Uruguayan consumers' perception of mandarins

insights for selection and marketing of new cultivars

Editor

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Percepción de las mandarinas por los consumidores uruguayos

aportes para la selección y la promoción de nuevos cultivares

Percepção dos consumidores uruguaios sobre tangerinas

contribuições para a seleção e comercialização de novas cultivares

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Abstract

A better understanding of the key characteristics influencing consumers' perception and purchase decisions of mandarins can contribute to the selection of new cultivars that assertively meet their needs and expectations, as well as to the development of strategies to increase mandarin consumption in the different markets. In this context, the aims of the present work were: i) to explore Uruguayan consumers' perception of mandarins, and ii) to identify the key characteristics that drive mandarin purchase decisions. A consumer study with 197 consumers was conducted in a supermarket in the metropolitan area of Montevideo (Uruguay). A word-association task was used to identify consumers' associations with mandarins, whereas a best-worst scaling was used to estimate the relative importance of specific characteristics. Results from the word association task revealed that sensory characteristics (juiciness, sweetness, color, flavor and odor) were the most salient concepts associated with a mandarin, followed by fruit characteristics and consumption context. Mandarin flavor was identified as the most important characteristic underlying consumers' purchase decisions in the best-worst scaling, followed by juiciness and high vitamin content; while packaging, size or price resulted less relevant. Consumer segments who attached different relative importance to vitamin content, price, lack of seeds and easiness to peel were identified. Results from the present work suggest that strategies to increase mandarin consumption should focus on sensory and hedonic aspects rather than package appearance or health-related ones.

Keywords: breeding, citrus, flavor, sensory, fruit quality

Resumen

Conocer las características de las mandarinas que más influyen en la percepción y la decisión de compra de los consumidores contribuye a la selección de nuevos cultivares que cumplan sus expectativas, así como las estrategias que promuevan su consumo en diferentes mercados. En este contexto, los objetivos de este trabajo fueron: i) explorar la percepción de las mandarinas por parte de los consumidores uruguayos, y ii) identificar las características que influyen en la intención de compra de mandarinas. Para ello, se desarrolló un estudio en un supermercado del área metropolitana de Montevideo (Uruguay) que incluyó 197 consumidores. Para identificar las características que el consumidor asocia con las mandarinas se utilizó el método de asociación libre, mientras que el método de escala mejor-peor (*best-worst scaling* -BWS) se aplicó para estimar la importancia relativa de determinadas características. Los resultados del primer estudio revelaron que las características sensoriales (jugosidad, dulzor, color, sabor y olor) fueron los conceptos más destacados asociados con las mandarinas, seguidos por características de la fruta y del contexto de consumo. El sabor fue identificado como la característica más importante que determina la intención de compra de los consumidores uruguayos, seguido por el contenido de jugo y de vitaminas, mientras que el envase, el tamaño del fruto o su precio resultaron menos relevantes. Se identificaron diferentes segmentos de consumidores que difieren en la importancia relativa del contenido de vitaminas, el precio, la ausencia de semillas o la facilidad de pelado. Los resultados del presente trabajo sugieren que los esfuerzos para promover el consumo de mandarinas deberían centrarse en aspectos sensoriales y hedónicos más que en aspectos relacionados con la apariencia o la salud.

Palabras clave: mejoramiento genético, citrus, sabor, sensorial, calidad de fruta

Resumo

O melhor entendimento das principais características que influenciam a percepção dos consumidores e as decisões de compra de tangerina pode contribuir para a seleção de novas cultivares que atendam de forma assertiva às suas necessidades e expectativas, bem como para o desenvolvimento de estratégias para aumentar o consumo de tangerina nos diferentes mercados. Nesse contexto, os objetivos do presente trabalho foram: i) explorar a percepção dos consumidores uruguaios sobre o mandarim e ii) identificar as principais características

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que orientam as decisões de compra do mandarim. Um estudo de consumidor com 197 consumidores foi conduzido em um supermercado na região metropolitana de Montevidéu (Uruguai). Uma tarefa de associação de palavras foi usada para identificar associações de consumidores com mandarins, enquanto uma escala de melhor-pior foi usada para estimar a importância relativa de características específicas. Os resultados da tarefa de associação de palavras revelaram que as características sensoriais (suculência, doçura, cor, sabor e odor) foram os conceitos mais salientes associados a uma tangerina, seguida pelas características da fruta e contexto de consumo. O sabor da mandarim foi identificado como a característica mais importante subjacente às decisões de compra dos consumidores na escala melhor-pior, seguida por suculência e alto teor de vitaminas, enquanto a embalagem, tamanho ou preço resultaram menos relevantes. Foram identificados segmentos de consumidores que atribuíram importância relativa diferente ao teor de vitaminas, preço, falta de sementes e facilidade de descascar. Os resultados do presente trabalho sugerem que as estratégias para aumentar o consumo de tangerina devem focar nos aspectos sensoriais e hedônicos, e não na aparência da embalagem ou relacionados à saúde.

Palavras-chave: melhoramento, citros, sabor, sensorial, qualidade do fruto

1. Introduction

During the last decade, mandarin production has increased by 30% worldwide, creating new market opportunities[1]. Consumers have been identified as a major driving force of this situation due to the exponential increase in the demand for new varieties that fulfill consumers' sensory and hedonic expectations[1]. However, breeding strategies have been traditionally focused on improving on-tree productivity, fruit appearance, adaptation to local conditions and resistance to pests and diseases[2]. In order to develop mandarin cultivars that meet consumers expectations, the sensory characteristics of mandarins are increasingly considered as part of breeding programs[1][3][4][5][6] as well as to the development of strategies to increase mandarin consumption in the different markets.

Sensory characteristics are key determinants of consumers' purchase and consumption decisions of mandarins. Different studies conducted in the United States of America (USA) and Spain have reported that sweetness, acidity and mandarin flavor are the most important factors driving consumers' willingness to try a mandarin[4][7][8]. In addition, previous studies with consumers reported that juiciness, skin quality, sweetness and texture were the most important characteristics for citrus fruits[9]. However, consumers' perception of mandarins is expected to depend likewise on non-sensory characteristics. In this sense, convenience of consumption, easy peeling and easy carrying have been identified as relevant characteristics for mandarin consumers[1][7][8]. In this sense, mandarins content a wide range of antioxidants and vitamins that could contribute to the prevention of non-communicable diseases, and could also be relevant for consumers with a strong health-motivation[1][10][11][12].

Consumers' preferences, purchase and consumption of mandarins depend on the complex interaction between their individual characteristics (i.e. gender, age, habits, psychological traits), fruit sensory and extrinsic characteristics (i.e. price, packaging), as well as the context where decisions are made[13]. Currently, there is no information available on the factors influencing consumers' purchase of mandarins in Latin America. This information is crucial for breeding programs, and for the development of communication and marketing strategies aimed at increasing fruit sales and consumption.

In this context, the aims of the present work were: i) to explore Uruguayan consumers' perception of mandarins, and ii) to identify the key characteristics that drive mandarin purchase decisions.

2. Materials and methods

2.1. Participants

A total of 197 people (58% female, ranging in age between 18 and 86 years old –mean=46.4, SD=15.4) participated in the study. They were recruited at a local supermarket in the metropolitan area of Montevideo (Uruguay) while doing their purchases at the fruit and vegetable section. Consumers were intercepted by one of the researchers involved in data collection, who asked them if they consumed mandarins. Consumers who answered affirmatively were asked to take part in the study. All participants signed a consent form and received a small gift for their participation.

2.2. Questionnaire

The study was conducted in the supermarket where participants were recruited. Researchers read the questions aloud and registered the participants' responses in a paper ballot.

The first part of the questionnaire involved a word association task[14]. Participants were asked to say all the words that came to their mind when thinking of mandarins. They were encouraged to say as many words as possible.

After the word association task, participants were asked to complete a best-worst scaling task[15] aimed at capturing the relative importance of a series of factors when purchasing mandarins. They were presented with 10 choice sets composed of 5 characteristics of mandarins. For each of the choice sets, participants were asked to indicate the most and least important when purchasing for mandarins. The choice sets were created using a balanced incomplete block design based on the following 10 characteristics: "Without seeds", "Easy to peel", "Intense orange color", "Good taste", "Small", "Without spots on the skin", "High vitamin content", "Juicy", "Cheap", and "Attractive packaging". The choice sets were presented to participants following a Williams' Latin square design to minimize order and carry over effects. The presentation order of the characteristics within each of the 10 sets was also balanced using a similar procedure.

Finally, participants answered a series of socio-demographic questions (gender, age, education level, place of residence, number of children in the household) and stated their consumption and purchase frequency of mandarins.

2.3. Data analysis

Data from the word association task were analyzed using content analysis based on inductive coding[16]. Responses with similar meaning were grouped into categories as they emerged from the data. Two of the researchers who authored the study (with a minimum of two years of experience in consumer content analysis) performed an initial coding of the data. After completing an individual coding, the two researchers held a meeting to define the final categories by consensus. Results presented in the current paper represent the consensus between the two researchers. The same procedure was used to group the categories into dimensions. The percentage of consumers who provided responses within each category and dimension was calculated.

Data from the best-worst scaling were analyzed following the procedures recommended by Louviere and others[15]. For each consumer, the number of times that each characteristic was selected as most and least important was counted across the 10 choice sets. These two values were then subtracted to calculate B-W scores for each characteristic. Analysis of variance (ANOVA) was used to compare the B-W scores of the 10 characteristics. A confidence level of 95% was considered. Tukey's test was used for post-hoc comparison of average values.

Hierarchical cluster analysis was performed on the B-W scores to identify groups of consumers who attached different importance to the 10 characteristics when purchasing mandarins. Euclidean distances and Ward's agglomeration criterion were considered. The identified groups were compared in terms of their socio-demographic characteristics using the chi-square test.

3. Results

3.1. Consumers' associations with mandarins

A total of 179 different words and expressions were mentioned when participants were asked to say the

first words that came to their mind when they thought of mandarins. Following an inductive coding approach, responses were grouped into 33 categories, which were subsequently merged into six dimensions. The percentage of participants who provided responses related to each category and dimension are shown in Table 1, along with examples of responses.

Table 1. Percentage of consumers who provided responses within each of the dimensions and categories identified in the content analysis based on inductive coding performed on responses to the word association task about mandarins, and examples of individual responses

Dimension/Category	Examples of individual responses	Percentage of consumers (%)
Sensory characteristics		74
Sweetness	Sweet, Sweetness	42
Juiciness	Juicy, Very juicy	22
Color	Color, Orange color	20
Flavor	Flavor, Taste	18
Odor	Odor, Aroma, Aromatic	17
Sourness	Sour, Sourness, Acidity	9
Freshness	Fresh, Freshness	8
Tastiness	Tasty, Tastiness	4
Texture	Texture, Firm	3
Appearance	Appearance, No spots	2
Size	Small, Big, Size	2
Fruit		53
Citrus fruits	Citrus, Orange, Mandarin, Tangerine	19
Parts of the fruit	Seeds, Segments, Skin	18
Without seeds	Without seeds, No seeds	8
Fruit	Fruit, Fruits	8
Tree	Tree, plant	3
Consumption context		48
Juices	Juice	21
Winter	Winter, cold	10
Summer	Summer, sun	6
Culinary preparations	Fruit salad, Cake, Cocktails	4
Eating	Eating, food	3
Occasions	Dessert, breakfast	3
Locations	House, garden	2
Health and Nutrition		25
Vitamins	Vitamins, Vitamin C	19
Health	Health, Healthy	13
Hedonics		24
Pleasure	Yummy, Delicious	24
Neutral hedonic reaction	Not a big deal	1
Other characteristics		20
Convenient	Convenient, Easy to peel, Easy to eat	13
Hydration	Hydration, Refreshing, Thirst	4
Emotional associations	Nostalgia, Calm	4
Natural	Natural, Nature	1
Cheap	Cheap	1

The dimension *Sensory characteristics* was the most frequently mentioned when participants thought of mandarins. All the responses related to this dimension were connected to typical sensory characteristics of the product. As shown in Table 1, the most relevant category within this dimension was *Sweetness*, followed by *Juiciness*, *Color, Flavor* and *Odor*. The remaining responses related to sensory characteristics were mentioned by less than 10% of the participants.

The second most frequently mentioned dimension was *Fruit*, which included responses related to citrus fruits, parts of the fruit (e.g. seeds, segments, skin), general associations with fruits, trees and plants (Table 1). The third most salient dimension was related to product consumption, which was mainly associated to consumption occasions (e.g. winter, occasions and locations) or ways to consume mandarins (i.e. juices, culinary preparations).

Responses within the remaining dimensions were mentioned by 25% of the participants, or less. As shown in Table 1, mandarins raised associations with health and nutrition, particularly vitamins and health, as well as with hedonic aspects of product consumption. In particular, it is worth highlighting that 24% of the participants associated mandarins with pleasure by mentioning words such as *Yummy* or *Delicious*. Another relevant association was related to convenience, as 13% of the participants referred to convenience, ease of peeling and ease of eating (Table 1)

3.2. Relative importance of mandarins' characteristics for consumers' purchase decisions

Best-worst scaling was used to evaluate the relative importance of 10 characteristics of mandarins for consumers' purchase decisions. ANOVA of the B-W scores revealed significant differences between characteristics ($F_{9,1790}=160.8$, $p<0.001$), indicating that they differed in the relative importance that consumers attached to them when making their purchase decision. As shown in Table 2, good flavor was the most important characteristic underlying consumers' purchase decisions of mandarins, followed by juiciness and high vitamin content. On the contrary, attractive packaging was the least important characteristic.

Table 2. Results from the best-worst scaling showing the relative importance of 10 characteristics of mandarins, expressed as average B-W scores among participants

Characteristic	B-W score
Good flavor	2.6 a
Juicy	1.5 b
High vitamin content	1.2 b
Without seeds	0.2 c
Easy to peel	0.0 c
Intense orange color	0.0 c
Cheap	-0.8 d
Without spots on the skin	-0.8 d
Small	-1.1 d
Attractive packaging	-2.8 e

Note: B-W scores for each participant and characteristic were calculated by subtracting the number of times that the characteristic was selected as most important (B) across the 10 choice sets and the number of times it was selected as least important (W). B-W scores with different letters are significantly different according to Tukey's test for a 95% confidence level.

Three groups of consumers who attached different relative importance to the evaluated characteristics of mandarins were identified using hierarchical cluster analysis. No significant differences were found in the distribution of the clusters according to their socio-demographic characteristics or consumption frequency of mandarins (all p-values higher than 0.092).

As shown in Figure 1, flavor and juiciness were among the most important characteristics for the three clusters, whereas small size and attractive packaging were among the least important. However, the clusters largely differed in the relative importance attached to six characteristics: high vitamin content, without seeds, easy to peel, intense orange color, cheap and without spots on the skin. Consumers in Cluster 1 (n=64) were characterized by the high relative importance attached to the attribute "without seeds". Meanwhile, Cluster 2 gave higher relative importance to "ease of peeling" and

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"cheapness" and lower importance to "orange color". Finally, Cluster 3 (n=57) tended to attach higher importance to "vitamin content" and "absence of spots on the skin", and lower importance to "ease of peeling" compared to the other two clusters. These consumers also gave higher relative importance to "juiciness" compared to the other two groups of consumers.

Figure 1. Results from the best-worst scaling showing the relative importance of 10 characteristics of mandarins, expressed as average B-W scores among participants in each of the three clusters identified using Hierarchical cluster analysis
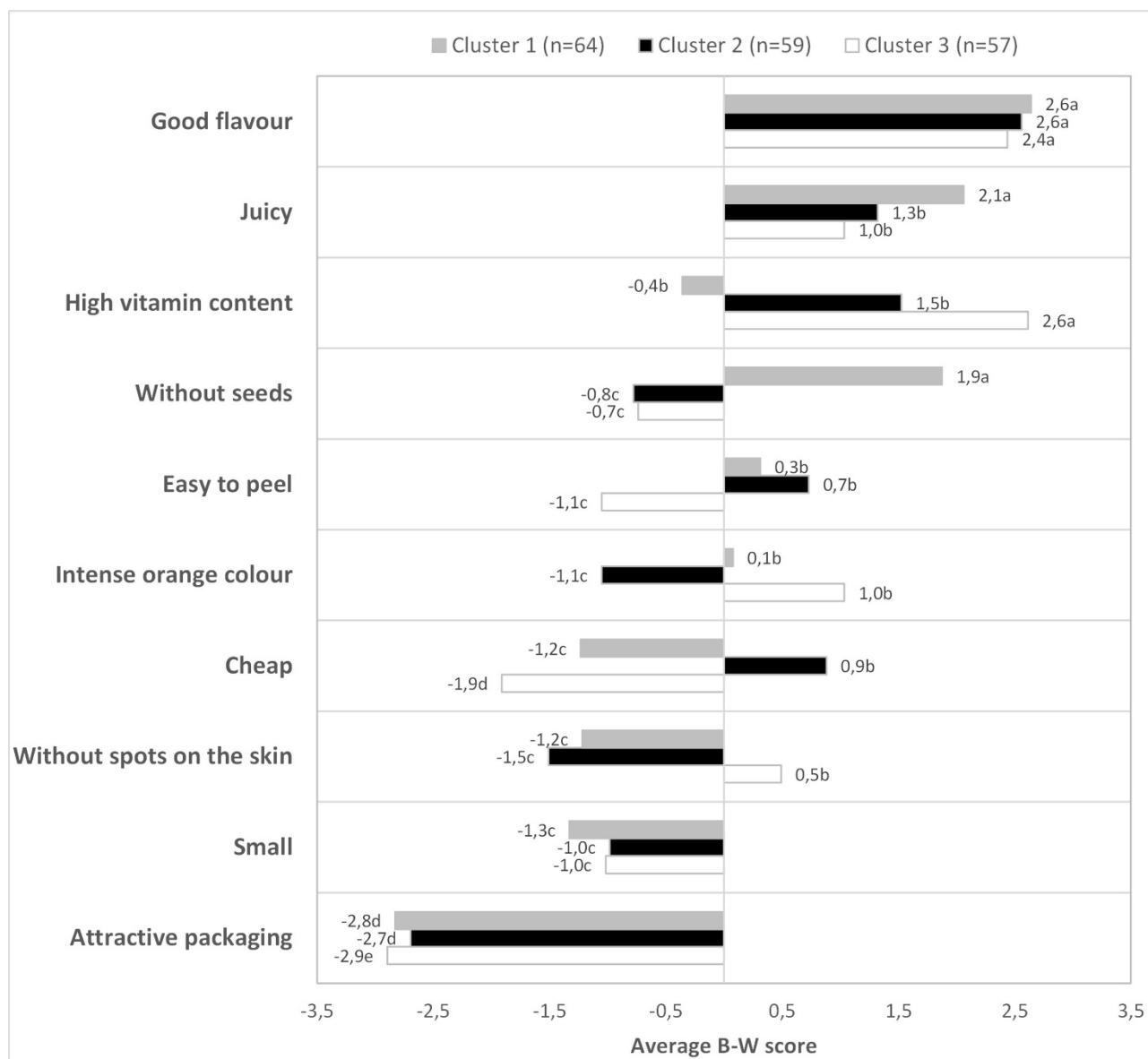
Note: B-W scores for each participant and characteristic were calculated by subtracting the number of times that the characteristic was selected as most important (B) across the 10 choice sets and the number of times it was selected as least important (W). B-W scores with different letters for each cluster are significantly different according to Tukey's test for a 95% confidence level.

4. Discussion

The present study explored Uruguayan consumers' perception of mandarins using a mixed approach that involved word association and B-W scaling. Results from the word association task showed that mandarins raised a wide range of associations related to their sensory characteristics, consumption context, health, nutrition and hedonic characteristics. Responses related to sweetness were the most frequently mentioned, suggesting that this sensory characteristic is the most relevant for consumers' conceptualization and the most influential on their purchase decisions[14]. Previous studies conducted in USA have reported that sweetness and flavor are key drivers of consumers' willingness to purchase mandarins[7][8][17]. Additionally, juiciness and color were also relevant sensory characteristics for consumers' conceptualization of mandarins.

Results from the B-W scaling highlighted the importance of sensory characteristic *good flavor* as the most important characteristic underlying consumers' purchase decisions of mandarins. According to Kurzer and others[17], adults feel frustrated by the lack of flavor and inconsistent sensory quality of mandarins. These results stress the need to integrate sensory and consumer science into breeding programs in order to improve marketability of new cultivars and increase consumption of mandarins[4][18]. Integration of sensory information through the use of novel and rapid methods has proven to be successful in the breeding programs of other crops[19][20][21]. Sensory studies will also provide crucial information to fulfill consumers satisfaction through different steps of the citrus commercialization chain. Since fruit flavor and juiciness can be affected by storage time and conditions (1,74), sensory studies would provide crucial information during citrus conservation experiments.

The importance of flavor for consumers' conceptualization and purchase decisions of mandarins suggests that strategies to increase consumption of this product should focus on sensory and hedonic aspects rather than health-related ones. Given the importance of pleasure on consumers' food choices, this approach has been recommended by Pettigrew[22] for promoting healthier eating habits.

From a marketing perspective, the results point towards opportunities for the differentiation of cultivars in the marketplace. New cultivars could be differentiated at the point of purchase based on key sensory attributes, such as sweetness, juiciness and mandarin flavor. In this sense, tastings at supermarkets and markets could contribute to familiarizing consumers with the characteristics of new cultivars and increase their purchase intention. Consumers may be willing to pay more for premium cultivars with distinct and consistent sensory quality, as reported by Kurzer and others, and it will be important to provide positive experiences to stimulate consumption[8].

Health related-aspects, and particularly vitamin C content, were identified as a relevant component of consumers' conceptualization of mandarins, suggesting that they are aware of the nutraceutical benefits of this products. High vitamin content showed high relative importance in the B-W scaling, which can be attributed to the fact that consumers clearly associate vitamins with a healthy diet[23]. However, it is worth noting that sensory characteristics were more important than vitamin C content for consumers' purchase decision of mandarins, suggesting that they may not be willing to compromise pleasure for potential health benefits. For this reason, marketing of cultivars based merely on claims related to vitamin C may not be successful. In this sense, a previous study conducted in USA showed that although consumers were positive about vitamin C labelling, information about this nutrient did not increase their willingness to purchase[24]. Another study showed that younger consumers are more aware of healthiness, easy of peeling, social use and eating preferences when choosing citrus[17].

Although consumers agreed in the high relative importance attached to sensory characteristics, heterogeneity in the relative importance attached to other characteristics was identified, coinciding with previous works[24]. This suggests the existence of marketing segmentation. In the present work, consumer segments providing different relative importance to the evaluated characteristics of mandarins did not significantly differ in their socio-demographic characteristics. This result is in agreement with the fact that behavioral variables have been claimed to have more explicative power on consumers' food

purchase decisions than demographics[25]. Further research is needed to identify the psychographic and behavioral determinants of differences in the relative importance attached to different characteristics of mandarins.

The identified groups of consumers differed in the relative importance attached to ease of peeling and lack of seeds, two characteristics that have been previously identified as important drivers of consumers' purchase intention of mandarins[17][24]. The present study suggests that easy to peel mandarins without seeds may be particularly appealing for a market niche. Marketing of mandarin cultivars based on their sensory characteristics can help consumers to identify and select products that meet their expectations, which could potentially contribute to increase consumption.

5. Conclusions

Sensory aspects (juiciness, sweetness, color, flavor and odor) were the most salient concepts associated with a mandarin, followed by fruit characteristics and consumption context. Mandarin flavor was the most important characteristic underlying consumers' purchase decisions, followed by juiciness and high vitamin content; while packaging, size or price resulted less relevant. This stresses the importance of including sensory analysis as an integral part of breeding programs and conservation experiments.

Author contribution statement

JL, GA and FR conceived and designed the analysis. All authors collected the data. AIM and FA contributed to initial data analysis. GA and FA performed the analysis. GA and JL wrote the manuscript; FA, FR and AIM revised the manuscript.

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