J. Agr. Sci. Tech. (2017) Vol. 19: 85-95

Consumer Acceptance and Quantitative Descriptive Analysis of Pistachio Spread

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ABSTRACT

Pistachio nut (*Pistacia vera L.*) is one of the popular and nutritious tree nuts in the world. Pistachio spread is a new product which is made from pistachio paste, icing sugar, Soy Protein Isolate (SPI), and Red Palm Oil (RPO). This study involved sensory acceptability (by 32 assessors) using Hedonic scale and development of suitable terminology for describing pistachio spread using Quantitative Descriptive Analysis (QDA). This study represents the first report on using QDA for sensory evaluation of pistachio products. The QDA method is used to determine the sensory profile of the two pistachio spreads with higher acceptability in the Hedonic scale (Formulation 12 including 50% pistachio paste, 30% icing sugar, and 20% RPO and Formulation 16 including 58.3% pistachio paste, 25% icing sugar, and 16.7% RPO). According to the results, RPO has a direct effect on the sensory acceptance of pistachio spread (P< 0.05). Eight panelists were selected for evaluation of pistachio spread. Twenty attributes (in terms of appearance (green color, visible particles, glossy), aroma (sweet, roasted, nutty, milky/creamy), flavor taste (beany, sweet, oily, bitter, nutty, creamy), texture (stickiness, oiliness, firmness, adhesiveness, spreadability), and aftertaste (bitter, astringency) were identified and developed for the product. No significant difference was observed in all pistachio spread formulations attributes, except for sweetness (P< 0.05).

Keywords: Hedonic test, Panelist, QDA, Red palm oil, Sensory evaluation.

INTRODUCTION

The pistachio nut (*Pistacia vera* L.) is a nutritious and popular tree nut in the world. The nutritional composition of pistachio includes 45% fat, 20% protein, 28% carbohydrate, 3% ash and 5% moisture (w/w) (Venkatachalam and Sathe, 2006). Predominant fatty acid of pistachio oil is oleic acid (69.6%), followed by linoleic acid (15.4%) and palmitic acid (9.9%) (Arena *et al.*, 2007). Pistachio oil contains large amounts of phytosterols and tocopherols (Bolling *et al.*, 2011; Ryan *et al.*, 2006). Evidence from several studies suggests that pistachio consumption can reverse several adverse blood lipid parameters such as hypercholesterolemia (Edwards *et al.*, 1999).

The split pistachios are consumed as roasted and/or salted nut snacks. The unsplit form can be used for the production of pistachio nut spread (De Pilli *et al.*, 2012; Maghsoudi *et al.*, 2012; Rafiee *et al.*, 2009; Shakerardekani *et al.*, 2013a). Nut spreads are spreadable product having at least 40% nut ingredients, which can be added in various forms such as whole or pieces of nuts, a paste or a slurry (Nielsen, 2010; Shakerardekani *et al.*, 2013b). They are made by grinding roasted nuts into a paste that can be spread like true butter. Analysis of nut spread by sensory methods provides important information to the product developers. In development of pistachio spread, sensory attributes such as aroma, taste, color, spreadability, and texture are

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[DOR: 20.1001.1.16807073.2017.19.1.3.8]

amongst important factors that determine consumer acceptability. One of the most used scales to quantify consumer acceptance is Hedonic scale. Hedonic tests ask consumers to quantify their degree of liking for a given product (De Pilli *et al.*, 2012). It is recommended not to ask consumers for sensory description of the evaluated product, during Hedonic tests (Veinand *et al.*, 2011). Hedonic scales have been applied for assessing the acceptability of pistachio products such as raw pistachio (Mexis and Kontominas, 2009; Nejad *et al.*, 2003; Tsantili *et al.*, 2010), roasted pistachio (Nikzadeh and Sedaghat, 2008) and pistachio butter (Emadzadeh *et al.*, 2011).

Most descriptive methods require trained assessors. During training, the assessors qualitatively describe the sensory perceptions in their own words, and quantitatively use past experience to evaluate intensity. Trained assessors need a common qualitative language and a quantitative reference for evaluation of standardized products on an intensity scale (Murray *et al.*, 2001; O'Keefe *et al.*, 1993). QDA method is a descriptive analysis technique in which a trained sensory panel assess a full range of sensory characteristics by generating an agreed list of attributes and individually rating the received intensity on line scales. This method is based on the principle of a panelist's ability to verbalize perceptions of a product; panelists are screened and trained in attribute recognition and scaling, they use a common and agreed sensory language, and products are scored on repeated trials to obtain a complete, quantitative description (O'Keefe *et al.*, 1993). QDA have been used to characterize the sensory properties of peanut products such as peanut butter (Gills and Resurreccion, 2000a; McNeill *et al.*, 2002), peanut spread (Yeh *et al.*, 2002) and peanut soy spread (Dubost *et al.*, 2003), but until now, no study has reported the use of QDA for evaluating pistachio products. Therefore, this study concentrated on the development of pistachio spread. The objectives were to evaluate the sensory acceptability of pistachio spread using Hedonic scale and assess the sensory characteristics of the most acceptable pistachio spreads using QDA.

MATERIALS AND METHODS

Experimental Design

Pistachio spreads were prepared using pistachio paste (41.7-70%), icing sugar (8.3-37.5%), SPI (0-25%) and RPO (0-25%). A full factorial design was applied to create the different formulations of pistachio spread (Table 1). The analysis of variance (ANOVA) was performed using Minitab 16.1.0.0 (Minitab Inc., USA). Tukey's test was applied to detect the differences among the pistachio spread samples and panellists ($P< 0.05$).

Pistachio Spread Preparation

Raw, dried pistachio nuts (Ohadi variety) were provided by the Pistachio Research Center (Kerman, Iran). The method of preparation was according to the production of pistachio spread (Shakerardekani *et al.*, 2013a) with some modifications. Pistachio kernels (10.3 kg) were roasted using a hot air oven (Memmert, UNB 500, GmbH, Schwabach, Germany) at 134±1°C for 30 minutes. The roasted pistachio kernels were ground in a Supermass Colloider (Masuko, model MKZA6-5, Japan) that was set at a stone clearance of 20 µm at 1,000 rpm. The following ingredients were added to the pistachio paste according to the formulations as shown in Table 1 (Shakerardekani *et al.*, 2013a): Icing sugar (Prai, Malaysian Sugar Mfg. Co. Bhd., Malaysia), soy protein isolate, SPI (Gushen, Gushen Biological Technology Group Co., Ltd, Shandong, China), and red palm oil, RPO (Carotino, Carotino Sdn. Bhd. Johor, Malaysia). The mixture of pistachio paste, icing sugar and RPO was blended in a laboratory blender (Waring, Model HGBTWT, Torrington, USA) at low speed for 3 minutes to obtain

[DOR: 20.1001.1.16807073.2017.19.1.3.8]

Table 1. Formulations of pistachio spread using factorial design.

Formulation	Ingredients (%)			
	Pistachio Paste (PP)	Icing sugar	Soy Protein Isolate (SPI)	Red Palm Oil (RPO)
1	70.0	10.0	0.0	20.0
2	87.5	12.5	0.0	0.0
3	62.5	12.5	0.0	25.0
4	50.0	30.0	20.0	0.0
5	70.0	30.0	0.0	0.0
6	50.0	10.0	20.0	20.0
7	62.5	37.5	0.0	0.0
8	70.0	10.0	20.0	0.0
9	58.3	8.3	16.7	16.7
10	41.7	25.0	16.7	16.7
11	58.3	25.0	16.7	0.0
12	50.0	30.0	0.0	20.0
13	60.0	20.0	10.0	10.0
14	83.3	16.7	0.0	0.0
15	50.0	21.4	14.3	14.3
16	58.3	25.0	0.0	16.7
17	62.5	12.5	25.0	0.0

pistachio spread. The spread samples were prepared in triplicate, filled in a polypropylene plastic container (8 cm height, 11 cm diameter) with lid and stored at 4±2°C for not more than three days.

Sensory Evaluation Using Hedonic Scale

Sensory evaluation of pistachio spreads was performed using the structured 9-point Hedonic scale. Thirty-two untrained panelists (11 males, 21 females) comprising students and staff of the Faculty of Food Science and Technology, Universiti Putra, Malaysia, participated in the pilot study. Since there were too many samples for one session, the test was conducted at the Sensory Laboratory, Faculty of Food Science and Technology, Universiti Putra, Malaysia, in two sessions. Samples for testing were taken out of the chiller and allowed to stand at 20±2°C for 1 hour before preparation. About 10 g of each spread was placed in polypropylene containers (4.5 cm in diameter and 3.3 cm height) fitted with lids and labeled with a three-digit random code number. Nine samples were evaluated in Session 1, while another eight samples were evaluated in Session 2. Plain crackers were provided to test the spreadability of the pistachio spreads. All samples were randomly served to the panelist (ISO, 1993).

Sensory Evaluation of Pistachio Spread Using QDA

Selection and Training of Panelists

Selection and training of panelists were conducted at the Sensory Laboratory, Faculty of Food Science and Technology, Universiti Putra, Malaysia, Serdang, Selangor. The pre-selection criteria used were interest, willingness to participate, availability, healthy and absence of food allergies, especially to nuts. Panelists were regular consumers of nut butter, such as peanut butter (at least once a month). Potential panelists with no prior descriptive experience were recruited after a series of screening tests that consisted of basic taste, aroma identification, ranking, and triangle tests (Meilgaard *et al.*, 1999; Molteberg *et*

[DOR: 20.1001.1.16807073.2017.19.1.3.8]

al., 1996; Richter *et al.*, 2010). In the basic taste test, the candidates were asked to correctly identify four randomly coded aqueous solutions of sucrose (0.5%), sodium chloride (0.1%), caffeine (0.02%) and citric acid (0.02%). In the ranking test, each candidate was required to rank four samples to evaluate their ability to differentiate different degrees of sweetness based on a series of sucrose concentrations (2, 5, 10, and 15%). In the triangle test, the candidates had to identify the odd sample among three peanut butter samples in term of creaminess and crunchiness. Finally, in the aroma identification test, the candidates were required to correctly identify six aromatic food substances including butter, almond, lemon, rose, vanilla, and ginger essences in six, 100 ml glass stoppered bottles. Approved candidates in all screening tests were invited for the training session, which took place over a four day period with a total of 4 sessions each lasting for 2.5 hours each day. The training activities involved the development of terminology to describe pistachio spread sensory properties, familiarization of the newly developed terminology and the 150 mm line scale used for each descriptor (Meilgaard *et al.*, 1999). To ensure the effectiveness of the training, the panelists performance were monitored by using ranking and triangle tests according to International Standard Organization, ISO (1993), prior to the pistachio spread samples evaluation .

Evaluation of Pistachio Spread Using QDA

Approximately 1 hour before each test, 10 g of each pistachio spread (20±2°C) was placed in polypropylene containers (4.5 cm in diameter and 3.3 cm height) fitted with lids and labeled with a three-digit random code number. Based on the overall findings obtained from Hedonic scale, the 2 most acceptable pistachio spreads (Formulations 12 and 16) were selected for QDA. Both of these spreads were served in triplicate i.e. all together 6 pistachio spread samples were randomly presented for evaluation by the trained panelists during each session. They were instructed to assess the stickiness, firmness, and adhesiveness of the spread and rate the intensity of each of the attributes using a 150-mm line scale. All the panelists were required to rinse their mouth before tasting each sample. Plain crackers (2×3 cm) were also provided as a carrier for panelists to evaluate the spreadability of the product (Meilgaard *et al.*, 1999).

RESULTS AND DISCUSSION

Sensory Evaluation Using Hedonic Test

Table 2 shows the mean scores of different formulations of pistachio spread in terms of taste, aroma, color, spreadability, overall texture, and overall acceptability. The scores of formulations 4, 8, 11, and 17 which did not contain RPO were among the lowest mean scores (scores of 2.5 to 5.2) for all the sensory attributes tested, indicating that these samples were considered from ‘neither like nor dislike’ to ‘disliked very much’ by the panelists. This could be due to the ability of the product to spread easily, which further affected the texture and overall acceptance of the product among panelist as shown by the lowest mean scores on spreadability attribute. Also, these samples (4, 8, 11, and 17) had lowest mean scores for color attribute (as an important attribute that affected the overall acceptability).

In the presence of 16.7-25.0% soy protein isolate, RPO was required as lubricating agent to form a spreadable pistachio spread. Furthermore, based on visual observation, in the absence of oil and presence of excessive soy protein isolate, the product was too dry and brittle, hence, it was unsuitable to be categorized as spread.

As for spreads that did not contain RPO and SPI as in Formulations 2, 5, 7, and 14, the mean scores were in the range of 4.3-6.1 (i.e. ‘dislike slightly’ to ‘like slightly’). Formulations 5 and 7 contained a higher

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Table 2. Mean score for acceptability attributes of pistachio spreads using Hedonic scale [a] (N= 32).[b]

Formulation	Taste	Aroma	Color	Spreadability	Overall Texture	Overall Acceptability
1	5.5 ± 0.3bcdef	5.9 ± 0.2abc	6.0 ± 0.3a	7.1 ± 0.4ab	6.3 ± 0.3ab	6.1 ± 0.1abcd
2	5.5 ± 0.3bcdef	6.2 ± 0.3abc	6.0 ± 0.3a	6.5 ± 0.5abc	6.1 ± 0.1ab	6.1 ± 0.2abcd
3	6.1 ± 0.3abcd	6.3 ± 0.3abc	5.9 ± 0.3a	6.0 ± 0.3abcd	5.5 ± 0.2ab	5.8 ± 0.1bcd
4	5.0 ± 0.2def	5.2 ± 0.2bc	3.7 ± 0.2b	2.5 ± 0.1g	3.7 ± 0.2c	4.0 ± 0.2e
5	5.9 ± 0.3abcde	5.9 ± 0.3abc	5.2 ± 0.3ab	4.6 ± 0.2de	5.1 ± 0.2b	5.3 ± 0.2d
6	5.5 ± 0.3bcdef	6.3 ± 0.3abc	6.2 ± 0.4a	6.8 ± 0.5abc	6.5 ± 0.1a	6.5 ± 0.1abc
7	6.2 ± 0.3abcd	6.1 ± 0.3abc	5.1 ± 0.2ab	4.3 ± 0.2ef	5.1 ± 0.2b	5.3 ± 0.2d
8	4.1 ± 0.2f	4.9 ± 0.2 c	3.7 ± 0.2b	2.6 ± 0.1g	3.3 ± 0.1c	3.3 ± 0.3e
9	5.5 ± 0.3bcdef	6.2 ± 0.3abc	6.2 ± 0.3a	6.6 ± 0.4abc	6.2 ± 0.3ab	6.1 ± 0.3abcd
10	6.5 ± 0.3abcd	5.9 ± 0.3abc	5.9 ± 0.3a	5.7 ± 0.3bcde	6.3 ± 0.3ab	6.3 ± 0.3abc
11	5.1 ± 0.2cdef	5.0 ± 0.2c	4.1 ± 0.2b	3.0 ± 0.1fg	3.4 ± 0.1c	3.8 ± 0.2e
12	7.0 ± 0.2a	6.8 ± 0.2a	6.1 ± 0.4a	7.4 ± 0.3a	6.3 ± 0.3a	6.7 ± 0.3a
13	6.6 ± 0.4abc	6.2 ± 0.3abc	5.9 ± 0.3a	5.9 ± 0.3bcd	6.2 ± 0.3ab	6.5 ± 0.4abc
14	6.0 ± 0.3abcd	5.9 ± 0.3abc	4.9 ± 0.2ab	5.5 ± 0.3cde	5.6 ± 0.1ab	5.6 ± 0.1cd
15	6.7 ± 0.4ab	6.5 ± 0.3ab	6.1 ± 0.3a	5.7 ± 0.3bcde	6.4 ± 0.3ab	6.5 ± 0.1abc
16	7.1 ± 0.2a	6.8 ± 0.4a	6.3 ± 0.4a	7.5 ± 0.4a	6.5 ± 0.3a	6.9 ± 0.4a
17	4.4 ± 0.2ef	5.0 ± 0.2c	3.8 ± 0.2b	2.7 ± 0.1g	3.5 ± 0.1c	3.7 ± 0.2e

[a] Score 1= Extremely disliked; Score 2= Very much disliked; Score 3= Moderately disliked; Score 4= Slightly disliked; Score 5= Neither like nor dislike; Score 6= Slightly liked; Score 7= Moderately liked; Score 8= Very much liked, Score 9= Extremely liked. [b] Different letters within the same column indicate significant difference at $P < 0.05$, mean±standard deviation.

amount of icing sugar than Formulation 2, which probably contributed to the differences in spreadability of the product. Table 2 clearly shows that the highest mean scores of all the sensory attributes (taste, aroma, color, spreadability, overall texture and overall acceptability) were depicted by Formulations 12 and 16 spreads that were made without addition of SPI (6.1-7.5), denoting that they ranged 'slightly liked' to 'very much liked'. Both Formulations 12 and 16, which contained between 50-58.3% pistachio paste, 25-30% icing sugar and 16.7-20% RPO, were considered as the most acceptable spread. No significant difference was observed in the mean scores of Formulations 12 and 16 in all the sensory attributes studied. The findings of this study indicated that even though slightly acceptable spread can be made from pistachio paste, icing sugar, and RPO and SPI, the most acceptable pistachio spread can be produced without addition of SPI. Other researchers have also shown that SPI can be added to nut butter and nut spreads such as peanut spread (Yeh *et al.*, 2002), peanut soy spread (Dubost *et al.*, 2003; Khatib *et al.*, 2002) and peanut sesame soy blends (Sumainah *et al.*, 2000) and remained acceptable. This finding also indicated that the overall acceptability of spread by panelists was significantly *(*P< *0.05)* influenced by the textural property especially with regards to spreadability of the product.

Sensory Evaluation of Pistachio Spreads Using QDA

Thirty-two candidates who took part in the screening tests, but only 12 people (four males and eight females) were selected for QDA training. The selected candidates were trained on descriptive analysis test procedures as described by Meilgaard *et al.* (1999) for a total of 10 hours in four sessions. During the descriptors generation, commercial peanut butter was used to represent spread at the beginning of the training session. This was followed by the profiling of samples of the pistachio spread into several general terms such as appearance, aroma, flavor, and textural properties. About 50 terminologies were generated to describe the product attributes during the first day of the training session. Redundant terms were omitted during the discussion session conducted after the profiling session, resulting in only 20 perceived attributes that were agreed to identify and describe most of the pistachio spreads tested. The definition and intensity were described for all terms at a round-table discussion based on several previous studies on similar products (Dubost *et al.*, 2003; Gills and Resurreccion, 2000b; Yeh *et al.*, 2002). It was found that references for sensory terminology do not necessarily need to be identical to describe all attributes. They can be sufficiently similar in order to reduce confusion in identifying specific terms among panelists during training. Table 3 shows the finalized descriptors and definitions used to evaluate the sensory characteristics of pistachio spread in QDA. In the third phase of training, different formulations of pistachio spread samples were prepared in the laboratory using different amounts of ingredients to reflect the different intensity of pistachio spread attributes in order to familiarize panelists on the intensity rating during the evaluation. The panelists discussed and set the lower and upper limits scales for each attributes based on these samples and they assigned the actual score for each attribute of the tested samples. Before the actual QDA was conducted, the performance of trained panelists was evaluated using ranking and triangle tests according to ISO (1993). Out of twelve trained panelists, four panelists were not considered for QDA because they presented discrimination problems considering samples and repeatability. The remaining eight panelists were kept for the descriptive characterization of the most acceptable pistachio spreads by QDA, which were Formulations 12 and 16 based on Hedonic scale. The mean intensity ratings

[DOR: 20.1001.1.16807073.2017.19.1.3.8]

Table 3. Descriptors used in Quantitative Descriptive Analysis (QDA) of pistachio spread.

Attribute	Intensity level	Definition	Reference
Visual appearance			
Green color	Light-dark	The color of green	(Meilgaard *et al.*, 1999)
Visible particles	None-extreme	Amount of particles in the surface	(Meilgaard *et al.*, 1999)
Glossy	Dull-shiny	Amount of light reflected from the surface of the product	(Meilgaard *et al.*, 1999)
Aroma			
Sweet	None-extreme	The aromatic associated with butterscotch candy, vanilla, molasses	(Meilgaard *et al.*, 1999)
Roasted	None-extreme	The aromatic associated with medium roasted nuts	(Chu and Resurreccion, 2005; Dubost *et al.*, 2003; Yeh *et al.*, 2002)
Nutty	None-extreme	The aromatic associated with raw and cooked soybean	(Meilgaard *et al.*, 1999)
Milky/Creamy	None-extreme	The aromatic associated with cow's milk	(Meilgaard *et al.*, 1999)
Taste			
Beany	None-extreme	The flavor associated with raw beans	(Meilgaard *et al.*, 1999)
Sweet	None-extreme	The taste associated with sucrose solutions	(Chu and Resurreccion, 2005; Yeh *et al.*, 2002)
Oily	None-extreme	Amount of oil films on oral surfaces	(Meilgaard *et al.*, 1999)
Bitter	None-extreme	The taste associated with caffeine solutions	(Yeh *et al.*, 2002)
Nutty	None-extreme	The flavor associated with nuts	(Meilgaard *et al.*, 1999)
Creamy	None-extreme	The flavor associated with cream	(Meilgaard *et al.*, 1999)
Texture			
Stickiness	Low-high	Amount of sample adhere to lips	(Chu and Resurreccion, 2005; Yeh *et al.*, 2002)
Oiliness	Low-high	Amount of oiliness on the oral surface	(Meilgaard *et al.*, 1999; Yeh *et al.*, 2002)
Firmness	Soft-firm	Force to compress sample	(Dubost *et al.*, 2003)
Adhesiveness	Low-high	Degree sample sticks to palate; force to remove from palate	(Chu and Resurreccion, 2005; Yeh *et al.*, 2002)
Spreadability	Low-high	Ease of spread on a cracker	(Chu and Resurreccion, 2005)
Aftertaste			
Bitter	None-extreme	Chemical feeling which leaves a bitter sensation in the throat after swallowing	(Meilgaard *et al.*, 1999)
Astringency	None-extreme	Chemical feeling on the tongue described as puckering/dry and associated with tannins	(Meilgaard *et al.*, 1999)

of 20 attributes of the two pistachio spreads are shown in Table 4. High intensity ratings were observed in the glossiness, green color, nutty taste, spreadability, and sweetness attributes of pistachio spreads. No significant (P< 0.05) difference was observed between Formulation 12 (which comprised of 50.0% pistachio paste, 30.0% icing sugar, and 20.0% red palm oil) and Formulation 16 (which contained 58.3% pistachio paste, 25.0% icing sugar, and 16.7% red palm oil) for all the attributes tested, except for the sweet taste of spread. As expected, Formulation 12, which contained more icing sugar, was found to be significantly (P< 0.05) sweeter than Formulation 16. The presence of RPO and high fat content of pistachio paste contributed to the glossiness and spreadability of spreads. The greenish color is due to the chlorophyll pigment (150 mg kg^{-1}) of the pistachio paste (Bellomo and Fallico, 2007). The pistachio paste provides the nutty flavor to the spread. Moderate beany and oily flavors intensity detected in the spread were probably due to the addition of pistachio paste and RPO to the formulation. The ratings of bitterness, astringency and bitter aftertaste were below 4.5, indicating those attributes that exhibited slight intensity. These attributes could be due to the presence of phenolic compounds such as tannin (Karamac, 2009) in the pistachio kernel skin (testa). The mean intensity ratings for the aroma characteristics of spread such as sweet, roasted, nutty, milky/creamy aromas were less than 7.5, indicating that they were moderately

Table 4. Mean intensity ratings of pistachio spreads attributes using QDA.[a]

Sensory Attributes	Mean intensity[b]	
	Formulation 12	Formulation 16
Visual appearance		
Green color	8.5 ± 0.6a	9.7 ± 0.9a
Visible particles	5.5 ± 0.6a	7.0 ± 0.9a
Glossy	10.1 ± 1.0a	9.7 ± 0.7a
Aroma		
Sweet	6.6 ± 0.5a	6.3 ± 0.3a
Roasted	5.7 ± 0.8a	6.1 ± 0.6a
Nutty	6.4 ± 0.6a	7.0 ± 0.2a
Milky/Creamy	7.1 ± 0.2a	7.0 ± 0.2a
Taste		
Beany	7.8 ± 0.6a	7.6 ± 0.3a
Sweet	9.6 ± 0.4a	7.9 ± 0.4b
Oily	7.2 ± 0.5a	6.9 ± 0.4a
Bitter	3.7 ± 0.5a	3.4 ± 0.6a
Nutty	8.8 ± 1.0a	9.3 ± 0.3a
Creamy	6.8 ± 0.4a	7.5 ± 0.3a
Texture		
Stickiness	7.6 ± 0.5a	8.1 ± 0.8a
Oiliness	7.2 ± 0.8a	6.5 ± 0.7a
Firmness	5.2 ± 0.8a	6.0 ± 0.5a
Adhesiveness	7.5 ± 0.5a	8.4 ± 0.4a
Spreadability	9.9 ± 0.7a	9.3 ± 0.3a
Aftertaste		
Bitter	4.3 ± 0.7a	4.4 ± 0.2a
Astringency	3.6 ± 0.3a	3.7 ± 0.6a

[a] Means of each row with the same letter indicated no significant different (P> 0.05). [b] Mean±standard deviation.

[DOR: 20.1001.1.16807073.2017.19.1.3.8]

detected by the panelists. It is possible that the sweet aroma was derived from the aromatic compound in the spread formulations, whereas the roasted aroma was due to the roasting of pistachio kernel prior to production of paste. The nutty aroma was probably due to the pistachio paste and the milky/creamy aroma was probably due to the RPO and oily pistachio paste. Similarly, for textural properties, such as intensity of stickiness, oiliness, and adhesiveness, the attributes were in the middle range of the line scale used (7.4-7.6), showing that they are in the suitable range for consumption (Meilgaard *et al.*, 1999). The spreads were considered slightly soft as a result of the suitable combination of ingredients used in the formulations. Based on visual appearance, panelists considered that the particle size of the spreads were not too fine and not too coarse, indicating that proper mixing and grinding were adopted in the preparation of the product. The findings of this research is a breakthrough in the study of pistachio spread sensory characterization. This is the first study that introduced new terminologies to describe the detailed sensory attributes of pistachio spread. The findings obtained can be used to further improve the quality of pistachio spread.

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[DOR: 20.1001.1.16807073.2017.19.1.3.8]

پذیرش مصرف کننده و آنالیز توصیفی کمی کرم صبحانه پسته

ا. شاکر اردکانی

چکیده

پسته (*Pistacia vera* L.) یکی از محبوب ترین و مشتری پسند ترین مغزهای درختی در دنیا به شمار می رود. کرم صبحانه پسته محصول جدیدی است که از خمیر پسته، پودر شکر، ایزوله پروتئین سویا (SPI)و روغن پالم قرمز (RPO) تهیه می گردد .این مقاله به بررسی پذیرش حسی (بوسیله ۳۲ ارزیاب) با مقیاس هدونیک و توسعه واژه های مناسب برای توصیف کرم صبحانه پسته با روش آنالیز توصیفی کمی (QDA)می پردازد. این مطالعه اولین گزارش در مورد کاربرد روش آنالیز توصیفی کمی برای ارزیابی حسی محصولات پسته ای است. روش آنالیز توصیفی کمی برای تعیین مشخصات حسی ۲ کرم صبحانه پسته دارای پذیرش بالاتر در مقیاس هدونیک (فرمول ۱۲ دارای ۵۰ درصد خمیر پسته، ۳۰ درصد پودر شکر و ۲۰ درصد RPO و فرمول ۱۶ دارای ۵۸/۳ درصد خمیر پسته، ۲۵ درصد پودر شکر و ۱۶/۷ درصد (RPO به کار رفت. بر اساس نتایج، RPOروی پذیرش حسی کرم صبحانه پسته اثر مستقیم دارد 8 .($p < 0.05$) ارزیاب برای ارزیابی کرم صبحانه پسته انتخاب شدند. ۲۰ صفت (ظاهر(رنگ سبز، ذرات قابل دید، براقیت)، بو (شیرین، برشته، آجیلی، شیری/خامه ای)، مزه (لوبیایی، شیرین، روغنی، تلخ، آجیلی، خامه ای)، بافت (چسبندگی، روغنی، سفتی، پیوستگی، قابلیت مالش روی نان)، پس طعم (تلخ، فلزی)) برای محصول شناسایی و توسعه داده شد. بجز شیرینی اختلاف معنی داری در تمام صفات بررسی شده در فرمول ها مشاهده نگردید.($p<0.05$)

[DOR: 20.1001.1.16807073.2017.19.1.3.8]