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Original/*Alimentos funcionales*

Acceptance of functional food among Chilean consumers: Apple leather

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Abstract

Aim: **the aim of this study is to measure acceptance of a specific functional food: apple (fruit) leather, based on organoleptic characteristics and to identify consumer types and preferences for natural additives which increase the product´s functionality and meet current nutritional needs.**

Materials and methods: **a sample of 800 consumers provided an evaluation of apple leather in terms of acceptance (liking). A sensorial panel was carried out using a 9-point hedonic scale. Cluster analysis was used to identify different acceptance-based consumer types. In addition, a conjoint analysis was carried out to determine preference for different additives.**

Results: **the cluster analysis resulted in four groups with significant differences in the average likings obtained from the sensory panel. Results indicate that the sweetness of the tested apple leather was evaluated best among all groups and, on average, color was rated as the worst attribute. However, overall likings differ significantly between groups. Results from the conjoint analysis indicate that, in general, consumers prefer natural additives included in the product which enhance functionality.**

Conclusions: **although there is a "global acceptance" of the product, there are significant differences between groups. The results of the conjoint analysis indicate that, in general, consumers prefer the aggregation of natural additives which increase the product´s functionality. Apple leather with natural additives, such as anticariogenics and antioxidants, can be considered a functional substitute of unhealthy snacks and/or sweets.**

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LA ACEPTACIÓN DE LOS ALIMENTOS FUNCIONALES ENTRE LOS CONSUMIDORES CHILENOS: LÁMINAS DE MANZANA

Resumen

Objetivo: **el objetivo de este estudio es medir la aceptación de un alimento funcional como la lámina frutal de manzana, en base a características organolépticas. Se identificaron tipos de consumidores y sus preferencias hacia los aditivos naturales que aumentan la funcionalidad del producto y satisfacen las necesidades nutricionales actuales.**

Materiales y método: **una muestra de 800 consumidores permitió la evaluación de la lámina frutal de manzana en términos de aceptación (gusto). se llevó a cabo un panel sensorial utilizando una escala hedónica de nueve puntos. Se utilizó el análisis de conglomerados para establecer diferentes tipos de consumidores, basados en la aceptación del producto. Además, el análisis conjunto permitió determinar la preferencia sobre diferentes aditivos.**

Resultados: **el análisis de conglomerados permitió identificar cuatro grupos con diferencias significativas en los gustos promedios, obtenidos del panel sensorial. Los resultados indican que el dulzor de la lámina frutal de manzana fue mejor evaluada entre todos los grupos y, en promedio, el color fue calificado como el peor atributo. Además, a pesar de que existe una "aceptabilidad global" por el producto, existen diferencias significativas entre los grupos. Los resultados del análisis conjunto indican que, en general, los consumidores prefieren la agregación de aditivos naturales que aumentan la funcionalidad del producto.**

Conclusiones: **en este estudio, la lámina frutal de manzana como alimento funcional se ajusta con el hábito de las personas de consumir alimentos dulces, lo que promueve su aceptación. Además, la agregación de aditivos naturales al producto, tales como anticariogénicos y antioxidantes, permite considerarlo como un alimento funcional sustituto de los *snacks,* poco saludables y/o de los caramelos.**

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Palabras claves: *Alimentos funcionales. Sabor. Comportamiento del consumidor. Atributos intrínsecos. Hábitos alimentarios.*

Introduction

For the past few decades the threat of unhealthy diets has been an increasing issue worldwide. Causing 2.8% of deaths annually, unhealthy diets are currently considered one of the main causes of the four major risk factors of death: high blood pressure, high blood glucose, overweight and obesity and high cholesterol[1]. In 2005, 33% of the world´s adult population was either overweight or obese, and this number is expected to grow to 57.8% in 2030; due to this rapid increase it is considered a global burden[2]. Chile is not an exception: with almost 70% of the population overweight in 2010, the entire population is expected to be overweight by 2040[3].

Similar to other countries, one of the main causes of unhealthy diets in Chile is urbanization which causes changes in lifestyles[4]. These Western and sedentary lifestyles increase energy intake due to less physical activity and consumption of high caloric processed foods and beverages[5]. A clear indicator of this concern in Chile is the fruit and vegetable consumption per capita. With around 168 and 227 grams per day, consumption is far below the WHO´s daily recommended 400 grams[6,7]. Fruits and vegetables are the primary source of antioxidants, which are known to decrease oxidative stress and consequently the development of non-communicable diseases[8]. Another example of the growing tendency in unhealthy dietary habits is the consumption of energy drinks which has increased by 80% between 2006 and 2014[9].

It is clear that changes have to be made in order to improve dietary habits; however, the question is: why do humans not improve their dietary habits? There are three simple answers to this question: because they don't know how to, they can't accomplish it or they don't want to[10]. To confront these issues a government can provide health and nutrition education, (and/while) another alternative is food enrichment[10]. The important objective here is maintain or achieve a food product with a satisfying taste, as most consumers are not willing to compromise taste for health[11]. Advanced food technologies allow for the development of products which fit current tendencies but can also meet nutritional needs. Although in Chile there is no specific definition of foods that address particular health needs, in Asia[12], North America and Europe these are defined as "functional foods"[13]. While natural energy additives follow the functional food trends[14], antioxidants and anticariogenics are components that can bring health benefits which are needed in the Chilean diet. Dental caries is considered one of the main health problems in Chile[15].

With increasing health costs, the Chilean government has undertaken various actions to improve the population´s dietary pattern using public policies and campaigns. However, without continuity effectiveness has shown to be temporary[16]. Convincing consumers to change their eating habits and adopt a healthier diet can be difficult as the benefits of eating healthy are not directly visible[17]. Additionally, food choice has been shown to be primarily determined by taste rather than health benefits[11].

The challenges that arise here are the development of healthy food that tastes good and the acceptance by the consumers. The acceptance of functional foods has been studied broadly in Europe, Asia and North America[18,19]. In South America, however, the concept is still new and few studies are available on the acceptance of these types of foods by South American consumers[12].

The aim of this study is to measure acceptance of a specific functional food: apple (fruit) leather, based on organoleptic characteristics and to identify consumer types and preferences for the product enriched with natural additives which increase the product´s functionality and meet current nutritional needs.

Materials and Methods

As test material (apple) fruit leather was used. Fruit leather is a novel product in the Chilean market; however, in the North American market this product is already established as a healthy snack under the name of fruit leather or fruit roll ups[20]. It is made by drying a very thin layer of fruit puree, and its name ´fruit leather´ is related to the resulting sticky, chewy soft structure. Although processed, fruit leather retains the same concentrations of fibre, minerals, sugars and nutrients as fresh fruit. In addition, this product has far less calories than other snacks with less than 100 kcal per leather and can be an economic and convenient value-added substitute of fresh fruits and a source of nutrient elements[21].

A personal survey was carried out between the months of August and September 2014 on a convenience sample of 800 consumers, of which 400 live in the city of Santiago de Chile (5.428.590 inh.), Metropolitan region and 400 in the city of Talca (193.755 inh.), Maule region[22]. The reason for conducting this survey in two different cities is the country´s unique geographical territory which among other aspects causes cultural differences between people who live in the Metropolitan region and people who do not[23]. In addition, according to statistics of the Chilean National Statistics Institute (INE), the Maule region is characterized as the area with the highest percentage of rural population in the country, with 34% of the population working in rural areas, equivalent to more than 305,000 people.

Respondents were considered eligible for the interview when above the age of 18 and responsible for household food shopping. Consumers were recruited in shopping areas. Prior to the survey a short oral introduction was given on the aim of the survey, the handling of the information obtained from the survey with strict confidentiality and the concept of a snack and a healthy snack. Accordingly, the consumers were asked if they were willing to participate, and those who

Table I
Orthogonal design: Attributes and levels

Design	*Approximated Price USD*	*Antioxidants*	*Anticariogenics*	*Natural energetics (Guavana)*
1	0,35 cents	Without antioxidants	Without anticariogenics	With energetics
2	0,26 cents	With antioxidants	Without anticariogenics	Without energetics
3	0,35 cents	With antioxidants	Without anticariogenics	With energetics
4	0,26 cents	With antioxidants	With anticariogenics	Without energetics
5	0,35 cents	Without antioxidants	Without anticariogenics	Without energetics
6	0,26 cents	With antioxidants	With anticariogenics	With energetics
7	0,35 cents	Without antioxidants	With anticariogenics	Without energetics
8	0,26 cents	Without antioxidants	With anticariogenics	With energetics

agreed to participate were asked to sign consent prior to responding the survey. The survey was divided into three sections of which the first section was introductory. This section included general closed questions on frequency of snack consumption and buying location. Also, a filter question was included to disregard respondents who do not consume snacks at the initial stage of the interview.

The second section of the survey included preference based questions, which were designed, based on information obtained from processed food expert opinions on product properties, organoleptic characteristics and product design of the apple fruit leather[24]. The sensorial panel allows testing for consumer preference, acceptance and attitude towards the tested product. Consumers were presented with an apple fruit leather for sensory testing. Consumers were asked to indicate their degree of preference by using a 9-point hedonic scale from ´Dislike extremely´ (1) to ´Like extremely´ (9)[25]. The evaluated attributes included color, aroma, acidity, sweetness and overall liking[24]. Before tasting, consumers were asked if they recently had eaten something, if so they were served water and unsalted crackers in order to reduce any residual effect.

The acceptance responses of the overall sample were evaluated by comparing the means of each attribute on the 9-point hedonic scale. Consumers were clustered together based on the consumer likings for each of the measured attributes on the 9-point hedonic scale, by agglomerative hierarchical clustering with Euclidian distance and Ward´s method as aggregative criterion[26]. Cluster analysis can be defined as a multivariate technique which looks for homogeneous separated subsets (clusters). An analysis of variance (ANOVA) was done in order to identify significant differences in likings of the attributes, captured by the 9-point hedonic scale, between the identified clusters. Levene statistics was carried out to determine homogeneity of variance, and based on the results a/the Dunnet-T3 post-hoc test was performed to identify differences in means of each attribute between clusters[26].

To determine the acceptance of different nutritious additives a Conjoint Analysis (CA) was separately carried out for each of the clusters (Table IV). CA is a multivariate technique and can be defined as a decompositional method that allows the preference structure of each individual consumer to be measured by the part-worth utilities. The part-worth utilities indicate the degree of preference of each individual for each level per attribute[26]. The attributes included antioxidants, anticariogenics and natural energy; each of these attributes had two levels: with or without the specific additive. Also, price was included as an attribute with two levels (USD 0.26 and USD 0.35), as it has shown to be an important determinant in consumers´ purchasing decision[27]. The national currency values (Chilean pesos) were converted to dollars using the average 2014 value (Ch$570.37/US$). From these attributes and levels a total of 16 combinations (2x2x2x2) were obtained. In order to facilitate response for participants, an orthogonal design was used which allowed the number of stimuli to be reduced to eight with one specification for each attribute, which were presented as cards to the consumer (Table I). Each respondent ordered the cards with the combination of attributes from most to least preferred, on a scale of 1 to 8, where 1 = most preferred; 8 = least preferred. The validity of the estimation was measured by calculating Pearson´s correlation coefficient R and Kendall´s tau coefficient between the observed evaluations of the respondents and evaluations estimated by the model[26].

The final section of the survey included questions related to demographic and socio-economic characteristics of the respondents, such as age, gender, household income, household size and living with children. These variables allowed profiling each cluster using Chi-square analysis for nominal socio-demographic variables. The SPSS statistical analysis software version 15 (Spanish) was used to carry out the data analyses.

Table II
Average Apple leather acceptance ratings per segment

Attribute	*Total sample (n=800)*	*Group 1(n=260)*	*Group 2(n=168)*	*Group 3(n=212)*	*Group 4(n=160)*	*F*	*P-value*
Color	4,6	6,7a	4,4bc	4,7cb	2,6d	209,094	0,000*
Aroma	5,6	7,3a	5,6b	4,9c	3,2d	260,31	0,000*
Acidity	4,8	7,5a	1,9b	4,9c	3,3db	704,96	0,000*
Sweetness	7,1	8,2a	8ab	7c	4,4d	345,306	0,000*
Overall liking	6,1	7,5a	7,1b	5,5c	3,5d	388,231	0,000*

*Significant at 1%. Evaluated using a 9-point hedonic scale were 1 = disliked extremely and 9 = liked extremely. Different letters in the same row indicate statistically significant differences in averages according to the T3 Dunnett comparison test (p≤ 0.001), for nonhomogeneous variances.

Results

The sample included slightly more female (50.4%) than male respondents and the average age was 39 (S.D. 14.7). As for the educational level around 10% had not completed high school; 33% completed high school; 17% finished some technical education; 16% graduated from university and, the remainder did either not finish technical education or university. About 28% of the respondents had an income between USD 416 and 934; 35% had an income between USD 935 and 1160; 32% had an income between USD 1161 and 3129; 9% of the remainder earned less than USD 416 and 6% earned more than USD 3129.

The sensory panel resulted in an average overall liking of 6.1. Sweetness was the highest rated attribute (7.1) followed by aroma (5.6) and acidity (4.8), whereas the lowest rated attribute was color (4.6). Based on the acceptance ratings obtained from the sensory panel the hierarchical cluster analysis resulted in four groups. Significant differences were found between groups in the average ratings of the attributes (Table II) tested in the sensory panel ($p \leq 0.001$). As for socio-demographic characteristics, the groups presented significant differences in the gender profile ($p \leq 0.05$) and educational level ($p \leq 0.05$). Also, significant differences were found in the region of origin ($p \leq 0{,}001$), presence and age of children ($p \leq 0.001$) average household income ($p \leq 0.001$) and average age ($p \leq 0.001$) (Table III).

The CA results for the total sample indicated that consumers assigned higher utilities to the product with all the natural additives included. The CA carried out for each cluster resulted in differences in utilities and relative importance of the attributes between groups, which are indicated below. The total sample considered anticariogenics as the most important attribute, followed by natural energy, antioxidants and price (Table IV). Although consumers preferred the lower price, it is important to highlight that this is considered relatively the least important attribute. The resulting value for both Pearson´s R and Kendall´s tau of the total sample and each of the clusters indicated that the model shows a valid prediction of consumer´s preferences for each of the measured attributes.

– Group 1 (32.5% of the total sample) was the largest group and assigned the highest scores to all attributes in the sensory panel which were significantly higher than those of the other groups. These results suggest that this group had a high acceptability of all the attributes tested in the sensory panel. Sweetness was the highest ranked attribute in this group (8.2). This group included more women (55%) than men and a larger percentage of this group lived in the Metropolitan region (60%). This group had the highest educational level in comparison to the other groups and a middle-high income (table III). The most important attribute was anticariogenics, followed by antioxidants, natural energy and price (table IV). In general, this group preferred the product with all the natural additives included. Based on these results this group was named the "Approachable".

– Group 2 (21% of the total sample) assigned irregular scores to the attributes of the sensory panel, with low ratings for the individual attributes (except for sweetness) and a high acceptance rating for the overall liking. Acidity was the lowest rated attributed in this group and in comparison to the other groups. This group consisted of mostly consumers who live in the Maule region (88.1%) and included more men (55.4%) than women. Also, it had the highest average age (41.9, S.D. 16.4), and the highest percentage of children over 18 (41.7%). The educational level and income were lowest in this group in comparison to the other groups (Table III). Natural energy was considered the most important attribute in the CA, followed by antioxidants, anticariogenics and price (Table IV). This group prefers the product with all natural additives included, especially natural energy. Considering the above, this group was named the "Taste oriented".

Table III
Socio-demographic characteristics (%) of the groups obtained from the cluster analysis

	Group 1 (n = 260)	*Group 2 (n = 168)*	*Group 3 (n = 121)*	*Group 4 (n =160)*	*P-value*
Gender					
Male	45	55,4	49,1	51,9	0,004*
Female	55	44,6	50,9	48,1	
Average Age (S.D.)					
	39,3a (14.5)	41,9bd (16.4)	38,6c (14.1)	35,5db (13.2)	0,000*
City of origin					
Santiago de Chile	60	11,9	42,9	83,1	0,000*
Talca	40	88,1	57,1	16,9	
Educational level					
Unlearned	1,9	1,2	1,4	1,3	0,005*
Elementary school degree	0,4	0,6	0,9	1,3	
Some high school	8,8	7,1	7,1	5	
High school degree	29,2	48,2	27,4	34,4	
Some technical college	5,4	8,9	9	10	
Technical college degree	16,9	7,7	18,9	11,3	
Some university	16,2	12,5	18,9	20	
University degree	18,1	13,7	16	15	
Postgraduate	3,1	0	0,5	1,9	
Presence and age of children					
No children	27,3	18,5	26,4	42,5	0,000*
Children younger than 5	20,4	19,6	21,7	17,5	
Children between 5 and 12	11,5	11,9	17	12,5	
Children between 13 and 17	4,2	7,7	7,5	7,5	
Children over 18	31,9	41,7	24,1	15,6	
Other (different age ranges)	4,6	0,6	3,3	4,4	
Household´s average income					
Less than USD 416	6,9	16,7	6,1	8,1	0,000*
Between around USD 416 and USD 934	27,7	35,7	29,2	16,9	
Between around USD 935 and USD 1159	23,5	23,2	29,7	27,5	
Between USD 1160 and USD 3120	32,3	21,4	32,1	40,6	
More than USD 3120	9,6	3	2,8	6,9	

P values were obtained using Chi2 at 5%. ** Significant at 1%. Different letters in the same row indicate statistical significant differences in averages according to the T3 Dunnett comparison test (p≤ 0.001), for nonhomogeneous variances.

Table IV
Importance values % of the natural additives and price in buying apple leather and the utilities of levels of each of the attributes obtained from the conjoint analysis for the total sample and each of the identified group obtained from the hierarchical cluster analysis

	Total sample	*Group 1 (n = 260)*	*Group 2 (n = 168)*	*Group 3 (n = 121)*	*Group 4 (n = 160)*
Importance of attribute %					
Natural energetics	27,564	25,39	29,367	30,082	25,697
Anticariogenics	28,17	28,423	25,826	28,48	30,072
Antioxidants	25,881	27,403	26,589	24,879	23,944
Price	18,385	18,784	18,218	16,56	20,287
Utility of each attribute level					
With natural energetics	0,494	0,446acd	0,659bc	0,623cab	0,229da
Without natural energetics	-0,494	-0,466acd	-0,659bc	-0,623cab	-0,229da
With anticariogenics	0,268	0,199ac	0,464bc	0,519cab	-0,159d
Without anticariogenics	-0,268	-0,199ac	-0,464bc	-0,519cab	0,159d
With antioxidants	0,506	0,566a	0,536a	0,539a	0,332a
Without antioxidants	-0,506	-0,566a	-0,536a	-0,539a	-0,332a
Price (USD 26 cents)	-0,362	-0,369a	-0,321a	-0,495a	-0,217a
Price (USD 35 cents)	-0,724	-0,738a	-0,643a	-0,991a	-0,434a
(Constant)	5,039	5,051	4,978a	5,236	4,825
Pearson´s R	0,997	0,992	0,999	0,997	0,962
Kendall´s tau	1	0,857	1	1	0,786

Utility numbers of the different attribute levels with a positive sign indicate the consumers´ preference, utility numbers with a negative sign indicate loss in utility or rejection, a negative utility means a bigger loss in utility. Different letters in the same row indicate statistically significant differences in averages according to the T3 Dunnett comparison test ($p \leq 0.001$), for nonhomogeneous variances.

– Group 3 (26.5% of the total sample) evaluated all sensory attributes with lower scores than group 1 and 2. In this group sweetness was rated best (7) and color was rated worst (4.7). Interestingly, the overall liking was equal to the average rating of the individual attributes. Group 3 includes slightly more women (50.9%) and the majority lived in the Maule region (57.1%). Most consumers in group 3 finished at least high school (90.7%) and had a middle income with 61.8% earning between than USD 935 and USD 3120, while the average age was 38.6 (S.D. 14.1). Natural energy was the most valued attribute in the CA, followed by anticariogenics, antioxidants and price. Although price was the least important attribute, this group showed greatest rejection of the product with a higher price, in comparison to the other groups. Based on the results, this group was named the "Critical".

– Group 4 (20% of the total sample) rated all sensory attributes lowest in comparison with the other groups, with an overall liking of 3.5. 83.1% of this group lived in the Metropolitan region. This group had the lowest average age (35.5, S.D. 13.2) which significantly differs from group 2 (table III). The majority at least finished high school (92.6%) and this group had the highest percentage of people with no children (42.5%) and the highest income in comparison with the other groups (Table III). This group preferred apple leather without anticariogenics and a relatively lower importance was assigned to the attributes of natural energy and antioxidants in comparison to the other groups. Therefore, this group prefers a natural product over an enriched product. Although price was valued as the least important attribute, it was valued slightly higher in this group than in the other groups. It is remarkable this group has the smallest rejection towards the higher price (Table IV). Considering these results, this group was named the "Conservatives".

Discussion

The acceptance of functional foods has been studied broadly in developed countries, indicating that besides

cognitive, motivational and attitudinal determinants, taste is one of the main conditions for acceptance[11,18]. This study contributes to the knowledge on functional food and healthy snack acceptance based on a sensory panel (taste among other attributes) and socio-demographic factors, in a developing country of Latin America, Chile. In addition, a conjoint analysis shows the preference for natural additives which increase the functionality of the product. In this regard, in general sweetness was the best rated attribute in the sensory analysis of the apple leather, followed by aroma, color and acidity, with an overall liking of 6.1 (Table II). This implies that apple leather responds to the Chilean habit of sweets consumption and thus, that the products fits the palate of the Chilean consumer. This finding highlights that sweet intake is of very high proportion among the Chilean population. Consumption of sugar in general is around 76.9 grams per day of which 25.5 grams comes from candy and other sweet foods[7]. Again, this highlights the necessity of a dietary change as in 2014 the WHO changed its recommended sugar intake to below 5% which is equivalent to around 25 grams per day. The above could imply a higher likelihood of product acceptance by the Chilean population.

Related to the above, dental caries is a serious public health problem in Chile[28], which could explain why anticariogenics, in general, is valued as the functional attribute with most relative importance. This could be an indicator of the awareness of the problem of dental caries by the public and the potential acceptance of apple leather with anticariogenic properties.

The Approachable (Group 1) has a middle-high income but the highest educational level, percentage of female consumers and product acceptability. Also, this group prefers all the additives included in the product. These results are in line with studies conducted in the US suggesting that females who have a higher income and educational level are most interested in functional foods[29].Contrary results were found in the EU where believes and knowledge overshadow socio-demographic factors in the acceptance of functional food[18]. According to our results, the determinants of acceptance of functional food in Chile are more similar to those of the US than the EU.

The Taste oriented (Group 2) showed a clear orientation towards taste. The difference between scores of overall liking and ratings for the individual attributes might infer that this group could have been uncertain during the sensory panel or that the importance of sweetness outweighs that of the other attributes for this group. This result agrees with previous studies which indicate the great importance of sensory characteristics, especially taste, in the acceptance and choice of functional foods[17,18]. The majority of this group lives in the city of Talca (88.1%), which could explain the lower acceptance of apple leather in comparison to the Approachable group, as acceptance of functional foods has been shown to be lower in rural areas than in urban areas[30]. However, the Conservatives group, has lower acceptance ratings for all the attributes; considering that 83.1% of this group live in the city of Santiago[31], this result could indicate that acceptance is not related to living in either a rural or urban area.

The Critical (group 3), similar to the Approachable and Taste oriented groups, preferred all the natural additives included in the apple leather; however, antioxidants and price are relatively less important for the Critical group than for the latter. Thus, this group seems to find a low price less important than the other groups, even though the Critical group has a relatively lower income than the Approachable. This result could suggest that acceptance is barely determined by price. In addition, price was the least important attribute for all groups, which contradicts the result of studies done in Spain and Italy in which price of functional food is relatively more important to consumers than other product attributes[32,33].

The Conservatives consist of consumers with the lowest acceptability of the apple leather. This group has the youngest average age and the largest percentage of "no children". The latter suggests that consumers are less likely to accept fruit leather when having no children, which is in line with the research of Gilbert (2000)[34]. The CA indicated that, unlike the other groups, the Conservatives prefer apple leather without added anticariogenics and that price is relatively more important in this group than in the other groups. Corresponding with other studies, this finding could indicate that this group is not willing to compromise on taste for health and that this group prefers a more ´natural´ product. While attitudinal and cognitive factors were not measured these results could indicate an unawareness of the benefits of these additives, especially anticariogenics[11].

Conclusions

In our study, we found that apple leather is accepted by consumers due to their habit of sweets consumption. From this perspective, fruit leather with similar characteristics as dried fruit can be considered as a healthy substitute of unhealthy snacks and/or sweets. Therefore, governmental authorities and private entities could encourage the consumption of these snacks and the replacement of high caloric snacks by such as product. This product can be introduced in campaigns that promote healthy living and diet which are focussed on taste and functionality.

Regarding the limitations of the study, it can be noted that the sample is not representative of the population distribution of Chile. However, the higher proportion of women interviewed is similar to that of other studies in which respondents are filtered by being ´responsible for household purchasing´[35]. Also, the inclusion of antioxidants as an attribute could have interfered with the results as respondents might have not been familiar with the actual health benefits. Finally, results of this

study might be inconclusive considering the exclusion of cognitive and attitudinal factors as suggested in the research of Verbeke (2005)[18].

Conflict of interest

The authors report no conflict of interest.

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