



Understanding older people perceptions about desserts using word association and sorting task methodologies

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ABSTRACT

Techniques derived from psychology and consumer research have gained interest in the food science area to study consumers' opinions and perceptions concerning food products. For that reason, Word Association (WA) and Sorting Task (ST) methods were applied to study older people's perceptions about desserts. In the WA study, older people (>60 years old) were asked about the first four words that come to mind using the following stimuli: dessert, healthy, ideal, indulgent, and ideal dessert. For ST, they had to classify 15 dessert photographs into four groups related to "healthiness" and "hedonic perception" categories. WA and ST data were analyzed by correspondence analysis and multiple correspondence analysis, respectively. Regarding WA, older people 187 terms distributed in 11 main categories: sensory characteristics, fruits, diet-health related terms, dairy products, other desserts, among others. The perceptual map showed that the different stimuli were related to emotions, healthy characteristics, hedonic characteristics, and traditional products. In the ST methodology, older people classified desserts mainly by their composition. Fruits, jelly, and yogurts were grouped in the healthy category, while the products with high sugar and fat content, such as cake, ice cream, lemon pie, were grouped in the unhealthy category. In conclusion, it is possible to know older people's opinions about desserts using WA and ST methodologies, where fruits and dairy-based desserts are considered healthy and appetizing alternatives.

1. Introduction

The world population has been aging due to the increase in life expectancy, so that the number of older people has rapidly increased. According to the United Nations World Population Prospects 2019, 15.9% of the planet's habitants will be over 65 years old, and 426 million people will be around 80 years old by the year 2050 (United Nations, 2019). Hence, the main nutritional concerns of this population group are the decrease in food intake and loss of motivation to eat due to the aging process and a decline in the functionality of all organs (Laguna et al., 2017). These changes often result in poor nutrition, leading to poor health or the development of chronic diseases (Laguna et al., 2016; Song et al., 2016; Shlisky et al., 2017; Pellanda et al., 2021). Thus, it is necessary to adopt strategies to improve older people's life quality from a nutrition and feeding point of view. Herein, the development of palatable and nutritious foods with the requirements of these populations is essential.

In Chile, 35.1% of the elderly are obese, according to the National

Health Survey (MINSAL, 2017), increasing one's likelihood of developing non-communicable diseases (NCDs) such as diabetes, obesity, or hypertension. The seriousness of this problem has led to the search for strategies to improve the population's health, so that Chile's Law of Food Labeling and Advertising was implemented in 2016. The new regulation includes the mandatory use of front-of-package warning labels on packaged foods/beverages high in energy, sugars, saturated fats, and sodium (Correa et al., 2019). This change in food regulation has modified the food habits and purchases of the Chilean population (Taillie et al., 2021). Therefore, it is necessary to understand the elderly's needs, preferences, and perceptions about different food products, especially those consumed daily, such as fruits and vegetables, desserts, dairy, and bakery products.

Currently, there is little information regarding the preferences, motivation, and/or sensory needs of older people, where only a few studies have evaluated their opinion as consumers for the development of food products (Clicer et al., 2017; Baugreet et al., 2018; Song et al., 2018; Chalermisri et al., 2020). What drives older people to consume and

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choose certain types of food can be useful to successfully design products targeted to them, since factors such as familiarity with the product, ease of consumption, evoked emotions, healthy diet, and food safety are relevant for their consumption and acceptance (Song et al., 2018; Chalmers et al., 2020). Thus, there is an excellent opportunity to develop food products from older people's needs and requirements because their sensory and physiological requirements cannot be interchangeable or extrapolated to adults < 60 years (Sulmont-Rossé et al., 2018). Furthermore, it is essential to understand how they perceive the food products or how their choices and preferences can be related to their memories, history, and past sensory experiences (de Andrade et al., 2016; Boesveldt et al., 2018; Schwartz et al., 2018).

On the other hand, the elderly have limited their food options due to medical recommendations. Therefore, most of them must reduce the intake of calories and critical ingredients content, such as salt, sugar, and unsaturated fats (Nowson, 2007). Accordingly, there is a significant number of food products that older adults should not consume or should reduce their consumption because they have high sugar and/or fat content, such as desserts, high-fat foods, bakery products, among others (Laureati et al., 2006; van der Meij et al., 2012). However, desserts are one of the most appreciated foods by older people due to their sensory properties and palatability (Roininen et al., 2003; van der Meij et al., 2012). In addition, eating dessert at the end of a meal is considered a ritual for older people (Ratcliffe et al., 2019), which results in a higher affective response since its consumption is associated with positive emotions and memories, such as from childhood, family or friends, celebration, homemade meals, among others (Laureati et al., 2006). Therefore, the design of this kind of elderly-focused product should have a more holistic approach considering that the non-sensory factors influence the final food acceptance (Song et al., 2016).

Dessert is a sweet food product consumed mainly after meals, with different sensory attributes and nutritional properties. There are various categories of dessert according to healthiness and/or indulgence. For example: "light" desserts are called to the products with reduced amounts of sugar, fat, and calories, but with sensory characteristics differing or deficiency compared to their counterpart with total sugar and fat. On the other hand, "indulgent" desserts can be defined using favorable descriptive terms, such as sweet, creamy, palatable, among others, that mainly are consumed for hedonic or reward-driven reasons (Fazzino et al., 2019). Therefore, understanding how these concepts are interpreted and their associations with different products can be helpful to know perceptions and preferences by the elderly about desserts.

There are various methodologies to study consumer opinion. Among them, the projective techniques by association stand out because they allow understanding consumer behavior when accepting food and/or knowing their expectations or needs regarding a particular food product. These techniques are based on the principle that the respondents' unconscious desires and feelings can arise when a stimulus is presented to them (Mesías & Escribano, 2018). In this context, the Word Association methodology is used to know consumers' perceptions regarding food (Doherty & Nelson, 2010; Gambaro, 2018). This technique obtains information from consumers by spontaneously expressing their feelings when a stimulus is presented (Guerrero et al., 2010; Fiszman et al., 2014). In addition, this methodology is a valuable tool for its application in food development, since these first associations should be relevant in purchasing and choosing products by the consumer (Piqueras-Fiszman et al., 2013). Esmerino et al. (2017) identified the main aspects of consumers' perception of three different fermented dairy products, where the main factors influencing consumer choices were sensory aspects, emotional factors, perception of benefits, and food products' composition. Bryant & Barnett (2019) investigated the effect of different names for *in vitro* meat (IVM) on consumer acceptance, finding that consumers' associations, attitudes, and behavioral intentions towards IVM vary depending on the associations elicited by different products names. However, studies with older consumers using this methodology have not been carried out yet.

Alternatively, Sorting Tasks have been applied to study products' categorization, where consumers must classify products according to their similarities and differences using their own criteria (Ares & Varela, 2018). However, Sorting methodologies have recently received attention for studying older adults' perception, where their main goal has been developing palatable food products. For example, Clicerí et al. (2017) investigated the factors that affected pea and sweet corn samples categorization within different age segments of the healthy elderly consumers. They found that this methodology is a suitable method to use with healthy older adults who can detect differences in categorizing food stimuli.

Finally, although some researchers have focused on the development of healthy foods for the elderly, most of these studies have not considered the expectations, beliefs, and/or sensory needs of this population previous to the food design (Methven et al., 2016; Ruark et al., 2016; Murphy & Vertrees, 2017). Thus, the initial step to design acceptable food products for specific groups of the population, such as older adults, is to find out their opinion and perception about different types of food products, since their opinions play an essential role in the acceptability and preference, and subsequent consumption. In this context, this research aimed to study elderly opinions and perceptions about desserts using two consumer research techniques: Word Association (WA) and Sorting Task (ST) methodologies.

2. Materials and methods

2.1. Stimuli

Word Association (WA) and Sorting tasks (ST) methodologies were carried out to understand elderly opinion and perception about desserts and related-to concepts. The stimuli used in this study depended on the methodology. For the Word Association method, 5 different dessert concepts were presented: dessert, healthy dessert, ideal dessert, light dessert, and indulgent dessert. No description or photograph of desserts was provided. In the Sorting Task methodology, 12 color photographs (15x15 cm) of different desserts (commonly consumed in Chile) were shown to the participants: light yogurt, greek yogurt, fruit puree, jelly, fruits, rice pudding, traditional Chilean dessert (dehydrated peach in its juice with cooked wheat and sugar), flan, ice cream, kuchen, cake and lemon pie (Fig. 1).

2.2. Participants

WA and ST studies were carried out by 101 and 87 elderly volunteers, respectively, who did not have experience with consumer perception methodologies. The inclusion criteria for recruitment were as follows: older than 60 years old, living at home, no severe diseases at the study time, and able to communicate for themselves. Both studies were conducted before the Covid-19 worldwide pandemic (from September to December 2019) in different community elderly centers (social centers from Santiago and Valparaíso, Chile). Table 1 shows the demographic characteristics of each group of participants. All the participants received the study's information, and they consented to their participation in the study. After completion of the study, the consumers received a small gift for their participation. The studies and older people's recruitments were conducted according to the protocol approved by the Institutional Ethics Committee from the Universidad de Santiago de Chile (Report No. 483).

2.3. Word Association

The Word Association (WA) study was conducted using a questionnaire, which was previously tested with 3 participants (interview for 20–30 min) to confirm that questions and instructions were understood. Participants were asked to provide the first four single words (products, associations, thoughts, or feelings) that came into their minds when each

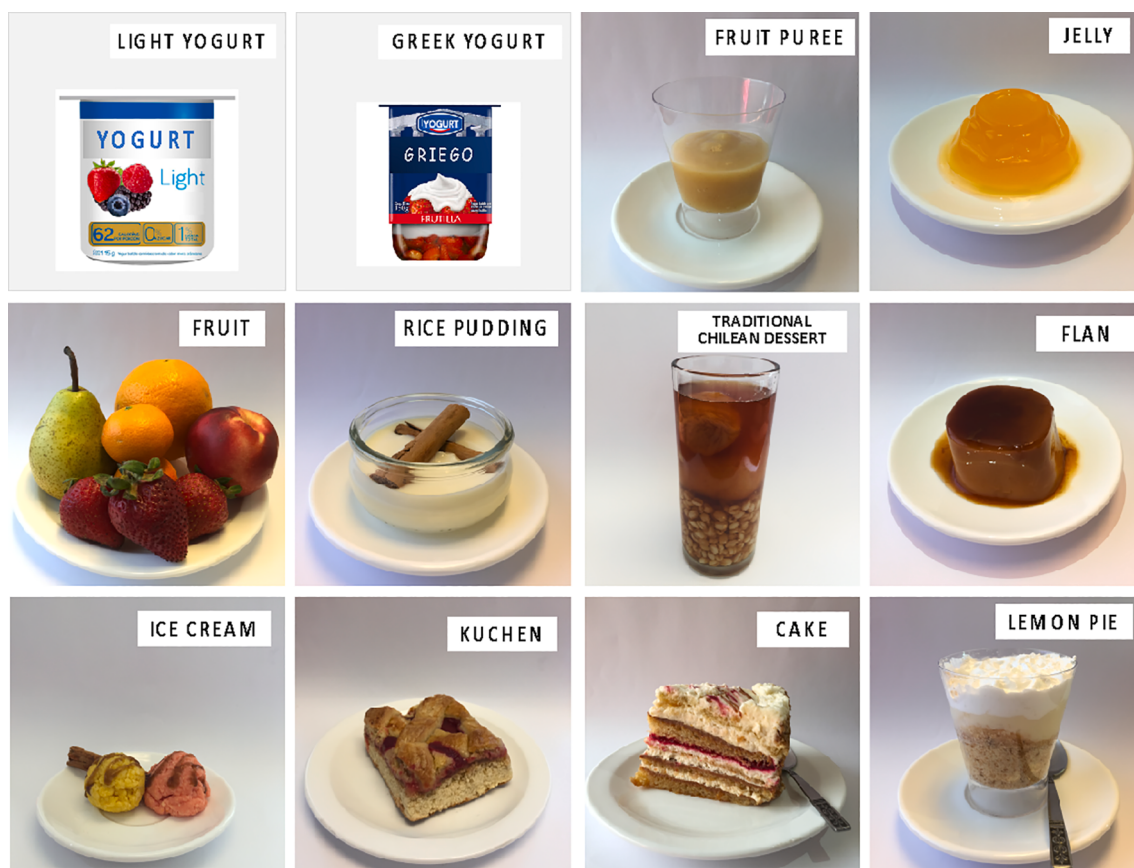


Fig. 1. Photographs of the desserts used as stimuli in the Sorting Task methodology. Traditional Chilean dessert (mote con huesillos) corresponds to dehydrated peach in its juice with cooked wheat and sugar.

Table 1

Characteristics of the consumers (gender and age) who participated in Word Association and Sorting Task studies.

Methodology	Characteristic		Consumers (%)
Word Association (n = 101)	Gender	Male	29.6
		Female	70.4
	Age	60–69 years old	59.5
		70–79 years old	28.4
		> 80 years old	12.1
Sorting Task (n = 87)	Gender	Male	36.7
		Female	63.3
	Age	60–69 years old	51.7
		70–79 years old	31.7
		> 80 years old	16.6

of the five stimuli was presented. For example: What are the first four words that come to mind when you think of DESSERT? Each stimulus was presented in a separate sheet, where there was a blank space to write what participants considered necessary. Before the WA task, participants were individually interviewed face-to-face to the familiarization of the methodology and to answer the demographic questions. Then, they were asked to answer the WA questionnaire where they evaluated one stimulus at a time, randomly presented.

2.4. Sorting Task

The methodology was based on the *Structured Sorting Task* proposed by Varela & Salvador (2014) and Alfaro et al. (2020) for children, with some modifications since the test was adapted for older people, i.e., no symbols and emoticons were used to identify the classification groups. The participants had to classify 12 photographs of dessert that were

selected according to the highest mentions number in the WA study, being these products the most consumed in Chile (Fig. 1). The photographs of the desserts were taken at the laboratory on a white background under the same natural light conditions, using authentic desserts bought in local stores. The classification of the photographs was carried out in four previously defined group, A: “healthy and I like it”, B: “healthy and I don’t like it”, C: “unhealthy and I like it”, and D: “unhealthy and I don’t like it”, using a white sheet (53x75 cm) separated into four equal quadrants, where each quadrant corresponded to a stimulus. The task instructions and classification were carried out in the presence of a responsible researcher. Participants were able to ask questions during the classification task.

2.5. Data analysis

Word Association data was analyzed qualitatively by grouping the terms with similar meanings into different categories, where two researchers evaluated the data and classified the words in the categories. The terms mentioned by at least 10% of the participants were considered for quantitative analysis to avoid losing a large amount of information (Guerrero et al., 2010; Vidal et al., 2013; de Andrade et al., 2016). Cochran’s Q test was performed (Meyners et al., 2013) to determine the statistical differences in the frequency of mention for each term among stimuli. Correspondence Analysis (CA) was also used to obtain the perceptual map of the relationship between stimuli and elicited words. A contingency table with bi-dimensional representations was obtained, where rows corresponded to the different stimuli and columns represented the elicited words. Sorting Task data was analyzed using Multiple Correspondence Analysis (MCA) to obtain a variable plot and product map. The data matrix consisted of the products (dessert’s photographs) in the rows and the participants in the columns, where each participant

assigned each photograph to a group (A, B, C, or D). All data analyzes were conducted using XLStat® software (version 2019, Addinsoft, France), and results were considered significantly different at a significance level of $p\text{-value} \leq 0.05$.

3. Results and discussion

3.1. Perceptions about different desserts' concepts

Word Association (WA) projective methodology was used to obtain information about older consumers' concepts relevant to dessert stimuli. The 101 participants generated 2020 words (4 for each stimulus: dessert, healthy dessert, ideal dessert, light dessert, and indulgent dessert), grouped into similar meanings, obtaining 178 different terms distributed in 11 categories (Table 2). The hedonic and sensory characteristics category presented the highest percentage of mentions (23.8%), where the most relevant terms were: delicious, sweet, tasty/good taste, creamy, soft/smooth, and I like it (Table 2). This result could be related

Table 2

Categories identified in the Word Association methodology, frequency of mention and example of associations elicited by older people.

Category and terms	Number of terms	Number of mentions
Hedonic/Sensory characteristics Delicious, sweet, slightly sweet, tasty/good taste, fresh/refreshing, tasteless, creamy, soft/smooth, nice, I like it, I don't like it, aromatic, color, palatable, bad, consistent, texture, crispy, etc.	28	480 (23.8%)
Fruits Fruit, apple, banana, watermelon, cantaloupe, strawberry, fruit salad, melon, nuts, peach, orange, fruit juice, kiwi, pineapple, canned fruit, pear, grape, plum, walnuts, cherry, berries, vanilla, etc.	32	360 (17.8%)
Diet/Health Healthy, sugar/calories/fat-free, Low-sugar/calories/fat, diet/non-fattening, for diabetics, satiating, good for health, nutritious, wellness, easy digestion/digestive, beneficial, caloric, with vitamins, with fiber, vitamins, antioxidants, etc.	21	339 (16.8%)
Dairy products Yogurt, Chilean dairy dessert (leche asada similar to crème brûlée), dairy, semolina pudding, flan, rice pudding, instant oatmeal, vanilla custard with meringue, cream, dulce de leche, mousse, etc.	13	295 (14.6%)
Other desserts Ice cream, jelly, cake, traditional Chilean dessert (dehydrated peach in its juice with cooked wheat and sugar), chocolate, kuchen, sponge cake, meringue, cereals, pancakes, lemon pie, etc.	15	247 (12.2%)
Family-related Family, memories, homemade, children, childhood, to share, conversation, grandchildren, home, etc.	10	73 (3.6%)
Emotions/feelings Satisfaction, boring, joy, happiness, enjoy, need, culpability, confidence, etc.	13	62 (3.1%)
Ingredients Natural, without additives, sweeteners, stevia, dairy free, artificial, etc.	10	63 (3.1%)
Moments/frequency of consumption After meals, daily consumption, lunch/dinner, I don't consume, snack, etc.	8	37 (1.8%)
Positive feelings Prize/incentive, I have earned it, I deserve it,	4	22 (1.1%)
Others Small portions, inexpensive, different, expensive, functional, packaging, extraordinary, etc.	14	42 (2.1%)

to the hedonic expectations that this product generates in the elderly, since dessert is one of the most enjoyable foods by this group of the population due to sensory properties and palatability (van der Meij et al., 2012). In addition, when WA has been applied to study of consumer perceptions about different food products (dairy dessert, fermented dairy products, fish, jam and lamb meat), consumer's associations obtained have mainly been related to positive sensory characteristics, regardless consumer's age (18–75 years old) (Ares et al., 2010; Mitterer-Daltoé et al., 2013; Piqueras-Fiszman et al., 2013; Esmerino et al., 2017; de Andrade et al., 2016), as in this work.

The second category with the highest number of mentions and terms was fruits (17.8%), which mainly included apple, banana, watermelon, strawberry, and orange. It is interesting to notice that older adults mentioned mainly fruits when they thought about “healthy desserts” because they consume these products daily (Minsal, 2010) by their nutritional characteristics (low fat and calories and/or vitamins and minerals sources) or medical recommendations. Similarly, Mingioni et al. (2016), who studied the elderly's fruit choice in Europe, obtained that 90% of them preferred traditional and fresh fruits (such as plum, peach, apple, pear, strawberry, and orange) compared to exotic and/or processed fruits, indicating that the elderly are more interested in health and natural aspects of fresh products than processed ones. In this case, our results suggest that the association of fruits with healthy desserts can be due to senior consumers associating these products with a better nutritional status or good health. Regarding the diet and health category, the third category with a higher percentage of mentions (16.8%) includes terms such as healthy, sugar/calories/fat-free, and low-sugar/calories/fat and mainly related to the “light dessert” stimulus. These results showed that older people have considerable nutritional-related knowledge regarding healthy foods since they associated the term “light” with reducing or eliminating critical nutrients (fat and sugar) that are harmful when consumed in excess. These associations can be due to the impact of Chile's Law of Food Labeling and Advertising, which requires a “high in sugar, fat, salt and calories” stamp on products that contain a large amount of these nutrients. The dairy products category also had a high percentage of mentions (14.6%), since this type of product is frequently consumed by the elderly in Chile, including Chilean dairy dessert (leche asada that is similar to crème brûlée), flan, oatmeal with milk, and semolina pudding, among others, which were also mentioned as “ideal dessert” (Table 2). The rest of the categories less frequently mentioned were related to “family-related”, “emotions and feelings”, “ingredients”, “others”, “moments or frequency of consumption”, “positive feelings” and “other desserts” (Table 2). Finally, the elderly mentioned a wide range of associations when they thought about dessert concepts, showing different associations for each stimulus and good communication of their opinions and perceptions.

Significant differences ($p \leq 0.05$) in the number of mentions were found (Table 3), where thirty of the fifty-seven elicited terms showed differences in the mentions among five stimuli (dessert, healthy, ideal, indulgent, and light dessert) (Table 3). For example, it was observed that the mentions of sugar-free, fat-free, and low calorie-related terms were significantly more associated with “light dessert” stimuli, while the delicious term was more elicited “indulgent dessert” and “ideal dessert”. In addition, no differences in the mentions were found in some terms, such as: palatable, tasty/good taste, fresh/refreshing, homemade, satisfaction, memories, healthy, and nutritious, which could indicate that these terms do not have a strong association with the target word (stimulus). Finally, results suggest a high capacity of the elderly to associate the different stimuli to a variety of desserts, sensory attributes, memories and emotions, among others; where each person provided relatively unrestricted access to their personal mental pictures for each stimulus (Fiszman et al., 2014).

To obtain a perceptual map of the different desserts' stimuli and terms generated by older people, a simple Correspondence Analysis (CA) was carried out (Fig. 2). The first two dimensions of the CA showed 78% of the data variability, representing 58.4% and 19.6% of the variance,

Table 3

Cochran's Q test for significant differences of frequency of mention of attributes between dessert related stimuli.

Attributes	<i>p</i> -value	Attributes	<i>p</i> -value	Attributes	<i>p</i> -value
Delicious	0.00	Nuts	0.03	Rice pudding	0.24
Sweet	0.00	Peach	0.58	Instant oatmeal	0.21
Slightly sweet	0.14	Orange	0.30	Vanilla custard with meringue	0.38
Tasty/Good taste	0.18	Fruit juice	0.12	Cream	0.15
Fresh/Refreshing	0.70	Healthy	0.07	Ice cream	0.00
Tasteless	0.00	Sugar free/Low sugar	0.00	Jelly	0.00
Creamy	0.00	Fat free/Low-fat	0.00	Cake	0.00
Soft/Smooth	0.01	Calorie free/Low-calorie/Light	0.00	Traditional Chilean dessert ²	0.00
I like it	0.20	Diet/Non-fattening	0.00	Chocolate	0.11
I don't like it	0.00	For diabetics	0.29	Kuchen	0.09
Aromatic	0.01	Satiating	0.43	Family	0.00
Palatable	0.63	Good for health	0.01	Memories	0.09
Fruit	0.00	Nutritious	0.41	Homemade	0.12
Apple	0.00	Wellness	0.02	Satisfaction	0.06
Banana	0.06	Yogurt	0.00	Boring	0.00
Watermelon	0.78	Chilean dairy dessert ¹	0.00	Natural	0.01
Strawberry	0.25	Dairy	0.37	After meals	0.00
Fruit salad	0.39	Semolina pudding	0.03	Prize/Incentive	0.00
Melon	0.03	Flan	0.03	Small portion	0.21

¹ *Leche asada* similar to crème brûlée

² *Mote con huesillos* is a dessert based on dehydrated peach in its juice with cooked wheat and sugar

respectively. The perceptual map showed differences among stimuli, observing three groups of stimuli (Fig. 2). The first group of the perceptual map corresponded to “light dessert” and “healthy dessert” that were related to terms such as diet and health (wellness, healthy, for diabetics, sugar-calories-fat-free, low-sugar-calories-fat), negative sensory characteristics (slightly sweet, tasteless, I do not like it) and negative emotions (boring). The associations of these stimuli with negative sensory characteristics can be attributed to sensory defects in taste and texture of the products with reduced fat and calories (Ares et al., 2008; da Silva et al., 2014). In addition, Soucier et al. (2019) and van den Heuvel et al. (2019) have reported that the elderly have a more traditional food concept than other groups of the population, since they are not receptive to novel and unfamiliar foods, such as light or functional foods. The second group, composed of “indulgent dessert” and “ideal dessert” stimuli, was associated with traditional desserts (Chilean dairy dessert, flan, rice pudding, ice cream, kuchen, among others), and hedonic and sensory characteristics (tasty/good taste, creamy, soft-smooth, aromatic, and palatable) (Fig. 2). This group showed a strong association of these concepts with desserts and sensory attributes that they enjoy. The last group (“dessert” stimulus) was associated with terms unrelated to food products, evoking positive and traditional meanings, such as family, satisfaction, homemade, memories, I like it, among others. These associations can be related to the elderly expectations based on childhood, emotions, and memories evoked by past dessert consumption (Doets and Kremer, 2016).

Finally, the elderly mentioned terms related to sensory characteristics such as tasty-aromatic, creamy, soft, and fresh/refreshing, especially for “dessert” stimulus, since these characteristics can be related to sensory needs due to the physiological changes that occur during aging, such as loss of the senses: smell and taste, swallowing problems (dysphagia) and reflux problems (Aguilera & Park, 2016; Song et al., 2016; Baugreet et al., 2017; Cichero, 2018; Rusu et al., 2020).

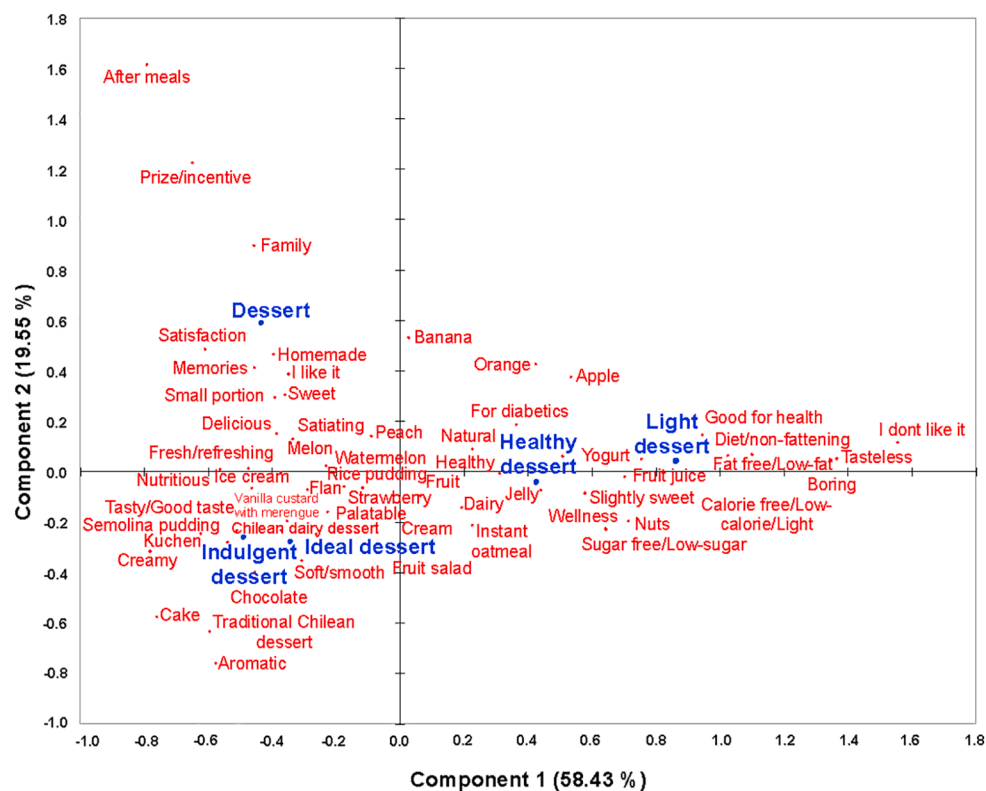


Fig. 2. Perceptual map of the different concepts of “dessert” in the first two components of the correspondence analysis. Traditional Chilean dessert (mote con huesillos) corresponds to dehydrated peach in its juice with cooked wheat and sugar.

3.2. Desserts classification about hedonic and healthy perceptions

The assignment frequency of the different desserts for each group studied (A: healthy and I like it, B: healthy and I don't like it, C: unhealthy and I like it, and D: unhealthy and I don't like it) in the Sorting task, is shown in Table 4. For group A, the most assigned frequency corresponded to fruits, jelly, fruit puree, and a traditional Chilean dessert (dried peaches with wheat) with 64, 81, 46, and 42 of consumers' assignments, respectively. Group B showed a minor assignment frequency, since only a few photographs were classified into this group, where greek yogurt, fruit puree and light yogurt were frequently assigned into this group by the participants. Despite this, the light yogurt's classification was divided between two groups (A and B), since 37 and 34 of consumers classified the photograph as "I like it" and "I do not like it", respectively. Regarding unhealthy groups (C and D), photographs of bakery products were classified into these groups where ice cream, cake and lemon pie were assigned to the "I like it" group with the highest number of consumers' assignments (50, 57, and 60, respectively).

Multiple Correspondence Analysis (MCA) was performed to analyze ST data, obtaining perceptual maps where the three first dimensions represented 43.43% of the total variability of the data obtained (Fig. 3). The first dimension (F1 axis) separated the photographs mainly by healthy-unhealthy concepts, explaining 20.65% of the variability of the data; while the hedonic concepts (I like it-I don't like it) accounted for 11.99% and 10.79% of the variability of the F2 and F3 axis, respectively. Fig. 3A shows the representation of the first two axes (F1 and F2), where we can observe that older people classified fruit, fruit puree, jelly, rice pudding, and traditional Chilean dessert (dehydrated peach in its juice with cooked wheat and sugar) in the "healthy and I like it" group. Conversely, light and greek yogurt were grouped into the "healthy and I do not like it" category, probably because of the elderly exhibit skepticism towards new food concepts, as "light" or "greek" (Soucier et al., 2019; van den Heuvel et al., 2019). High-calorie desserts such as cake, kuchen, and lemon pie were classified as unhealthy products, but consumers did not have a clear consensus about their liking (Fig. 3A, with axis 1 and 3). Apparently, they do not like them because the older adults try to keep a healthy diet to prevent diseases related to the diet, such as diabetes and obesity (Lesáková, 2018); however, their sensory properties are appreciated and enjoyable (Kurzer et al., 2020). The classification of these bakery products as "unhealthy" was probably due to their high fat, sugar, and calories content. This result is similar to that observed by Mena et al. (2020), who found that the elderly (60–81 years) considered unhealthy products with high fat, salt, and sugar

Table 4

Frequency of assignment of the photographs of desserts to each of the four pre-selected groups for the older people.

Dessert photographs	Number of participants who assigned the desserts to each group			
	Group A	Group B	Group C	Group D
Light yogurt	37	34	4	12
Greek yogurt	33	20	20	14
Fruit puree	46	26	8	7
Jelly	64	14	6	3
Fruits	81	3	2	1
Rice pudding	37	13	27	10
Traditional Chilean dessert ¹	42	7	30	8
Flan	22	13	38	14
Ice cream	13	2	60	12
Kuchen	15	2	55	15
Cake	4	4	57	22
Lemon pie	7	7	50	23

Note: Group A: "healthy and I like it", Group B: "healthy and I don't like it", Group C: "unhealthy and I like it", and Group D: "unhealthy and I don't like it".

¹ Traditional Chilean dessert (mote con huesillos) corresponds to dehydrated peach in its juice with cooked wheat and sugar.

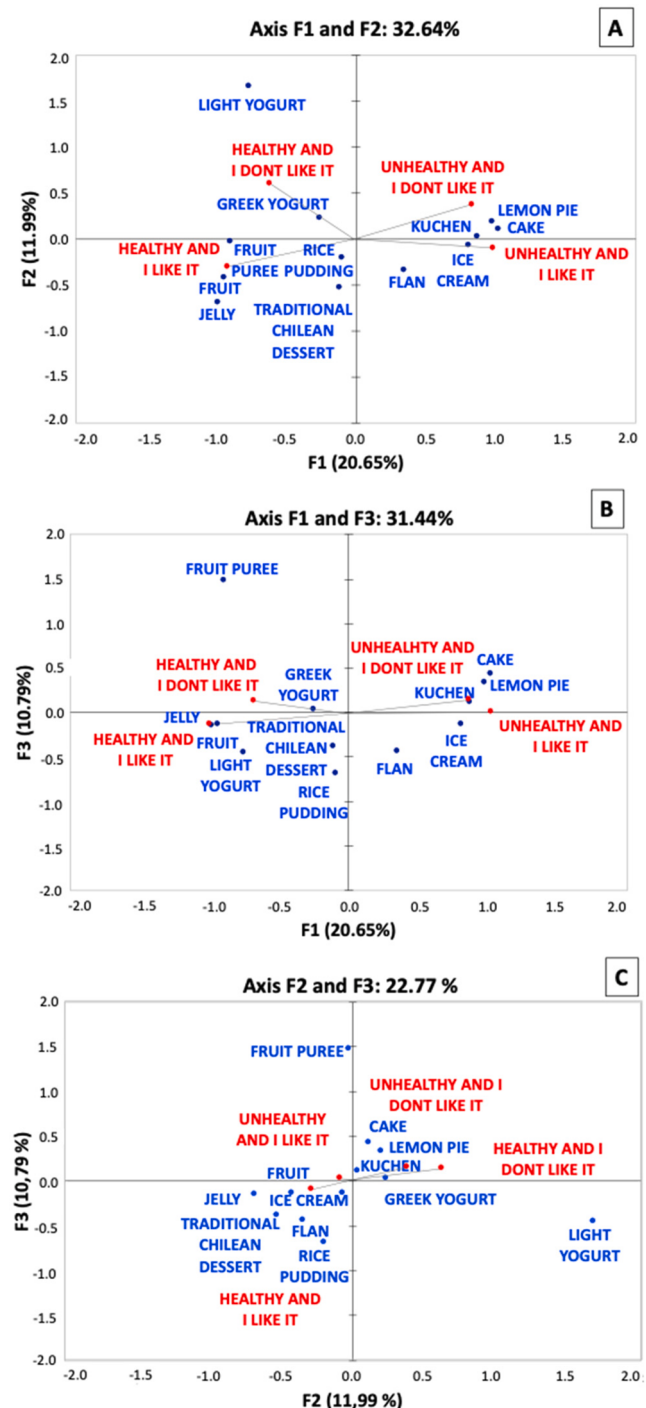


Fig. 3. Graph of variables and map of the products of the first three factors (A: F1 and F2; B: F1 and F3 and C: F2 and F3) of the Multiple Correspondence Analysis of the Sorting Task methodology. Traditional Chilean dessert (mote con huesillos) corresponds to dehydrated peach in its juice with cooked wheat and sugar.

content. On the other hand, the elderly classified flan and ice cream as an unhealthy dessert that they like, probably because of how they connect these desserts with past consumption moments or with emotions derived from long-term memory (Furst et al., 1996; Köster, 2002; Laureati et al., 2006), such as a nostalgic childhood or pleasant consumption moments (van der Meij et al., 2012).

The perceptual map with the F1 and F3 dimensions (Fig. 3B) showed a similar separation of the dessert's photographs than the F1 and F2

dimension map (Fig. 3A), where most of the desserts were separated by their healthiness. However, the classification of light yogurt and fruit puree was different, since the assignment of these images changed to “I like it” and “I don’t like it” groups, respectively (Fig. 3A and 3B). Hence, we can infer that there was no consensus on the classification of these desserts, given that an elderly group liked these products, and the other group did not, which was also observed in the assignment frequency (Table 4). These differences can be due to the decreasing of the ability to perceive the taste and odor that occurs during aging (Sulmont-Rossé et al., 2018), where products with low content of sugar and fat, such as light yogurt and fruit puree, can be perceived with poor sensory characteristics and, consequently, be rejected by older consumers. Finally, an intermediate category of desserts at the center of both maps was observed (Fig. 3), including greek yogurt, rice pudding, traditional Chilean dessert (dried peaches and wheat), and flan. This category of products was included into the “I like it” group, but there was no agreement in its assignment whether they belonged to the healthy or unhealthy groups. This behavior could be associated with the highest sugar content these products have (~15–20 g/100 g of product), considered “unhealthy” for the elderly. However, many of these desserts have been reformulated not to contain warning stamps (high in sugar, fat, or calories according to the Chilean food labeling law). Thus, another group of older adults recognizes these products as “healthy” because they do not stamp in their labels. In addition, some consumers perceive these products as “healthy” since they are traditionally prepared following familiar recipes at home, considering these products as less processed. In this way, the elderly can think that reducing the consumption of processed foods is a natural way to promote healthy eating (Fardet et al., 2017).

On the other hand, the F2 and F3 map (Fig. 3C) showed the classification of dessert photographs by liking, where fruit puree, fruit, jelly, ice cream, traditional Chilean dessert, flan, and rice pudding were included in the “I like it” category. While cake, lemon pie, kuchen, and greek and light yogurt were classified in the “I don’t like it” group. This result suggests that older adults prefer traditional desserts, regardless of their healthiness.

Finally, results demonstrate that most of the elderly presented good nutritional knowledge since they associated the healthy category with low calories (yogurt, jelly) and/or rich in fiber and vitamins (fruits) products. In addition, the elderly have different perceptions about traditional desserts since there was no agreement among participants to classify three traditional desserts (flan, rice pudding, and traditional Chilean desserts) located in the central part of the maps. This result suggests that the older people desire these desserts, but they were not considered healthy due to stamps on their labeling. Thus, fruits, dairy products, and traditional desserts could be used as the basis for developing healthy and acceptable products focused on older people. Despite this, it is also necessary to consider the sensory needs of older people, especially those related to texture, to design safe and easy-to-swallow desserts due to physiological dysfunctions that occur during aging.

Regarding methodology aspects, we can conclude that the WA task allowed us to know which desserts the elderly enjoy, those characteristics that they considered important in this type of product, and their sensory needs. Instead, ST methodology showed which desserts were more liked for older people and how they are perceived according to their healthiness. Despite this, some limitations of the present study should be considered. WA methodology allowed us to obtain more information about desserts and their related-to concepts, but the participants required a more significant cognitive effort to do the task. Instead, the ST technique was easier to carry out for older people, recommending its use.

4. Conclusions

In general, Word Association and Sorting Task methodologies allow to know older people’s perceptions regarding the desserts they like the

most and to detect some sensorial requirements related to this kind of product. Older people who participated in this study showed a clear opinion and perception about the different dessert stimuli. Furthermore, most of them presented good nutritional knowledge because they associated the healthy stimulus with low-sugar and fat products and/or rich in fiber and vitamins. Despite this, a small group of the elderly showed a different classification of some desserts, suggesting that their classification was due to traditional and natural homemade aspects rather than healthiness. In addition, some essential sensory characteristics for a type of dessert were detected, such as tasty-aromatic, creamy-soft and fresh/refreshing, which could be related to the elderly’s sensory needs triggered by physiological changes occurring during aging. Similar results were observed on the classification of the desserts photographs, since products with these sensory characteristics (fruit, rice pudding, jelly, and traditional Chilean dessert) were included in the “healthy and I like it” category. Thus, this information can help the food industry develop healthy and palatable foods for older adults.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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