

Consumers' perception of edible flowers using free word association

A percepção de consumidores usando flores comestíveis com livre associação de palavras

La percepción de los consumidores que utilizan flores comestibles con libre asociación de palabras

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Abstract

Edible flowers are trend in the novel food sector since they may be inserted in natural, health and eco-innovation approach. However, there is little information in literature about consumers perception about them, mainly in western society. Thus, the objective of the present work is to evaluate Brazilians perception about roses, hibiscus, ipê and pansy as edible flowers. An online survey was applied using a free word association methodology and a check-all-that-apply for their application in gastronomy. Results from word association show that all flowers were highly associated to positive attitudes and feelings, appearance and application aspects. Environmental words were also highlighted within the responses. These features were significantly related to frequency of buying new foods and show up as important characteristics to be explored for enhance edible flowers popularity. For application of them within food formulations, rose and hibiscus were tracked to tea, jam, bread and cookies utilization, meanwhile pansy to salads. Ipê was not related to none of gastronomy applications. Results indicate that knowledge of tangible and intangible flowers features, such as functional, environmental and application aspects can change and enhance people consumers perception and willingness to try these non-conventional edible plants. Deeper studies about people perception and attitude towards edible flowers are necessary to evaluate the influence of eating and shopping habits, neophobic behavior and others on their consumption.

Keywords: Unconventional edible plants; Word association; Innovative foods; Consumer behavior.

Resumo

As flores comestíveis são tendência no setor de novos alimentos, pois podem estar inseridas em abordagens naturais, saudáveis e deecoinovação. No entanto, há pouca informação na literatura sobre a percepção dos consumidores sobre eles, principalmente na sociedade ocidental. Assim, o objetivo do presente trabalho é avaliar a percepção de brasileiros sobre rosas, hibiscos, ipê e amor-perfeito como flores comestíveis. Uma pesquisa online foi aplicada usando uma metodologia de associação livre de palavras e um cheque-todos-que-se-aplicam para sua aplicação em gastronomia. Os resultados da associação de palavras mostram que todas as flores foram altamente associadas a atitudes e sentimentos positivos, aspectos de aparência e aplicação. Palavras ambientais também foram destacadas nas respostas. Essas características foram significativamente relacionadas à frequência de compra de novos alimentos e aparecem como características importantes a serem exploradas para aumentar a popularidade das flores comestíveis. Para aplicação deles em formulações de alimentos, rosa e hibisco foram rastreados para utilização de chá, geleia, pão e biscoitos, enquanto o amor-perfeito para saladas. O ipê não foi relacionado a nenhuma das aplicações gastronômicas. Os resultados indicam que o conhecimento das características das flores tangíveis e intangíveis, como aspectos funcionais, ambientais e de aplicação, pode mudar e melhorar a percepção dos consumidores e a vontade de experimentar essas plantas comestíveis não convencionais. Estudos mais aprofundados sobre a percepção e atitude das pessoas em relação às flores comestíveis são necessários para avaliar a influência dos hábitos alimentares e de compras, comportamento neofóbico e outros em seu consumo.

Palavras-chave: Plantas alimentícias não convencionais; Associação de palavras; Alimentos inovadores; Comportamento do consumidor.

Resumen

Las flores comestibles son una tendencia en el nuevo sector alimentario, ya que pueden formar parte de enfoques naturales, saludables y de ecoinnovación. Sin embargo, hay poca información en la literatura sobre la percepción que tienen los consumidores de ellos, especialmente en la Sociedad occidental. Así, el objetivo del presente trabajo es evaluar la percepción de los brasileños sobre las rosas, el hibisco, el ipé y el pensamiento como flores comestibles. Se aplicó una encuesta online utilizando una metodología de asociación de palabras libre y un *check-all-that-apply* para su aplicación en gastronomía. Los resultados de la asociación de palabras muestran que todas las flores estaban altamente asociadas con actitudes y sentimientos positivos, aspectos de apariencia y aplicación. Las palabras ambientales también se destacaron en las respuestas. Estas características se relacionaron significativamente con la frecuencia de compra de nuevos alimentos y aparecen como características importantes que deben explorarse para aumentar la popularidad de las flores comestibles. Para su aplicación en formulaciones alimentarias, la rosa y el hibisco fueron seleccionados para el uso de té, mermelada, pan y galletas, mientras que el pensamiento para ensaladas. El ipé no estaba relacionado con ninguna de las aplicaciones gastronómico. Los resultados indican que el conocimiento de las características de las flores tangibles e intangibles, como aspectos funcionales, ambientales y de aplicación, puede cambiar y mejorar la percepción de los consumidores y la voluntad de probar estas plantas comestibles no convencionales. Se necesitan más estudios sobre la percepción y actitud de las personas hacia las flores comestibles para evaluar la influencia de los hábitos alimenticios y de compra, el comportamiento neofóbico y otros en su consumo.

Palabras clave: Plantas comestibles no convencionales; Asociación de palabras; Alimentos innovadores; Comportamiento del consumidor.

1. Introduction

Consumers' awareness about their diet and the growing search for natural, fresh, healthy new products that value local biodiversity bring a great opportunity for edible flowers in western society, since these plants present important concentration of phytochemical, such as polyphenols, carotenoids and others, minerals and fibers (Chen, et al., 2015; Kinnup & Lorenzi, 2014). They may be also inserted within diet diversification since biodiversity is a driven force to make these foods available in markets. Also, consumption of edible flowers may be an important way to food security promotion, by enhancing nutritional value and diversification of peoples diet and by valuing local biodiversity, food culture and food sovereignty (Kinnup & Lorenzi, 2014).

The category of products for naturally healthy and sustainable foods had a turnover of approximately USD 253 billion and USD 1 trillion in 2017 and 2018 worldwide, respectively (Mascaraque, 2018; Li, 2019). In Brazil, both sectors are little explored, leading to a less competitive environment (De Barcellos, et al., 2009), which bring great opportunity to food industries operate.

Flowers have long been consumed as salads, soups, desserts, infusions and others mainly in Asia. In Europe and America, recently, they have been arising on the population's dietary, although they are still not as popular as in the Asian cousin (Kaisoon, et al., 2011; Benvenuti, et al., 2016; Rodrigues, et al., 2017).

Roses (*Rosa* sp.) and hibiscus (*Hibiscus* sp. e *Malvaviscus* sp.), although not present in Brazilians' daily diet, can be already found in markets and cuisines as teas, jellies, infusion and salads. Petals of roses present interesting concentration of minerals, carotenoids (Prata, et al., 2017), flavonoids, anthocyanins and compounds with antioxidant activity, indicating that flower's petals may be an important natural source for the prevention of diseases caused by oxidative stress (Chen, et al., 2015; 2018). Hibiscus, in the same way, also presents important concentration of polyphenols, compounds with capacity to scavenge free radicals (Silva, et al., 2016), fibers (Franzen, et al., 2016) and compounds with the ability to reduce oxidative liver damage (Wang, et al., 2000). Ipê (*Handroanthus* sp.) is a flower from an arboreal plant widely used in urban afforestation for ornamental purposes, which petals presents bioactive compounds such as carotenoids (Gonçalves, et al., 2019). They are not popular as edible plant, although Kinupp & Lorenzi (2014) showed than to be an interesting alternative for food applications.

Patsy or love- in-idleness (*Viola x wittrockiana*) is a garden type of flower that presents total polyphenolics (mainly resveratrol, quercetin and delphinides, and small amounts of gallic acid, coumaric acid and rutin) (Kucekova, et al., 2013) and minerals (Fernandes, et al., 2016).

Understanding the main triggers of consumers consumption of new food products is an essential step to promote all food chain to produce and commercialize them. Consumers' perception about flowers as edible plants are still scarce in literature. Even for popular ones, such as roses and hibiscus, and mainly for non-conventional flowers, such as ipê and patsy, determining the key drivers and stimulus of consumers' perception, attitudes and associations are highly relevant for promote their commercialization, reformulate or develop new products. Psychological and sociological approaches are an option to gather this information. Word Association (WA) technique has been used to study people's conceptual structures and also for studying beliefs or attitudes about foods. Consumers are asked to provide the first three/four words, images, thoughts, sensations or expressions that come to their minds (Ares, et al., 2008; Andrade, et al., 2016; Judacewski, et al., 2019). It has been used to understand for example consumers' perception about local and organic foods (Roininen, et al., 2006), functional yogurts (Ares, et al., 2008), traditional foods (Guerrero, et al., 2010), lamb meet (Andrade, et al., 2016) and white mold surface-ripened cheeses (Judacewski, et al., 2019). This methodology is a fast, convenient and efficient tool to understand how consumers perceive products, including new and undefined food concepts (Ares, et al., 2008; Andrade, et al., 2016).

The present work aims at exploring consumers' associations with edible flowers (roses, hibiscus, ipê and patsy in a food-related context, using free WA technique to gather information about Brazilian consumers' perception.

2. Methodology

This study was characterized as being cross-sectional and from the point of view of its approach, classified as qualitative. The WA is one of the most commonly used methods for the evaluation of conceptual structures and also for studying beliefs or attitudes in psychology and sociology of consumers, used for understanding attitudes and predicting people's behaviors (Ajzen & Fishbein, 1980; Ares, et al., 2008) and has been applied on food quality evaluation worldwide (Roininen, et al., 2006; Ares, et al., 2008; Guerrero, et al., 2010; Andrade, et al., 2016; Judacewski, et al., 2019). Check-all-that-apply is a methodology where volunteers inform to researchers all characteristics are presented in a food sample (Ares & Jaeger, 2013), largely applied to describe food quality attributes (Ares, et al., 2011; Alcântara & Freitas-Sá, 2018).

2.1 Participants

A total of 241 volunteers from Rio Grande do Sul, the southernmost Brazilian state were recruited through online survey. Invitations were shared in social media and by University database e-mails. Subsequent participants were recruited by snowball sampling technique, which characterizes the study sampling as non-intentional non-probabilistic. Like Andrade, et al. (2016), the intention here was not to obtain information that statistically reproduces a real population, but to explore associations between possible consumers of edible flowers. The experimental procedure was approved by the Ethics Committee and all participants were in accordance to participate of the study.

2.2 Data collection

As stimuli for WA technique, four flowers have been chosen: (1) roses, (2) hibiscus, (3) ipê and (4) patsi. These are considered familiar flowers in Rio Grande do Sul State.

Participants were presented with a single edible flower picture one at a time and asked to complete the word association task. They were asked to provide the first three words or feelings that came to their minds when they thought of

each flower as an edible flower. “Edible flower” was highlighted in each question to guarantee that participants had in mind the aim of the study. Data were collected through Google Forms during June and July 2020. Consumers were asked to answer all questions spontaneously. The software-imposed consumers to answer the questions one at a time, in the specified order.

Following, a list of potential utilization of each flower was provided and asked to check all of them that would be able to use. The options were: tea, jam, desserts, salads, bread and cookies, candies, not possible and others and presented in this exact order. These categories have been chosen based on previous literature (Kelley, et al., 2001; Chan & Wei 2017; Rodrigues, et al., 2017).

Besides, respondents were asked to answer socio-demographic questions and buying frequency of innovative foods (every day or almost every day; several times in a week, but not every day; once a week; several times in a month, but not every week; once a month; several times in a year, but not every month; once or twice a year; less than once a year or never).

2.3 Data analysis

All valid words cited by participants were considered for data analysis. The terms collected were classified into dimensions and categories in line with their similarities, meaning that a search for recurrent terms within each question was performed, and terms with similar meaning were grouped first into categories, and then into dimensions, being inspired by previous literature (Guerrero, et al., 2010; Ares, et al., 2015; Andrade, et al., 2016; Judacewski, et al., 2019). Then, triangulation process was performed for all categories and dimensions. Eventual discrepancies as well as converging ideas were discussed and resolved by the authors.

Words mentioned by at least 5% of the participants were considered for analysis (Judacewski, et al., 2019). Frequency of mention of each word was calculated and analyzed by Principal Component Analysis (PCA). Data from potential utilization of the edible flowers were compared two-by-two by Cochran Q test by XLSTAT program (Trial version 2020). Interdependence between categories and frequency of buying new foods was evaluated by independence chi-squared test in Excel. All statistical analyses were evaluated considering 5% of significance. Results are described and analyzed in the follow.

3. Results and Discussion

3.1 Characterization of the sample

From the 241 responses, 143 were considered valid. Volunteers that live out of Rio Grande do Sul (RS) and that did not provide 3 words, feelings or thoughts were considered outliers. The majority of the sample was composed by female respondents (79%); 60% were in the range of 18-46 years old, 60% were graduated and 25% income ranged between R\$3,0145.00 and R\$6,270.00). Consumers claimed to buy new products daily was 1%, while the majority, corresponding to 31% of consumers, buy a few times a month, and 1% reported not buying innovative products; the other responses were 23% for a few times a year, 17% weekly, 13% monthly, 10% more than once a week, and 4% once or twice a year. It was not intended to get information from a sample that corresponds to an actual market population, but to explore consumer associations for edible flowers among Brazilians, such as proposed by Andrade, et al. (2016) for lamb meat.

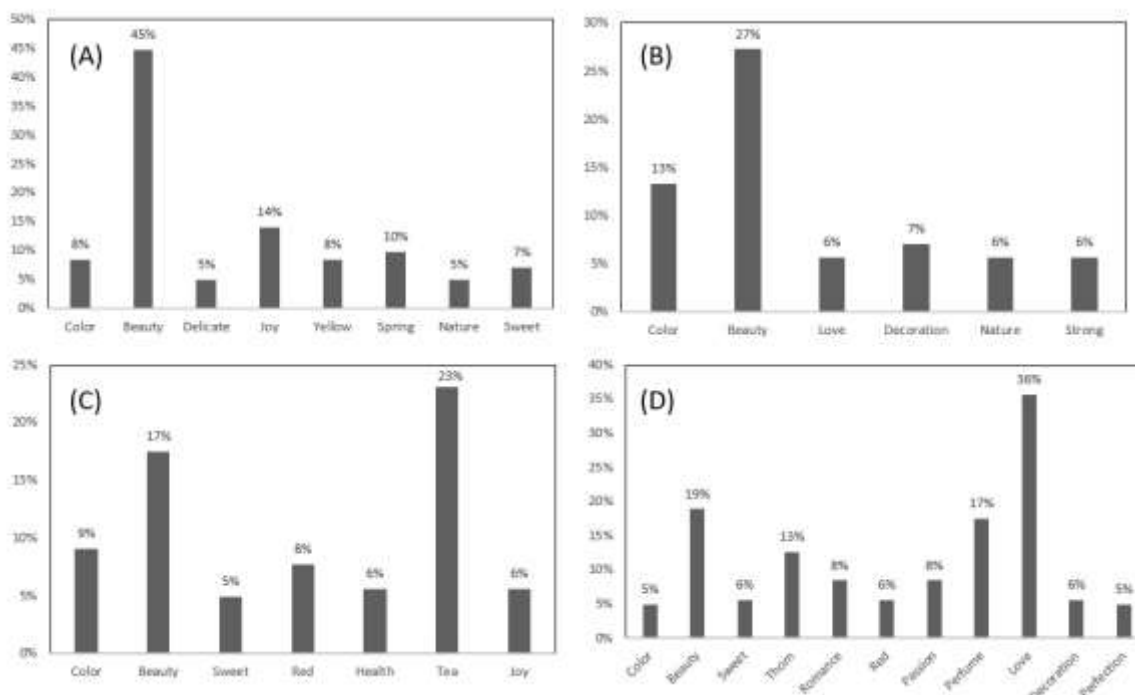
In general, the female gender, young to middle-age people and consumer with higher monthly income exhibit higher willingness to try and by new foods (De Barcellos, et al., 2009; Perito, et al., 2019). The buying profile of the present work are in consonance with this literature, since 13% claimed to buy new food at least monthly and 59% at least few times a month.

3.2 Free word association

A total 722 different words were associated to the four flowers. Figure 1 shows the relative frequency of those cited a least 5% for each flower of the volunteers for each flower. The most cited words indicate that the main characteristics of foods

related to the first attitudes of consumers' buying behaviors (Ajzen & Fishbein, 1980; Ares, et al., 2008), which brings important information for proper targeting of foods on the marketing point of view and consequently to popularize the edible flowers. Color was associated 5% for roses, 9% for hibiscus, 13% for patsy and 8% for ipê; perfume was associated 17% for roses; tea and health were associated 23% and 6%, respectively for hibiscus. Similar results were associated when evaluated "food products made with flowers" in southern Brazil (Rodrigues, et al., 2017).

Figure 1 - Words cited at least 5% in the free word association for ipê (A), patsy (B), hibiscus (C) and rose (D).



Source: Authors (2021).

"Sweet" was associated 6% with roses, 5% with hibiscus and 7% with ipê. Kinupp and Lorenzi (2014) observed the ipê petals have a sweet aroma and a slightly bitter taste. Several flowers present in their composition tannins and other polyphenols that may bring sour taste and astringency to sensory profile (Bedini, et al., 2003; Bajec & Pickering 2008; Rop, et al., 2012; Chen, et al., 2018). In this study, participants gave their responses based on images and did not tasted the flowers, and different expectations and real sensory attributes may lead consumer to enhance rejection of food products (Ares, et al., 2010). For long-term consumption habit, consumer knowledge about sensorial profile and expectation shall be properly communicated and taught in order to avoid the contrast expective. This is an important topic to be considered for the consumption of the flowers studied.

Joy was associated 6% for hibiscus and 14% for ipê; spring and nature were associated 10% and 5% for ipê, respectively; thorn was associated 13% for roses; romance, passion and perfection were associated 10%, 8% and 5% for roses, respectively; love was associated 36% and 6% for roses and patsy, respectively; strong was associated 6% for patsy. Words related to the appearance of the flowers were frequently cited. Beauty was associated 19% with roses, 17% with hibiscus, 45% with ipê and 27% with patsy; delicate was associated with 5% with ipê; yellow as associated 8% with ipê; red was associated 6% and 8% respectively with roses and hibiscus.

Flowers in Brazil are commonly used ornamentally since it presents a recent history of commercialization (Aki & Perosa, 2002; Rodrigues, et al., 2017). In haute cuisine restaurants, utilization of edible flowers is not rare and for the

popularization of them for ordinary consumers, additionally to higher availability, their incorporation in dishes where they can be seen wholly by consumers' or preparations that highlight their appearance seems to be an interesting strategy to improve their consumption. If incorporated in other formulation, the choice of flower carrier is important, since consumers' perception of the combination may be affected negatively if they access negatively the carrier (Aschemann-Witzel & Grunert, 2017). For example, if people has positive attitude and perception regards functionality and sustainability of edible flowers, they must be used in combination with other foods with similar perception, such as salads and cereal bars; if incorporated in a high fat, sugar, or salt formulation, for instance, the positive perception of health may be highly affected. However, more studies are necessary to evaluate and understand these aspects.

"Health" was associated just with hibiscus. Although they were not cited at least 5%, some volunteers related hibiscus to "diuretic", "slimming" and "smoothing", which may be related to healthy aspects too. It is well-documented by now that edible flowers present several bioactive compounds within their matrix that are able to promote human health, but they are not largely the main triggers associated to them, like shown in the present word. Thus, scientific divulgation and popularization of knowledge are important to people relate these non-conventional edible plants to functional compounds and then be closely interested in the naturally health food sector.

Due to exoticism and nonfamiliar characteristics non-conventional foods catch the attention of people based on the induction of curiosity (Van Trijp & Steenkamp, 1992; Rodrigues, et al., 2017). The terms associated to edible flowers in the present work shows consumer to relate them mostly to non-sensorial characteristics and they shall be explored to fill the lack between to appearance attributes and real potential to be inserted in regular dietary. In this context, marketing and labeling communication of tangible and intangible flowers' features can enhance consumers' acceptance and willing to try this innovation.

3.3 Dimension and categories and their relation to frequency of purchasing new foods

Words from WA tasks were then dimensioned and categorized (Table 1). Dimensioning and categorizing words is a technique that allows a holistic view of how the attributes fit into the consumer's perception and were based on previous studies (Guerrero, et al., 2010; Andrade, et al., 2016; Judacewski, et al., 2019). Results were divided into 7 dimensions and 17 categories. Most of the words given for all flowers were related to positive attitudes and feelings and was significantly ($p < 0.05$) related to buying innovative foods frequency. Rodrigues, et al., (2017) observed that Brazilian consumers related industrialized product made with flower with novelty, meanwhile Chen & Wei (2017) observed that the one of the main drivers for flower consumption in Twain was curiosity. It is well-known that consumers in general present some level of resistance in adopting innovation (De Barcellos, et al., 2009; Nazzaro, et al., 2019; Perito, et al., 2020) and a positive predisposition of flowers as edible ingredients like shown in Table 1 shows an interesting opportunity for innovation.

Attributes related to sensorial characteristics were cited for all flowers. Color and aroma aspects stand out for them. Flavor/taste and appearance were the words statistically related to frequency of buying new foods ($p < 0.05$). Interestingly, words related to the flavor of ipê and hibiscus were cited frequently. Nowadays in Brazil, edible flowers are found in organic products fairs and small flower business as fresh ingredient. Exploring these features by consumption and tasting demonstration for consumers, ingredient shops, restaurants, delicatessens may be important strategies to attract consumers and promote and/or enhance sales of these products. Additionally, trust and confidence in the innovation food chain are essential (Nazzaro, et al., 2019), and small bussies can more easily use marketing communication strategies for this sector. Corroborating, Kelley, et al. (2001) concluded that there is a substantial market niche for edible flowers, especially if they are available in small containers with a mixture of flowers, at a moderate price, exploring the fragrance and the visual appeal.

Table 1. Statistical relation of frequency of dimension and categories of roses, hibiscus, ipê and patsy or love-in-idleness and frequency of buying new foods. n (%).

		Ipê	Patsy or Love- in-idleness	Hibiscus	Rose
Attitudes and feeling	Positive (quality, beauty, strong, love, passion, perfection)	228 (53%)**	212 (49%)**	172 (40%)**	225 (52%)**
	Negative (would not eat, would not taste, non-edible, bad)	5 (1%)	10 (2%)	13 (3%)	13 (3%)
	Doubt (questioning, doubt, curiosity)	15 (3%)	11 (3%)	9 (2%)	3 (1%)
Sensory characteristics	Texture (texture, softness)	10 (2%)	11 (3%)	10 (2%)	18 (4%)
	Flavor/taste (taste, bitter, sour, grape taste, fruit taste)	29 (7%)*	17 (4%)*	24 (6%)*	19 (4%)*
	Appearance (color, red, yellow, purple)	33 (8%)*	43 (10%)*	30 (7%)*	17 (4%)*
	Smell (good smell, perfume, pleasant smell)	12 (3%)	13 (3%)	8 (2%)	41 (10%)
Utilization	Gastronomy (tea, jam, salad, cake)	14 (3%)	13 (3%)	69 (16%)**	22 (5%)*
	Ornamental (ornament, decoration)	5 (1%)	30 (7%)	6 (2%)	26 (6%)
	Medicine (cosmetic, diuretic, Slimming)	2 (0%)	3 (1%)	16 (4%)*	0 (0%)
Nature	Seasons (spring, summer, cold, warm)	25 (6%)*	6 (1%)	7 (2%)	1 (0%)
	Environment (garden, nature, flower, field)	35 (8%)**	34 (8%)**	37 (9%)**	8 (2%)*
	Plant physiology (thorn, petals,	1 (0%)	6 (1%)	7 (2%)	24 (6%)
Region	National (Porto Alegre, Rio Grande do Sul)	3 (1%)	0 (0%)	0 (0%)	0 (0%)
	International (Hawaii)	0 (0%)	0 (0%)	3 (1%)	0 (0%)
Unknown	Unknown (unknown, strange)	5 (1%)	6 (1%)	7 (2%)	2 (0%)
Others	Others (symbol, image)	7 (2%)	14 (3%)	11 (3%)	10 (2%)

* $p < 0.05$. ** $p < 0.001$. Source: Authors (2021).

Chen and Wei (2017) observed that floral aroma significantly impacts on buying intention of edible flowers, since they are popular in Asia. In long-term period, with the increasing of edible flowers popularity its aroma may be also considered since scents are olfactory stimuli that affects consumers' behavior by tracking emotions and memories to mood and consequently influencing peoples shopping desire (Mehrabian & Russell, 1974; Castellucci, 1985; Berridge, et al., 2010; Arshamian, et al., 2013; Chen & Wei 2017).

Hibiscus was cited in dimension "Utilization" and category "gastronomy" mainly due to the "tea" word citation. This category was only significantly ($p < 0.05$) related to the buying innovative foods for hibiscus and roses. Knowledge about an unfamiliar food is essential to enhance their consumption (Fernandes, et al., 2016; Franzen, et al., 2018; Cavaliere & Ventura, 2018), which was observed by Chen and Wei (2017) that attitude towards the consumption of edible flowers are greater among the respondents who are more experienced with edible flowers. In Brazil, De Barcellos, et al. (2009) observed consumers has

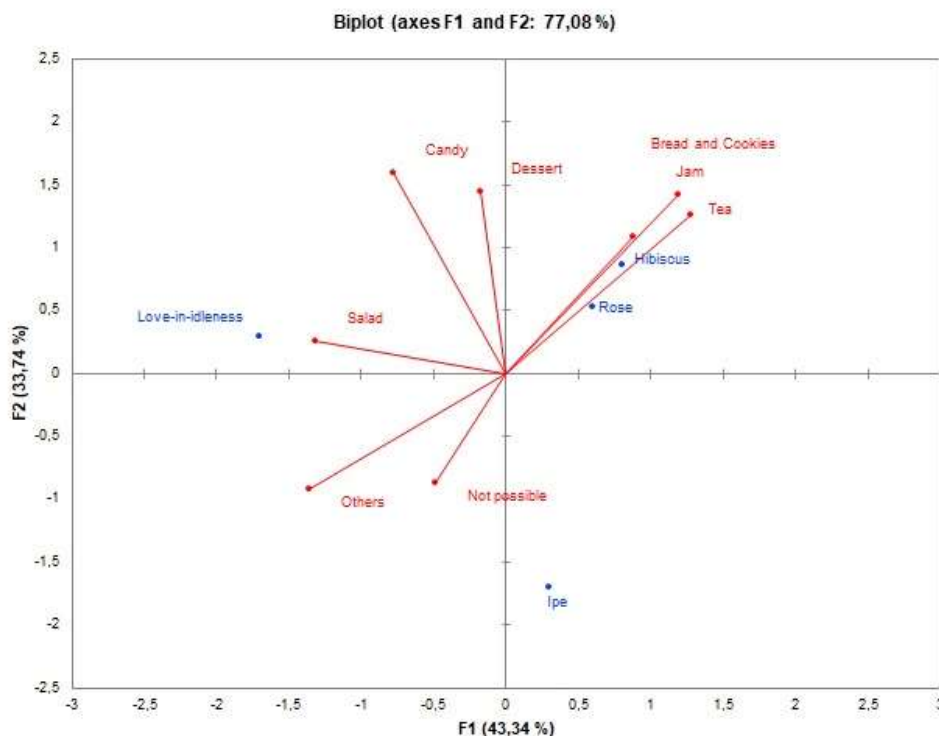
resistance to the adoption of new food products that are introduced into the market mainly due to neophobia related to traditional habits of cooking.

All four flowers were highly related to environmental category and significantly ($p < 0.05$) related to the buying frequency. Words cited into this category were related to environmental elements such as garden, field, nature. Willingness to accept eco-innovative food is positively associated with the degree of sustainability awareness and the perception of benefits from sustainable products (Perito, et al., 2020). Additionally, evoking nature images in advertising positively affect purchase intention due to activation of emotional mood of virtually experiencing nature, which positively influences brand attitudes and purchase intention beyond perceptions of environmental brand benefits (Schumuck, et al., 2017). Consumers' exposure to combined nature ad are even stronger for highly involved consumers' by leading to pleasant feelings (Hartmann & Apaolaza-Ibáñez, 2009; Schumuck, et al., 2017). De Barcellos, et al. (2015) observed that southern Brazilian consumers' purchase attitude are positively influenced by environmental and nature values and thus evoking the biodiversity valorization towards edible flowers are interesting strategies to promote them.

3.4 Edible flowers application

Figure 2 shows the results of PCA of potential consumption of the edible flowers studied. The data brings important information of the main strategies for popularization of them in food industries and in the gastronomy. Results from participants for utilization of the four flowers studied were evaluated by PCA and showed that the first two PC explain 77.8% of the total data variance, indicating good fit of the model (Myers & Montgomery, 2002). PC1 and PC2 explained 43.3% and 33.7%, respectively, of the variation (Figure 2). When samples or food are grouped closely, there are the indication that they present highly statistical relation. Hibiscus and roses were placed closely and were related to the consumption of tea, jam, dessert, bread and cookies. Patsy or love-in-idleness was related to salads, meanwhile ipê was not related to any of the application words.

Figure 2. Principal Component Analysis of utilization of the four edible flowers.



Source: Authors (2021).

Roses and hibiscus are more commonly related to foods in Brazil, and their addition to jams and teas are not rare in industrial products. Statistical evaluation by Cochran Q test showed no statistical difference ($p>0.05$) within this utilization. These results are in accordance with the free word association showed in section 3.2. This may be the main reason why they were grouped separately from ipê and patsy or love-in-idleness ($p<0.05$), which are difficult to be found in supermarkets and restaurants. Franzen, et al. (2020) evaluated the sensory acceptance of rose and hibiscus jellies in Brazil and observed acceptance rates of 80.71% for the jam made with rose petal tea, 73.57% for the one made with rose petal powder.

Patsy or love-in-idleness presented different behavior than ipê in PCA analysis and Cochran Q test ($p<0.05$). The first one is a garden flower, meanwhile the further an arboreal one. This availability may explain the relationship of patsy to salads and non-connection of ipê to gastronomic possibilities. The choice of innovative ingredient carrier food is crucial for consumer acceptance and perception of the benefits that it brings to foods (Aschemann-Witzel and Grunert 2017). Kelley, et al. (2001) evaluated in United States the perception of chefs about three species of edible flowers: *Viola tricolor* L., *Borago officinalis* L., and *Tropaeolum majus* L., for their flavor, fragrance and appeal visual and observed that 76% of consumers gave all flowers an acceptable rating. Santos, et al. (2017) evaluated the addition of patsy or love-in-idleness into yoghurt formulation and observed 80% of the participants were claimed that they would consume this product and would accept to pay up to 50% more for its aggregate differential (Santos, et al., 2017). Guinea, et al. (2019) observed that the consumption of edible flowers by consumers in Portugal is not an unknown subject, being consumed sporadically, cooked or incorporated into salads, mainly because of its flavor. Simoni (2018), in São Paulo (São Paulo, Brazil) observed that consumers were well receptive to the consumption of lettuce salad with flowers of the species *Bauhinia variegata*. Brazilians present neophobic profile when it comes to innovative foods but are not to technologic ones (De Barcellos, et al., 2009). Thus, utilization of patsy or love-in-idleness and even ipê petals in raw preparations may be an interesting alternative to these flowers' consumption. Although,

neophobia is an individual value (De Barcellos, et al., 2009; Perito, et al., 2020) and the study of consumer segmentation have also to be considered.

The flowers add versatility, flavor, beauty and nutrients to the foods; however people need to have the necessary knowledge to implement the use, surpassing the traditional concept of flowers for ornamentation and perceiving them as a potential food / ingredient. The necessity of both fresh and more elaborated sustainable food is urgent in market, but in convenient packages, easy to handle and to prepare (Bossle, et al., 2015). Among the main barriers to its consumption, there is also the difficulty of finding flowers in the market, in addition to the feeling of risks regarding the safety of flowers due to the presence of toxic components (Guiné, et al., 2019). Therefore, the food industry must make efforts in informing and communicating consumers about the benefits and differential of their products, in order to increase their perceptions about safety, quality, nutritional value (among others) and as consequence, trust and commitment to a product.

Trends about how consumers value food products are an important contribution to develop the strategy of food companies (Bossle, et al., 2015). Consumers' perception is an important driver to determine how agents from the food chain can persevere in the market, providing corporate vitality, enhancing performance-price index for consumers and opportunity to differentiate from competitors. Fernandes, et al. (2017) notes that the acceptance of edible flowers depends on a series of factors, such as: social group, flower species and their characteristics (taste, texture and appearance), gender, income and consumer education level, and the packaging for sale (composition, size and price). Hence, the development of products with non-conventional edible plants appears as an opportunity for the industry. Although the food sector is still mainly related to commodities, healthy, sustainable and convenient food is related to intensive knowledge and high added-value products.

4. Conclusion

Word association has been a popular technique in the last decade to study sensory and consumer perception since it gives relatively unrestricted access to mental representations of the stimulus term and, consequently, the first associations that might be the most relevant for consumers' choice and their decisions related to product purchase (Roininen, et al., 2006; Ares, et al., 2008; Ares, et al., 2010). In that sense, results from this study will contribute to increase comprehension about an increasing market in an emerging country. Considering that sustainable consumption is a recent subject in Brazil, identifying the main characteristics of this market will benefit companies of the food sector, both industry and retailing. Researchers in management and marketing must pay attention in the important role played by food on consumers' diet.

Naturally healthy foods are huge trend worldwide and the Brazilian food market has enough space to innovate. Hence, the results obtained with this research may help – particularly small and medium companies, but not restricted to them – that are interested in new product research and development, aiming to response to consumers who demands for healthier product options.

Reformulation of food products is often motivated by changings in the regulations and legislation in consequence of social changes and demands, or in relation to nutrition claims (Aschemann-Witzel & Grunert, 2017; Nazzaro, et al., 2019). For instance, Brazil is pioneer in Latin America in the development of functional food regulation, and the introduction of market innovations might promote changes in the institutional environment (Oliveira et al. 2014). In that sense, to follow the sustainability movement may be key to change products patterns previously stablished by institutions and change consumers' perception about non-conventional edible plants.

As limitation, the WA technique is capable of grasp affective and less conscious aspects of the respondents' mind-sets, although it may be less laborious when compared to other qualitative methods (Roininen, et al., 2006). Further research is necessary to study the influence of socio-demographic differences on consumer understanding of edible flowers.

Further studies are essential to popularize these flowers to human consumption. Evaluation of the attitudes of consumers to try and buy these products, using methodologies such as Planned Behavior Theory, Conjoint Analysis and Willing to Pay (Ares, et al., 2008; Nazzaro, et al., 2019; Neupane, et al., 2021) are important steps. Also, the characterization of the bioactive compounds (polyphenolics, antioxidant activity, anti-cancer capability) in the flowers matrix also is an important strategy to improve knowledge about them.

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