

What do Brazilian consumers know about olive oil, how do they consume it, and what factors influence their choice?

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Abstract

Although olive oil consumption in Brazil has increased, there is a lack of information about consumption patterns and consumer perceptions of olive oil quality. This is a quantitative study, with an exploratory, descriptive, and cross-sectional design about consumption habits, factors that determine the choice, and olive oil quality perception of Brazilian consumers. A total of 2,113 participants responded to the survey. Most of them (54.2%; 95% confidence interval [CI] 52.0–56.4) consume olive oil on a daily basis. Most important criteria of purchase are expiration date (80.5%; 95%CI 78.7–82.2). For 51.8% (95%CI 49.6–54.0) of the participants, aroma and flavor are the most important attributes with respect to quality perception. Most participants (61.8%; 95%CI 59.6–64.0) would buy more olive oil if it were cheaper. Participants preferably use olive oil in salads (93.3%; 95%CI 92.1–94.3). Health and taste are the greatest motivations for purchase (84.8%; 95%CI 83.1–86.3) and 68.7% (95%CI 66.6–70.8) of the responses, respectively. For 50.2% (95%CI 48.0–52.4) of the participants, the ideal olive oil is sweet and soft. The main reasons of those who do not usually buy olive oil were lack of habit (61.1%; 95%CI 53.4–68.2) and price (50.0%; 95%CI 42.3–57.6).

Keywords: extra virgin olive oil; consumer behavior; consumer preference; sensory quality.

Practical Application: It is very important that consumers know the sensory aspects of an olive oil, in order to choose oils with high-quality characteristics. The findings indicate the need for more efforts in informing and building consumers' awareness about the parameters of quality and benefits of olive oil. Although aroma and flavor were the most important attributes with respect to quality perception, a great number of participants considered expiration date and acidity the most important criteria of purchase, which are relevant, but not the only ones. The results support planning actions to encourage safe consumption in addition to contributing to the development of olive production in Brazil.

1 INTRODUCTION

Extra virgin olive oil is largely consumed due to its health-beneficial properties and unique sensory characteristics (Derakhshandeh-Rishehri et al., 2023; George et al., 2019; Seidita et al., 2022). Olive oil has been a key staple of the Mediterranean Diet for centuries (Naureen et al., 2022). In recent years, the consumption of olive oil in Brazil has been on the rise. In 2015, recorded consumption was 0.35 L/person/year, 2.5 times higher than in 2000. According to the most recent Brazilian family budget survey (Instituto Brasileiro de Geografia e Estatística [IBGE], 2018) the average expenditure on olive oil represents 25% of the average expenditure on oils and fats in general (International Olive Council [IOC], 2015; Vaz & Hoffmann, 2020).

The International Olive Oil Council defines as virgin olive oil the oil obtained solely from the fruit of the olive tree (*Olea europaea* L.) by mechanical or other physical means under certain conditions, especially thermal ones, which do lead to alterations to the oil, and using only treatments of washing, decantation,

centrifugation, and filtration (IOC, 2021). Based on the physicochemical parameters that are mandatory for assessment of quality, free acidity, peroxide values, and specific absorbency in ultraviolet, olive oil is marketed according to the following designations: extra virgin, virgin, and lampante olive oil. The latter type of olive oil does not fit for consumption (Brasil, 2012; IOC, 2021). The physicochemical properties of extra virgin oils should not only meet current legislation but also have some desirable and expected sensory attributes and be free from any sensory defects. Such sensory parameters are commercially mandatory in many countries. With respect to the desirable sensory attributes, extra virgin oil should have a fruity attribute and preferably a bitter and spicy taste. Among the defects most commonly found in virgin oils, identified by odors, are rancidity, acetic or vinegary, musty, and metallic. Through sensory analysis, complex aromas and flavors of olive oil are perceived by human senses (Barbieri et al., 2015; IOC, 2018).

Concerning consumers' perceived olive oil quality, including the sensory quality, it is strongly influenced by its extrinsic

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characteristics such as the visual perception of packaging, brand, and description of the oil, its origin, and even its price. Consumers usually believe in the information printed on the labels and associate them with the oil aroma and flavor (Del Giudice et al., 2015; Latino et al., 2022; Liberatore et al., 2018). This is why it is crucial to have sensory standards. On the other hand, it is critical that consumers understand what is a positive and a negative attribute of an oil, so that when they taste it and assess its characteristics, they can discriminate and choose the oils based on their quality attributes (Fernandes et al., 2020). It is very important that consumers know which parameters are important when buying an extra virgin olive oil, including the sensory parameters and label information directly related to the quality of the product (Teramoto et al., 2013).

Data on Brazilians' quality perception and consumption habits regarding olive oil are still scarce. Studies conducted in other countries show that buying and consuming olive oil are still influenced by myths and wrong criteria or choices (Caracciolo et al., 2020; Santosa et al., 2013; Zamuz et al., 2020). This lack of knowledge on the part of consumers, especially in new markets, is highly troublesome for the global market of olive oil, since some non-qualified companies can take advantage of this to justify the sale of low-quality products. Thus, it is necessary to develop a sensory education process so that consumers become familiar with the characteristics of high-quality olive oil (Fernandes et al., 2020). Consumers have become increasingly concerned about the foods that comprise their diet, particularly foods that have a direct relationship with health promotion and disease prevention, and this has a direct impact on the selection, purchase, and consumption of these foods.

This study is a quantitative investigation, with an exploratory, descriptive, and cross-sectional design, conducted through the administration of an online questionnaire and aimed to identify the profile and consumption habits that determine Brazilian consumers' choice and perceived quality of olive oil.

1.1 Relevance of the work

Production and consumption of olive oil have been increasing in Brazil. However, data on consumer habits and perceptions

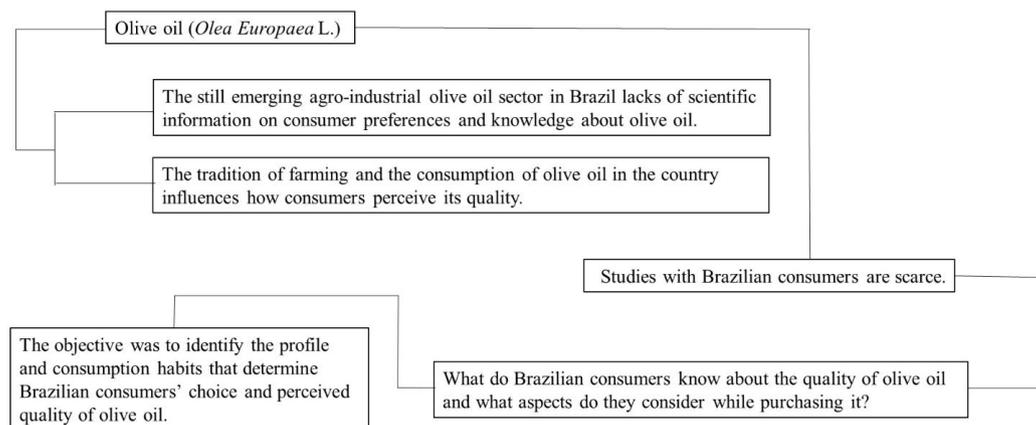
of olive oil quality remain limited. This study addresses this gap by investigating the profile, consumption habits, decision-making factors, and quality perception of olive oil among Brazilian consumers through an online questionnaire. A total of 2,113 participants responded to the survey. The findings highlight the urgent need to improve consumer education regarding quality parameters and the health benefits of olive oil. By shedding light on current knowledge gaps and misconceptions, this study provides valuable insights to guide public policies, industry practices, and educational strategies that promote informed and safer consumption of olive oil in Brazil.

2 MATERIAL AND METHODS

The study was conducted using an online questionnaire and followed a quantitative methodology with an exploratory, descriptive, and cross-sectional approach to collect data on Brazilian consumers' habits, choices, and perceived quality of olive oil. Figure 1 shows the theoretical framework of the study.

A non-probabilistic convenience sampling (snowball sampling) was used (Naderifar et al., 2017). The sample size was calculated according to the formula described by Daniel and Cross (2018) using a significance level (α) of 5%, corresponding to a 95% confidence level. The margin of error was set at 2.2% and the estimated proportion at 50%, which corresponds to the most conservative proportion, resulting in the largest sample size (Daniel & Cross, 2018). This calculation resulted in a sample of 1,985 people. Adult volunteers of all sexes freely and spontaneously consented to participate and signed the Informed Consent form. Data were evaluated and provided anonymously to ensure the participants' confidentiality. The project was approved by the Research Ethics Committee of Pedro Ernesto University Hospital (Document No 45815121.6.0000.5282).

The data were collected through a structured questionnaire, specifically designed for this study based on the scientific literature on the topic. It was made available in digital format via Google Forms and distributed online through social media, email lists, and institutional platforms. The questionnaire contained 41 questions (Supplementary Material), beginning with questions about socioeconomic characteristics. Afterwards, to



Relative frequency % (95%CI). Source: Survey data.

Figure 1. Theoretical framework of the present study: theoretical elements, problem, research, question, and objectives.

obtain more specific information about olive oil, the participants were asked about their general knowledge of olive oil, factors that determine their choice when shopping for olive oil, and the perceived quality of olive oil. For the general questions, single-select multiple-choice questions were used, and/or space was available for discursive questions. There were also selection boxes for multiple-select questions, where respondents could select more than one option, as well as options for discursive answers too, depending on the question at the moment. If the participant answered that he/she does not buy or consume olive oil, a section was provided to inform the reasons, with the following answer options: “I do not know,” “I know it but I have never had the opportunity to taste it,” “I don’t like the taste,” “I don’t know how to use it,” “Price is not affordable,” “I don’t like (the appearance, texture, taste, etc.),” “Difficulty in finding it in the establishments where I shop or eat,” “I don’t see nutritional advantages in consuming this kind of food,” “Not a habit/costume,” and “Others.” Since this is a self-response questionnaire, it is important to acknowledge that cognitive or situational bias may arise. Nevertheless, self-reported data can be accurate if participants understand the questions, feel strongly anonymous, and have little fear of reprisal (Brener et al., 2003). The questions had been carefully developed to ensure that the responses would remain anonymous and confidential and that the language used would allow for an adequate understanding of the terminology required for the responses. This helped to prevent these biases.

2.1 Statistical analysis

Descriptive statistical analysis was performed on the collected variables, including absolute and relative frequencies. Inferential analysis was conducted by calculating 95% confidence intervals (95%CI) to estimate the variability of the proportions observed in the sample. The confidence interval for the proportions was calculated using the Wilson method, according to the recommendation of Brown et al. (2001).

3 RESULTS

The survey had 2,113 participants, of which 32.9% (95%CI 30.9–34.9) were 18 to 25 years old, 84.2% (95%CI 82.6–85.7) declared they were identified as female, 41.3% (95%CI 39.2–43.4) informed having completed higher education and more than 30.1% (95%CI 28.3–32.1) informed having a graduate degree (specialization, master’s, and/or doctorate). For the categorization of the participants’ professions, the Brazilian Classification of Occupations (Brasil, 2010) was used. Of the total participants, 47.4% (95%CI 45.3–49.5) were graduated in science and art, among them dietitians, lawyers and teachers.

To assess the participants’ general knowledge about olive oil, the first questions of the questionnaire were about the place of origin of olive oil, the production and consumption of olive oil in Brazil, and the extraction processes used. The results showed that the participants do not know the origin of olive oil since 51.6% (95%CI 49.5–53.7) believed that it was in the Mediterranean region. Regarding the production of olive oil in Brazil, it was found that most of the respondents (71.7%; 95%CI

69.7–73.5) answered that olive oil production in Brazil began more than 10 years ago, and 69.7% (95%CI 69.7–71.6) think that Brazil is a great consumer of olive oil. About the olive oil extraction process, 53.0% (95%CI 50.9–55.1) of the respondents thought that olive oil is extracted from the whole fruit, and 63.2% (95%CI 61.1–65.2) answered that it may contain green and ripe olives.

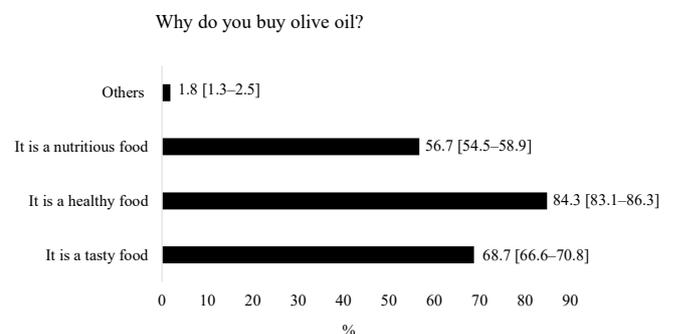
When asked about the difference between extra virgin olive oil and other types of oils, 69.1% (95%CI 67.1–71.0) of the participants said that they knew the difference, while 30.8% (95%CI 28.9–32.8) of respondents did not know how to differentiate the oils.

Considering the health-related benefits, the number of participants (90.2%; 95%CI 88.1–91.3) who believe that a regular consumption of olive oil prevents cardiovascular diseases is notable. Obesity and diabetes are second on the list with 53.3% (95%CI 51.2–55.5) and 44.5% (95%CI 42.3–46.1) of the responses, respectively. The participants believe that the main properties of olive oil are: antioxidant (81.9%; 95%CI 80.2–83.5), reduced cholesterol in blood (73.6%; 95%CI 71.7–75.4), and anti-inflammatory (59.0%; 95%CI 56.8–61.0).

Regarding the factors that determine how participants decide on choosing olive oil when buying it, of the total participants, 92.3% (95%CI 91.1–93.3) answered that they often buy olive oil, and, of them, 87.1% (95%CI 85.2–88.5) said that extra virgin olive oil is the type of olive oil that they usually buy. Among the reasons why the respondents consume olive oil, we found that 84.8% (95%CI 83.1–86.3) believe that it is a healthy food, and 68.7% (95%CI 66.6–70.8) because it is a tasty food (Figure 2).

The main place for buying olive oil cited by the respondents was the supermarket (98.41%). Buying directly from the producer is still an uncommon option, with only 2.31% of the responses. Other establishments, such as wholesalers, fairs, and natural food stores, were also cited by the participants for the option “Others.” The information that the participants looked at on the labels of olive oil were: expiration date, acidity, and origin (Table 1).

For 97.1% (95%CI 96.3–97.8) of the participants interviewed, the kind of bottle has a key influence on the quality of olive oil, and a dark glass bottle (87.2%; 95%CI 85.7–88.6) was the most chosen



Relative frequency % (95%CI). Source: Survey data.

Figure 2. Participants’ responses about the purchase motivation ($n = 1,951$).

type of packaging when buying this product. With respect to the bottle size, the majority of participants (78.2%; 95%CI 76.3–79.9) reported that they usually buy olive oil in bottles of 500 mL.

Considering the place of origin, Portuguese olive oils are at the top of the preference list. A large number of participants stated not having a preference for the country of origin or not observing it when buying olive oil. We point out that the preference for the Brazilian olive oil was reported only by 6.5% (95%CI 5.5–7.7) of participants (Table 1).

Table 1 shows the factors that most influence the purchase of olive oil. According to our sample, if olive oil were cheaper, 61.8% (95%CI 59.6–64.0) of the respondents said that they would buy it more customarily. Besides price, the respondents indicated that they would buy it more often if they knew more

about the quality of the product and could find it in more points of sale where they usually go shopping.

About price, 81.3% (95%CI 79.6–83.0) of participants think that the price of olive oil is associated with its quality. It was found that 12.5% (95%CI 11.1–14.1) of the respondents perceive olive oil as a “very expensive” product; 62.7% (95%CI 60.5–64.8) consider it “expensive,” 23.7% (95%CI 21.9–25.6) said that the price of olive oil is “fair,” and only 0.9% (95%CI 0.6–1.52) considered it “cheap.”

The 162 participants who informed that they did not buy olive oil were asked about the possible reasons for not buying and/or consuming it. Lack of habit/costume was the possible reason. Added to the lack of habit/costume, price was also among the main reasons. Few participants marked the option

Table 1. Participants’ answers about olive oil shopping places, what is observed on the labels, preference for origin, and which factors would influence them to buy more olive oil.

Variables	Total (<i>n</i> = 1,951)		
	<i>n</i>	%	95%CI
Where do you usually shop for olive oil?*			
Supermarkets	1,920	98.4	(97.7–98.8)
Grocery stores	196	10.0	(8.7–11.4)
Convenience stores	81	4.1	(3.3–5.13)
Direct from producers	45	2.3	(1.7–3.0)
Internet	44	2.2	(1.6–3.0)
Others	9	0.4	(0.2–0.8)
What do you usually read on the label when buying olive oil?*			
Expiration date	1,571	80.5	(78.7–82.2)
Acidity	1,150	58.9	(56.7–61.1)
Origin	997	51.1	(48.8–53.3)
Label design/color	320	16.4	(14.8–18.1)
Harvest or extraction date	228	11.6	(10.3–13.1)
Bottling date	290	14.8	(13.3–16.5)
Olive(s) variety(ies)	205	10.5	(9.2–11.9)
Peroxide index	195	9.9	(8.7–11.4)
Others	92	4.7	(3.8–5.7)
Which origin of olive oil do you prefer?*			
Portugal	669	34.2	(32.2–36.4)
Spain	89	4.5	(3.7–5.5)
Greece	51	2.6	(1.9–3.4)
Argentina	24	1.2	(0.8–1.8)
Uruguay	3	0.1	(0.0–0.4)
Italy	68	3.4	(2.7–4.3)
Tunisia	3	0.1	(0.0–0.4)
Brazil	128	6.5	(5.5–7.7)
Chile	46	2.3	(1.7–3.1)
I don't read the origin	361	18.5	(16.8–20.2)
I have no preference	487	24.9	(23.0–26.9)
Others	19	0.9	(0.6–1.5)
Would you buy more olive oil if:*			
Were cheaper	1207	61.8	(59.6–64.0)
I could find it in more points of sale where I usually shop	81	4.1	(3.3–5.1)
I could learn more about different ways of use in culinary	189	9.6	(8.4–11.0)
I knew more about the quality of the product	365	18.7	(17.0–20.5)
Others	97	4.9	(4.0–6.0)

*Questions where the participants could mark more than one alternative, thus altering the total *n*. Source: Authors.

that they did not like the taste, did not know, or did not see nutritional advantages in consuming this kind of food (Table 2).

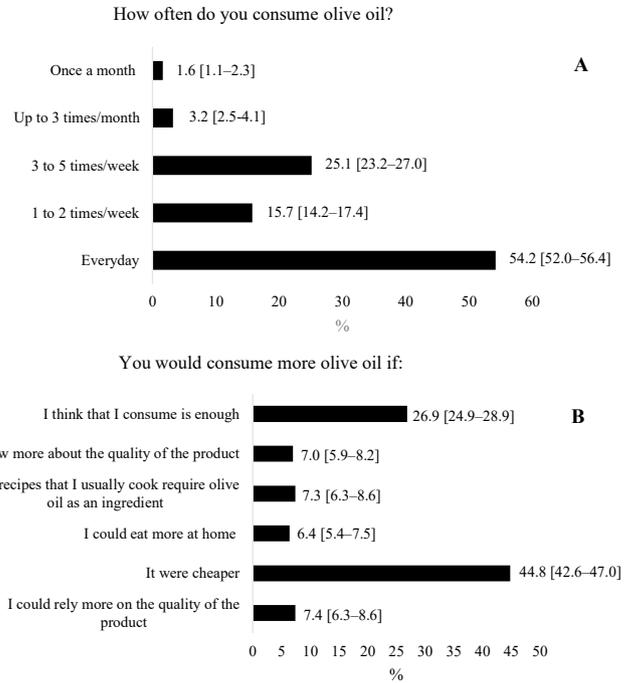
To identify the consumption habit, the participants were asked about how often they consume olive oil. Of the total participants who consume olive oil, more than half of them have the habit of consuming olive oil every day (Figure 3A).

Price appears again as a determinant factor that may influence a higher consumption of olive oil for a great number of the participants (Figure 3B). Compared to the quantity of olive oil consumed in the previous year, 43.6% (95%CI 41.4–45.8) of the participants informed that it increased, while for 41.4% (95%CI 39.3–43.6) of the participants consumption did not change, and for 14.8% (95%CI 13.3–16.5) the quantity of olive oil consumed was decreasing.

The results show that the most common use of olive oil was in salads, followed by finishing dishes and cooking foods (e.g., *sautéed*). The use of olive oil in fried foods and sweet dishes (e.g., cakes, cookies, ice creams) was less frequent (Figure 4).

Considering olive oil consumption out of the home, 29.0% (95%CI 27.0–31.0) of the consumers reported that they usually consumed it in cafeterias, restaurants, and pizzerias, while 51.2% (95%CI 49.0–53.4) of the respondents said that they consumed it only at places where they had confidence in the product quality, and 19.7% (95%CI 18.0–21.5%) said that they never consumed olive oil when eating out.

With respect to the parameters that determine the quality of extra virgin olive oil, more than 80% of participants answered that it should be the one that is pure, not blended with other kinds of oil, and more than 60% pointed out that it should be an olive oil with the lowest acidity. (Table 3). Aroma and flavor were identified as the most important attributes of quality. For the participants of this study, a good quality olive oil should be green in color, limpid, smell like olive, taste like olive, and be less spicy (Table 3). The participants also responded that the aroma of a good-quality olive oil should be perceived as the aroma of green leaves and that the taste should evoke green fruits (Table 3). Many participants said they prefer an olive oil considered as sweet and soft, which are oils that have ripe fruit attributes (Table 3).



*Questions where the participants could mark more than one alternative, thus altering the total n. Relative frequency % (95CI). Source: Survey data.

Figure 3. Consumption frequency (A) and which factors influenced participants to consume more olive oil (B) (n = 1,951).

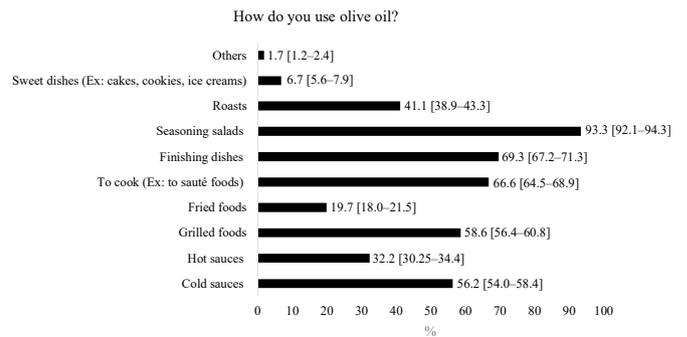


Figure 4. Use of olive oil (n = 1,951).

Table 2. Reasons for not buying/consuming olive oil.

Variables	Total (n = 162)		
	n	%	95%CI
Why don't you buy/consume olive oil? *			
I don't know the product	3	1.8	(0.6–5.3)
I know this product, but I have never had the opportunity to taste it	8	4.9	(2.5–9.4)
I don't like the taste	26	16.0	(11.1–22.4)
I can't afford it (too expensive)	81	50.0	(42.3–57.6)
Difficulty finding it at the establishments I usually shop for food	12	7.4	(4.2–12.5)
I don't know how to use it	10	6.1	(3.3–10.9)
I don't see any nutritional advantage in consuming this kind of food	1	0.6	(0.1–3.4)
Lack of habit/costume	99	61.1	(53.4–68.2)
Others	1	0.6	(0.1–3.4)

*Question where the participants could mark more than one alternative, thus altering the total n. The participants who answered that they usually do not buy olive oil (n = 162) were directed to this question. Source: Authors.

Regarding the sensory defects, the majority of participants (67.2%; 95%CI 65.1–69.2) reported having never felt an unusual taste or smell in olive oil that could be related to a certain sensory defect. Some of the respondents had already identified a vinegary smell or taste (15.9%; 95%CI 14.4–17.6) and had already perceived rancid odor/taste (14.8%; 95%CI 13.3–16.4). A very small number of participants reported perceiving the smell or taste of bread yeast (8.0%; 95%CI 6.8–9.2), cheese (4.9%; 95%CI 4.0–6.0), or mold (2.7%; 95%CI 2.1–3.5).

4 DISCUSSION

Although olive trees have been planted in Brazil for only nearly 12 years, the current scenario is very promising and indicates potential for growing (Instituto Brasileiro de Olivicultura [Ibraoliva], 2020). Domestic demand of olive oil is fulfilled with imported oils, and Brazil is one of the world's largest importers of this product, second only to the United States. In 2019/2020 (from October, 2019 to April, 2020), Brazil imported more than

Table 3. Participants' answers regarding the attributes that determine the quality of olive oil.

Variables	Total (n = 1,951)		
	n	%	95%CI
Extra virgin olive oil is the oil that*			
Has the least acidity possible	1,312	67.2	(65.1–69.2)
Is pure, with no addition of oils of other kinds	1,743	89.3	(87.8–90.6)
Has flavor and aroma typical of olive	673	34.5	(32.4–36.6)
Smells like fruits and green leaves	199	10.2	(8.9–11.6)
Is bitter	179	9.1	(7.9–10.5)
Is spicy	107	5.4	(4.5–6.5)
Is more expensive	628	32.1	(30.1–34.2)
Which of the following attributes do you consider more important for a higher-quality olive oil?			
Color	60	3.0	(2.4–3.9)
Aroma and taste	1,011	51.8	(49.6–54.0)
Acidity	594	30.4	(28.4–32.5)
Price	190	9.7	(8.5–11.1)
Place of origin	59	3.0	(2.3–3.8)
Others	36	1.8	(1.3–2.5)
The color of a high-quality olive oil is			
Green	845	43.3	(41.1–45.5)
Yellow	535	27.4	(25.4–29.4)
Color has no influence on the quality	571	29.2	(27.2–31.3)
A good quality olive oil is			
Cloudy	310	15.8	(14.3–17.5)
Limpid	1283	65.7	(63.6–67.8)
Turbidity has no influence on the quality	358	18.3	(16.6–20.1)
A good quality olive oil should smell like			
Olive	1159	59.4	(57.2–61.5)
Green fruits	182	9.3	(8.1–10.7)
Green leaves	238	12.2	(10.8–13.7)
Aroma does not have any relation to quality	372	19.0	(17.3–20.8)
A good quality olive oil should taste like			
Olive	1,201	61.5	(59.3–63.6)
Green fruits	212	10.8	(9.5–12.3)
Green leaves	212	10.8	(9.5–12.3)
Taste has no relation to quality	326	16.7	(15.1–18.4)
A good quality olive oil is			
Spicier	323	16.5	(14.9–18.2)
Less spicy	839	43.0	(40.80–45.2)
Pungency (spiciness) has no relation to quality	789	40.4	(38.2–42.6)
You consider as an ideal olive oil that is			
Sweet and soft	980	50.2	(48.0–52.4)
Slightly bitter and spicy	765	39.2	(37.0–41.4)
Bitter, spicy, and intense	206	10.5	(9.2–12.0)

*Questions where the participants could mark more than one alternative, thus altering the total n. Source: Authors.

66 thousand tons of olive oil, 20% higher than in the previous year, which shows the imminent importance of the olive oil market in the country (IOC, 2015). This increase can be explained by factors such as: (i) dissemination of the health benefits of the Mediterranean diet; (ii) entry of more affordable products in the domestic market; (iii) increased purchasing power of some social classes.

Although it has been growing, production of olive oil in Brazil is still recent, and most respondents indicated buying olive oil in supermarkets, where the national product is not always available. This result can be related to the access of Brazilian consumers to national olive oils, considering that in a study conducted in South Brazil, the national product appears in the second position, second only to the Portuguese oil and ahead of the Spanish one (Ambrosini et al., 2019). Thus, it could be inferred that, when available for purchase, consumption of the Brazilian olive oil is at the top of consumers' preference. In addition, the familiarity with the product may have consequences on the formation of taste preferences (Ambrosini et al., 2019).

The literature review conducted by Jiménez-Guerrero et al. (2012) points out that among the extrinsic factors that play a major role in the purchasing behavior of olive oil, price appears as the most important factor. However, when consumers are more familiar with the product, the country of origin is the main criterion.

Likewise, Del Giudice et al. (2015), analyzed the results of studies published between the years 2000 and 2014 and concluded that the most important attributes for consumers from various countries, including China and Japan, were brand, origin and organic certifications.

Dutra et al. (2013), in a study with olive oil consumers from Muriaé, state of Minas Gerais, found that 64% bought olive oil because they liked the product, 31% because it is a healthy food, and 5% following the recommendation of a health professional. According to these authors, the benefits of consuming olive oil were not entirely known by this population.

According to Latino et al. (2022) the consumers' purchase decisions and perceived quality are influenced by three types of attributes: search (e.g., package features, size, and color of product), experience (e.g., taste and flavor), and credence (e.g., organic products, safe and health-related statements, sustainable-related attributes, and processing techniques). Even though credence attributes cannot be identified by consumers even after the product's purchase and consumption, they have a positive impact on consumers' attitudes and preferences.

To understand what motivates people to include healthy products in their diets, Missaglia et al. (2017) decided to investigate the factors and motivations that determine this food choice. Six main factors were used: being healthy, taste, price, safety, convenience, and socialization. Taste was the most important factor considered by the population studied, and, unexpectedly, convenience achieved the lowest average score of the six factors. Socialization was also considered an important factor for these consumers. Finally, the authors concluded that the analyses

allowed them to identify that the health-related reasons were not in opposition to those related to pleasure, and that there were many nuances that consumers consider when deciding to buy some food.

A study conducted with chefs of Spanish restaurants aimed to identify which were the main criteria that the interviewees considered when buying olive oil. The results indicated that taste is by far the most important criterion, followed by price, trust in the supplier, place of origin and olive variety. Of 400 chefs interviewed, only eight indicated "health" as a criterion for purchasing olive oil, despite health is the main reason that consumers consider in their food choices (Gutierrez-Salcedo et al., 2021).

Ambrosini et al. (2019) pointed out that there are other important factors related to the eating habits that influence olive oil consumption, such as cooking meals at home and knowledge to substitute olive oil for other oils and fats. In the study conducted by Ambrosini et al. (2019) with consumers in Rio Grande do Sul, 58% of the participants agreed that olive oil should be consumed raw, and other oils or fats would be more appropriate for cooking. In a research of North American consumers, Wang et al. (2013) state that the majority of respondents use olive oil in the preparation of stews, barbecues, and sauces.

It is important to highlight that olive oil exhibits minor losses of antioxidant properties and small changes in the lipid profile after heating it up at high temperatures, but has high stability compared to other kinds of oils, virtually not leading to the formation of toxic compounds. So, it can be used in hot preparations, and maintaining most of its beneficial characteristics and, after heating, they remain higher than in other oils (Lozano-Castellón et al., 2020, 2022). Despite scientific data on the thermal stability of olive oil, consumers continue to have reservations about using it in hot culinary dishes, particularly in nations that are not traditional olive oil producers. Our research group has recently prepared an informative material for the communication of research results on the use of olive oil in cooking, not only for people unfamiliar with the concepts and technical terms of the area of knowledge in question, but also for specialists, given the importance and need for the population to be informed about the possibilities of using olive oil in cooking, particularly about heating stability and application (Zago et al., 2023).

About the sensory characteristics, in addition to the absence of defects, an extra virgin olive oil should have positive attributes such as a fruity flavor and, preferably, be bitter and spicy. The fruity attribute refers to smells sensed directly, or having a retronasal smell of healthy, fresh, green, or ripe fruits. Fruity olive oil is strongly influenced by factors such as the olive cultivar and handling care during harvest, postharvest, and extraction. Bitterness is a primary taste typical of olive oils extracted from green olives or those at an early maturation stage, which is felt by the circumvallate buds that constitute lingual V. Pungency is the typical tactile sensation produced at the early growing season, especially from green olives. It can be perceived throughout the mouth cavity, mainly the throat (IOC, 2018).

The color of olive oil results from the presence of chlorophyll, which gives the green color, and pheophytins and carotenoids, which give the green-yellow or yellowish color in olive oils, and also depends on the cultivar and harvesting time and does not interfere in the quality of olive oil (Moyano et al., 2010). Likewise, the more or less cloudy aspect depends on the filtration process, and, in the long term, the particles in suspension in the oil are more susceptible to oxidation, which accelerates the loss of quality; so, this oil should be consumed more rapidly (Eckelkamp, 2021).

Fruitiness results from the presence of volatile compounds, especially trans-2-hexenal, hexanal, and trans-2-hexan-1-ol (Villa & Silva, 2017). The presence of these compounds is associated with olive oils with a fruit aroma, reminiscent of healthy olives harvested at the optimal maturation time, as well as the herbal sensation, reminiscent of the scent of cut grass, or tomato leaf, artichoke, and green apple (Zago et al., 2019). Bitterness and pungency attributes are associated with the quantity of polyphenols, especially secoiridoids, such as oleuropein and its derivatives, and the phenolic alcohols tyrosol and hydroxytyrosol (Barbieri et al., 2015; Villa & Silva, 2017; Zago et al., 2019). It should be noted that the high content of polyphenols in olive oils not only increase the bitter and pungent characteristics, but also provides more stability and a longer shelf life, in addition to health benefits (Boskou & Clodoveo, 2020).

Only 10.5% (95%CI 9.2–12.0) of the participants prefer an olive oil with a bitterer, spicier, and pungent flavor. The more intense the bitter and spicy flavor of an olive oil, the higher the polyphenol contents, which provide more health benefits, protecting the body from free radicals and having anti-inflammatory properties. The shelf life of these oils is also longer, if well preserved (Cicerale et al., 2008).

Delgado and Guinard (2011) compared the preferences and attitudes relating to extra virgin olive oil of 23 trained experts and 110 consumers in the United States, an emerging market. The results showed that the experts rated the olive oil samples that were more pungent and bitter as high-quality olive oils, while for the interviewed consumers, bitterness and pungency were negative attributes, and fruitiness was rated as a positive attribute. In some cases, the consumers ended up preferring samples with sensory defects.

Recchia et al. (2012) based on a consumer test carried out in Finland, found that consumers in emerging markets may not have enough exposure to the product to be able to appreciate the bitterness and pungency of olive oil.

In a study with Swiss consumers, the authors found that the products rated as high-quality olive oil were those with improved characteristics of “ripe fruity” and “sweet.” Other attributes, especially “bitterness,” were rated as low-quality oils by these consumers (Valli et al., 2014).

Similar result was found by Barbieri et al. (2015), who showed that most of the consumers studied appreciated the fruity attribute but did not like bitterness. This could be related to the aversion reaction that is common to most bitter substances or to the degree of familiarity with this kind of sensation due to dietary habits. This result points to the need to develop

education actions with consumers about the “genuine” and “native” taste of extra virgin oil and its health-related properties.

A probable explanation for the rejection of bitter taste in food is connected to evolutionary issues, because a bitter taste signifies the presence of toxic substances in many plants. In contrast, the existence of a bitter taste in certain foods, such as extra virgin olive oil, has a direct relationship to the health benefits (Cavallo et al., 2018).

Chan-Halbrendt et al. (2010) in a study with a sample of 204 olive oil consumers from Albania, a country where olive oil is part of the traditional diet, concluded that only 7% of the sample appreciated the pungent taste, a percentage that drops to about 5% when bitterness is considered.

In contrast, the results obtained by Ambrosini et al. (2019) with consumers from the state of Rio Grande do Sul indicated a preference for olive oils with strong, intense characteristics, disapproving those with neutral characteristics.

Predieri et al. (2013), based on a study conducted in Italy, where extra virgin olive oil is well known, show that bitterness and pungency are effectively attributes related with consumers' preference.

According to the International Olive Oil Council, the negative attributes or sensory defects that can be present in olive oil are: sludge/sediments—when olive oil is unfiltered and remains in contact with decanted matter that settles into the bottom of the storage container; mustiness/fusty—great number of fungi and yeasts that has developed as a result of storage in humid conditions during several days or olives that have been harvested with earth or mud and not washed; vinegary—is a very common defect and occurs when the fruits are not properly stored and undergo a process of alcoholic aerobic fermentation; rancid—typical of oils that have undergone an intense oxidation process due to poor preservation conditions, and oils that remain for long periods in the supermarket shelves or at home, in the presence of light and under temperatures higher than and 18 °C; and wet wood: typical flavor of oils extracted from olives that were damaged by frost while in trees (IOC, 2018).

In Uruguay, where olive crops are also still recent, a study pointed out that a great number of consumers are not familiar with the sensory characteristics of extra virgin olive oil. Consumers clearly indicated a preference for defective oils. This could be the result of long-time consumption of olive oils with these characteristics or defects, which led the authors to emphasize the need to build consumers' awareness on the parameters and characteristics of extra virgin olive oil (Gámbaro et al., 2013).

Consumers are concerned with the quality of olive oil, especially regarding its nutritional value, and often correlate the flavor/taste of olive oil with its quality. In countries with a tradition of consumption of olive oil, the customers' sensory perception of a good quality olive oil corresponds to the perception of trained tasters. However, such correlation was not observed in consumers from non-traditional countries and new markets. Furthermore, there has been no clear understanding about the relationship between the sensory characteristics and

the health-beneficial properties of olive oil, since the more pungent and bitter an olive oil is, the greater the contents of phenolic compounds, resulting in an olive oil with more health benefits (Fernandes et al., 2020).

Brazil still has challenges in establishing olive crops for olive oil production, such as the lack of information on national production standards and lack of incentives by the public sector for expansion of this product, which ends up reflecting on the production and marketing of domestic olive oil, which is locally concentrated. The marketing of Brazilian olive oils is of great interest, considering that it fosters rural economy and the products reach the market more rapidly, thus offering fresher olive oils to consumers when compared to imported oils. In addition, the quality of the olive oils produced in Brazil has been recognized nationally and abroad, clearly showing the care and dedication of olive growers in producing it (Sá, 2024).

5 CONCLUSIONS

Of the consumers who participated in this survey, the majority informed that they consumed olive oil every day. The most important criteria for purchase were expiration date, acidity, and origin, these being the information that they looked for most on labels. Health and taste were the main purchase motivations. The main reasons pointed out by those who were not used to buying olive oil were lack of habit and price. About origin, Portuguese olive oils are at the top of the preference list, and more than 40% of the surveyed consumers do not look at information about the origin or do not have a preference. The majority would buy more olive oil if it were cheaper and they knew more about the quality of the product.

Aroma and flavor were considered essential attributes in a high-quality olive oil, and the ideal olive oil is that which is sweet and soft, having less preference for spicy, bitter, and intense oils. Olive oil is preferably used in salad dressing, to finish dishes, and cooking. Most consumers were not able to identify sensory defects.

The findings are encouraging and point to the need for more efforts in informing and building consumers' awareness about the parameters of quality and benefits of olive oil, stimulating safe consumption and contributing to the development of olive production in Brazil.

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