemented with sunflower oil had the highest acceptability and no negative sensory characteristics (Yilmaz et al., 2002). Lopez-Lopez et al. (2009) have proven that replacement of pork back fat with olive oil in frankfurters produced acceptable characteristics similar to control products. Muguerza et al. (2002) have stated that low fat sausage with olive oil scored the highest for odor and taste. While comparing fat spreads, it was determined that the olive oil based product had a similar hedonic preference to that of the market dominant brand (Bower and Saadat, 1998). The partial substitution of pork back fat with olive oil in 'salami' products did not affect the physical and sensory characteristics and shelf life of the product (Severini et al., 2003).

3.2.4. Choice of preference

When the panelists were asked to select the most preferred product as their "first choice", in blind sensory evaluation, 80% of males and 60% of females selected sunflower oil halwa (Fig. 2). About 30% of female and 10% of male panelists selected ghee as their first choice, whereas only 10% of males and 10% of females selected olive oil halwa as their first choice.

The selection of a new product may also be determined by the attitudinal differences especially between genders (Bower and Saadat, 1998). Bowar and Saadat (1998) stated that blind sensory evaluation alone cannot reflect the 'real' food selection and acceptance, thus product label information must be provided in this type of studies. In our study, the selection was changed when the product information was given. Around 55% females (vs. 10% in blind sensory) and 38% males (vs. 10% in blind sensory) selected developed olive oil halwa or with product improvement as their first choice. In general, females have more health awareness in terms of diet, an assumption would be that they perceived certain products as being 'healthy' and it would be expected that there would be a selective elevation of scores based on health-related decision (Bower and Saadat, 1998). In female groups, the labeled products scored higher, which was attributed to a balance between sensory and possible health concern based decisions (Bower and Saadat, 1998). In our study, overall 45% of the panelists preferred sunflower oil or olive oil halwa with product improvement. While educating and providing product information, panelists were keen to choose new healthy products. Further research is required to improve the product quality such as decreasing hardness or improving adhesiveness of olive oil product by changing processing condition or with partial replacement.

4. Conclusion

Saturated fat content of traditional halwa was reduced by replacing ghee with healthy vegetable oils, and this modified halwa had acceptable sensory qualities. Most of the instrumental textural properties of the olive oil and sunflower oil halwa samples were similar to the ghee halwa. But the olive oil halwa was harder and less adhesive than ghee halwa. Although many sensory attributes of olive oil halwa had the lowest scores compared to other products, their preference changed when the product information was revealed to the panelists. About 80% of panelists were ready to accept the non-ghee halwa with respect to the method of preparation or some product improvements in future. The shelf life study must be conducted for the modified products as unsaturated fats are unstable at long term storage while comparing to saturated fats. There are ample opportunities to modify and improve many popular traditional foods with healthy vegetable oils, and educate the people about their health benefits.

Acknowledgements

Author would like to thank the Dean of College of Agricultural and Marine Sciences, Sultan Qaboos University for providing Seed Grant. Dr. S. Rahman, Dr. Qassim Al-Shamsi, Rihal Said Salim Al Hashmi, Ahlam Salim Ali Al Sulti, Ibtism, Aysha, and Rashid Hamed Al-Belushi are acknowledged for their support in halwa preparation, texture and sensory evaluation. The help rendered by Barka Factory for Omani Sweets company and Mr. Zakaria (Production Manager) for making halwa in their production facility is greatly acknowledged.

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