THE PANORAMA OF USAGE OF FLOWERS FOR EATING PURPOSES: RESULTS FROM A QUESTIONNAIRE SURVEY

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Abstract

This work aimed to characterize the use of edible flowers for gastronomic purposes. A survey was done by internet in Portugal, and 147 valid questionnaires were completed, by individuals between 18 and 78 years old. The instrument included questions not only about consumption habits, but also about the knowledge relatively to edible flowers. The results revealed that flowers are appreciated when it comes to gastronomic preparations and could be consumed more frequently. They are recognized mostly for their organoleptic and decorative characteristics. Edible flowers are a part of modern gastronomic trends, and people are consuming this type of product more frequently, mostly fresh and particularly in salads. Nevertheless, it is important to consider the possible risks associated to their consumption, such as pesticides or toxicity, but fortunately the Portuguese consumers are aware of this problem. It is a reality that the market of edible flowers is expanding, and restaurants appear as important links on the chain of edible flowers consumption. Still, to further incentive the home preparation of recipes with edible flowers, it is necessary to provide cookbooks that include more edible flowers as in their recipes.

Keywords: *edible flower, survey, gastronomy usage, questionnaire*

1. INTRODUCTION

Since we eat with our eyes first, the edible flowers are a powerful way to step up the appeal of food. In fact, the use of edible flowers for culinary purposes and garnish of dishes are millenarian and their demand has been increased due to their potential as a source of nutrients as well as a source of several bioactive compounds. They are usually consumed in fresh to add color, fragrance and flavor to food, but they can also be used in dried state, canned sugar, preserved distillates and floral tea(Chen and Wei, 2017; Kelley et al., 2001a; Mlcek and Rop, 2011).

Popular edible flowers include chrysanthemum, lotus, saffron, daylily, lilac, mint, nasturtium, pansy, rose, tulip, violet and marigold (Chen and Wei, 2017). Many others are also edible but proper identification is essential because some are poisonous and no legal requirements for edible flowers marketing are available (Fernandes et al., 2017). Furthermore, flowers from florists or garden centers may have been treated with pesticides not labeled for food and thus, the purchase of edible flowers should be from organic cultivation and farmers' markets(Cunningham, 2015). Since edible flowers are very delicate, their refrigeration prior packaging (typically small, rigid, plastic packages) for small trips is recommended (Kelley et al., 2001b; Kou et al., 2012).

The main component of edible flowers is water varying between 70%–95% followed by carbohydrates ranging between 42.4 and 90.2 g/100 g dry weight for *E. caribaea* and *Rosa micrantha*, respectively, and proteins, ash and lipids in lower values. With respect to their micronutrients, potassium, phosphorus, calcium and magnesium are the major components followed by sodium, zinc, manganesium and copper (Fernandes et al., 2017; Kou et al., 2012; Pires et al., 2018; Rop et al., 2012).Moreover, the edible flowers present a wide range of polyphenolic compounds being the flavonoids and organic acids the most reported ones in the literature(Lu et al., 2016; Pires et al., 2018).

In general, the total phenolic compounds have presented a high correlation with antioxidant capacity (Li et al., 2014; Mao et al., 2006; Rop et al., 2012).

The bioactive components present in edible flowers contribute to their potential health benefits such as anti-inflammatory, anti-cancer, anti-obesity and neuroprotective effects(Arya et al., 2014; Benvenuti et al., 2016; Lu et al., 2016; Wongwattanasathien et al., 2010).

The acceptability of edible flowers by consumers depends on the flower species and its attributes, namely taste, fragrance and visual appeal. Other factors, such as the characteristics of consumers, price and composition of flowers in packaging, can also attract consumers to try floral food. Based on the opinion and preferences of consumers and professional chefs, the color was the most important sensorial attribute to make the decision to purchase. Price was the next most important factor and container size was the least important. In addition, the participants preferred to purchase edible flowers to eat as garnish, followed by salad and meal(Kelley et al., 2002, 2001b). On the other hand, Chen and Wei (2017) observed that specific curiosity and aroma are the greatest influences on attitude towards the consumption of edible flowers by the consumers. In addition, the healthy lifestyle also affects attitude towards the consumption of floral food. Similar results we obtained by Rodrigues et al.(2017). In this work, products made with flowers also reflected a product innovation, duo to their unpredictable character.

According to D'Antuono and Manco (2013) the main constraint for a wider use of flowers, specifically, *Allium* flowers, is due to the absence of a regular purchase and consumption.

Following the guidelines of the aforementioned studies, the main objective of this work is to give a contribution for the characterization of the Portuguese reality concerning the knowledge and habits regarding the use of edible flowers, by means of a questionnaire survey.

2. MATERIAL AND METHODS

The instrument used was composed of different parts, one destined to characterize the sample in terms of some basic sociodemographic variables, and the other designed to evaluate the knowledge and habits of the respondents about edible flowers. This last part included questions about identification, consumption habits, risks associated with the ingestion of flowers, and finally what are the consumers' thoughts and concerns related to the consumption of flowers.

The data collection was made using internet and occurred between November 2017 and January 2018. The participation was voluntary and confidentiality of the answers obtained was guaranteed. Only adults were included in the study sample and all ethical issues were followed when designing and applying the questionnaire.

The sample size consisted of 147 individuals, who voluntarily accepted to answer the questionnaire.

For the statistical treatment of the data was used the software SPSS, version 25 from IBM, Inc.

3. RESULTS AND DISCUSSION

3.1. Sociodemographic characterization of the sample

The respondents who accepted to participate in this survey were aged between 18 and 78 years, with an average age of 41 years old (Table 1). The men were older (average age of 47 years) when compared to women (with an average age similar to the global sample, 40 years).

Most of the participants were female (81%) and only 19% of men participated in the survey.

Table 1. Age of the participants (global and separated by gender).

Group	N	%	Age (Years)		
			Minimum	Maximum	Mean ± Standard Deviation
Women	119	81	18	73	39.54± 12.23
Men	28	19	18	78	46.79± 14.15
Global	**147**	**100**	**18**	**78**	**40.93± 12.88**

The participants were mostly from the Central Region of Portugal (65%), and 24 % were from the North (Figure 1). The representatively of the South and islands was not so intense because the study was made from Viseu, a district that stands on the Centre-North of Portugal, and hence is more difficult to each those from far, because the questionnaire link was sent by e-mail to known people for dissemination.

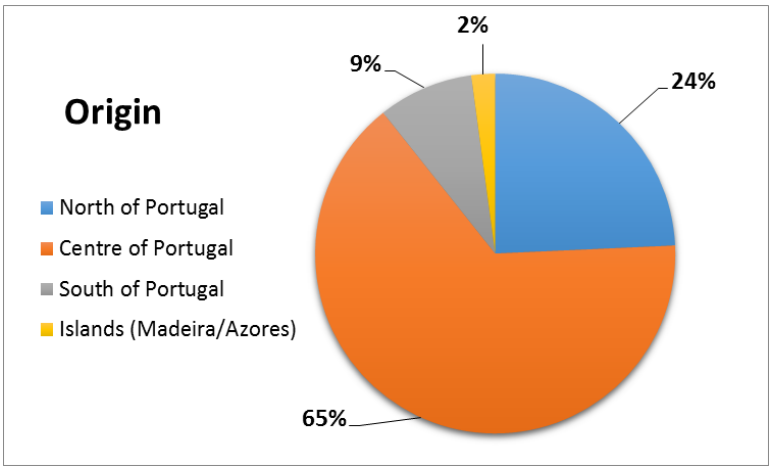

Figure 1. Geographical distribution of the participants.

Figure 2 shows that the great majority of those who responded to the questionnaire had a university degree (more than 80%). The lowest level of education was verified only for one participant, corresponding to less than 1% of the sample.

Regarding the living environment, 68.5% lived in urban areas, 6.8% in suburban surroundings and 24.7 in rural areas.

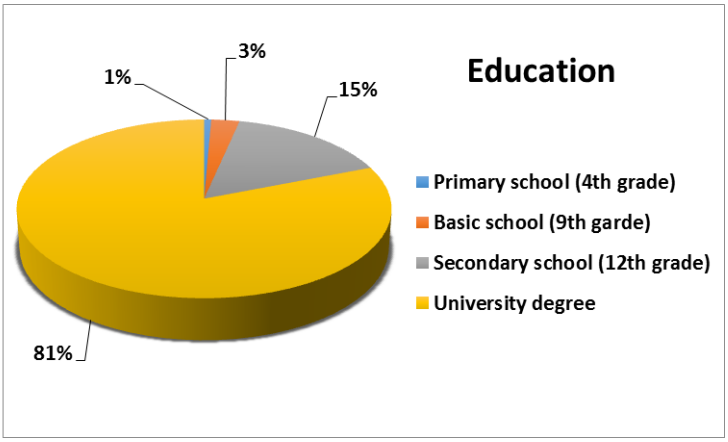

Figure 2. Level of education of the participants.

3.2. Knowledge and habits about edible flowers

From the participants in this survey, 96.6% had already heard about edible flowers, which demonstrates that edible flowers are generally known by the population. It is also interesting to note that both genders are equally aware of edible flowers, with percentages of 96.6% and 96.4% for women and men, respectively. Regarding the awareness according to level of education, apparently higher education leads to a higher percentage of people who are familiar with edible flowers: 75.0% for people with basic school, 91.3% for those with secondary school and 98.3% for university education.

Although people know about edible flowers, the consumption is not so popular, so that from sample at study only 46.9% had consumed them at least once, being less than half of the sample. Surprisingly, a higher percentage of men have already consumed edible flowers when compared to women: 53.6% and 45.4%, respectively.

Figure 2 presents the way in which the participants had already consumed the edible flowers, and salads appear as the most frequent way to eat flowers, with 78.3% positive answers. However, also with expressive results appear starters (62.3%), decoration and confection of dishes (57.9%) and as aroma intensifiers (50.7%).

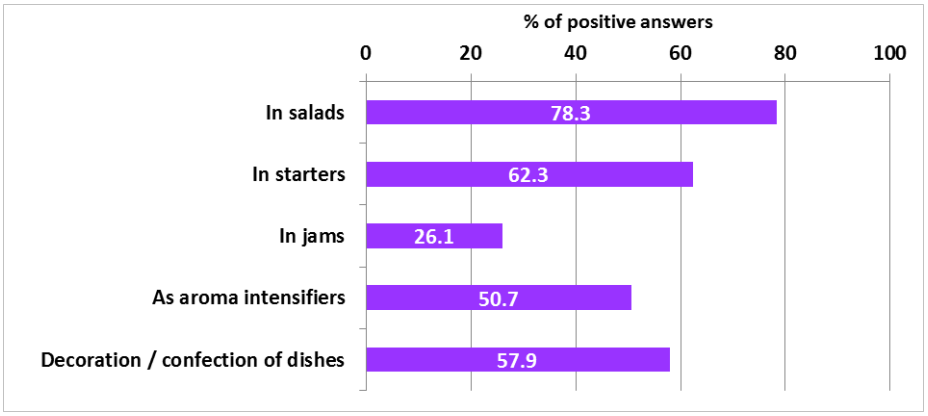

Figure 3. Possible ways to consume the edible flowers.

Figure 4 reveals which flowers the participants had already consumed. Camomile and pansy appear as those flowers that were eaten by a higher percentage of the participants (63.8% and 56.5%, respectively), while orchid is the flower consumed by fewer participants (only 5.8%).

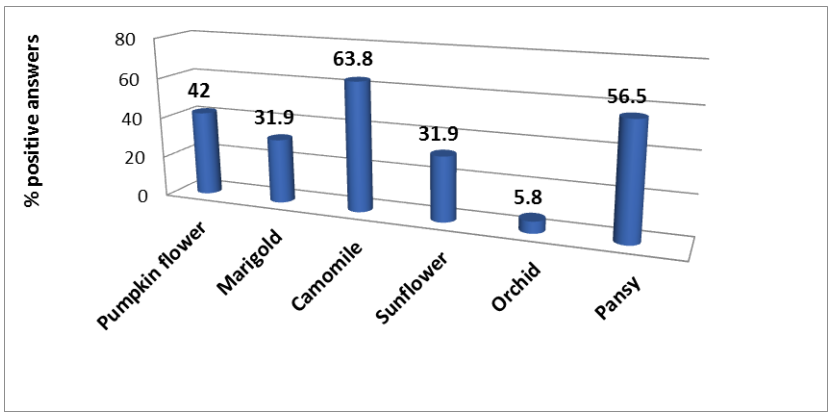

Figure 4. Consumption of some types of flowers.

Regarding the frequency of consumption, 100% of the participants refer it is sporadically, and therefore they do not eat edible flowers on a regular basis.

The main reasons for consuming edible flowers (Figure 5) are their decorative faculty (important for 73.9% of the participants) followed by novelty (68.1%) and their delicate aroma (60.9%). The nutritional value is not important for the generality of the participants, being recognized only by 20.3%.

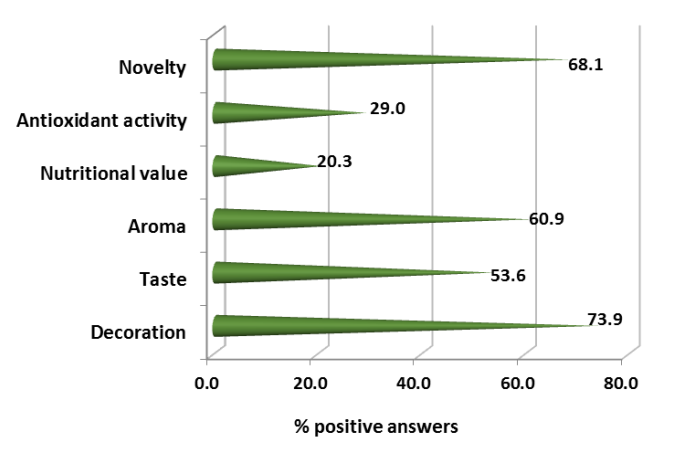

Figure 5. Reasons for eating edible flowers.

The restaurants, with their specialities and delicacies and suggestions from the chefs appear to contribute for the dissemination of the consumption of edible flowers, and in fact most of the participants ate for the first time edible flowers precisely in restaurants (58.0%). However, people still do not seem to use regularly edible flowers in their culinary practices, since only 29.0% do it.

The fresh form allows a better preservation of the nutritional and bioactive properties of the flowers, as well as aromas and taste. Hence, when consumed raw, the edible flowers maximise their gastronomic characteristics and health benefits. This is recognized by the generality of the consumers, who prefer to eat them in the fresh state (70.0%) against only 30.0% who consume them cooked.

Most of the participants seem to collect their flowers for culinary usages in the wild (65.0%) and some others (45.0%) indicate that they cultivate their own flowers to eat (Figure 6). The supermarket appears in third place with 35.0%. To buy flowers for culinary practices in flower shops is a dangerous practice, since those flowers might have been produced recurring to pesticides or other harmful chemicals. Hence, it is encouraging to realize that in the sample at study only a small percentage of the participants (10.0%) use that source to get the flowers.

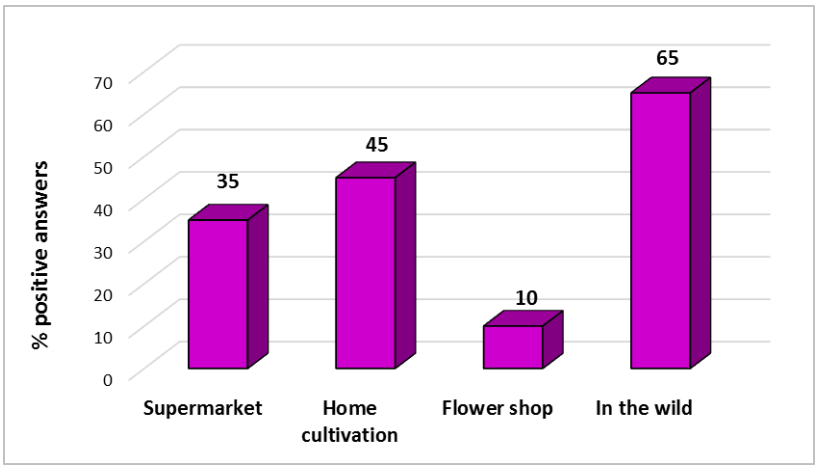

Figure 6. Place of purchase of edible flowers.

The great majority of the respondents believe that there is little information about edible flowers (95.9%), which certainly does not help to incentive their use. However, most people find it interesting to use edible flowers in gastronomy and recipes, 80.3%, and this could contribute for the rapid development of their potential (Table 2).

Table 2. Result whether people consider interesting the use of flowers in gastronomy (global and separated by gender)

Group	Answers		
	Yes	**No**	**Maybe**
Women	80.7	3.4	16.0
Men	78.6	3.6	17.9
Global	**80.3**	**3.4**	**16.3**

To eat flowers has some risks associated both with their nature and also with the production techniques and use of chemicals. The results of this survey show that less than half of the participants (42.9%) are aware of the potential risks when consuming flowers. As for the kinds of risks, most people consider the presence of pesticides a real threat (91.74%) but the toxicity is identified as a major risk by a very expressive part of the participants (93.1%) (Figure 7).

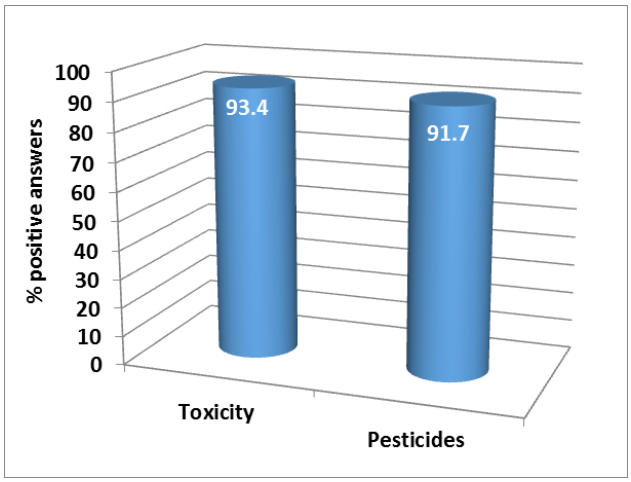

Figure 7. Perception of risks associated with the consumption of flowers.

The difficulty to find edible flowers at sale certainly contributes to condition their usage. Regarding the easiness to get edible flowers, the majority of the participants (51%) do not manifest their opinion, and 36% consider that it is difficult to obtain the flowers, while only 13% consider easy to get them. (Figure 8).

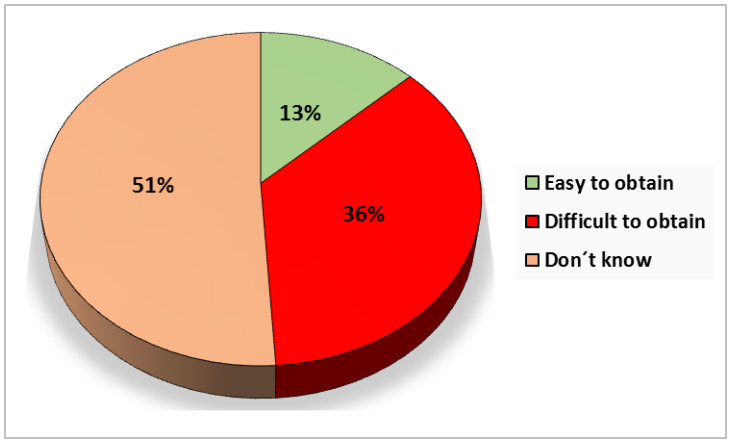

Figure 8. Facility to get edible flowers.

From the participants in this survey, 20% consider that edible flowers should be a part of our regular diets, while 13% think they should be eaten sporadically. Nevertheless, the majority do not express an opinion about this (67%) (Figure 9).

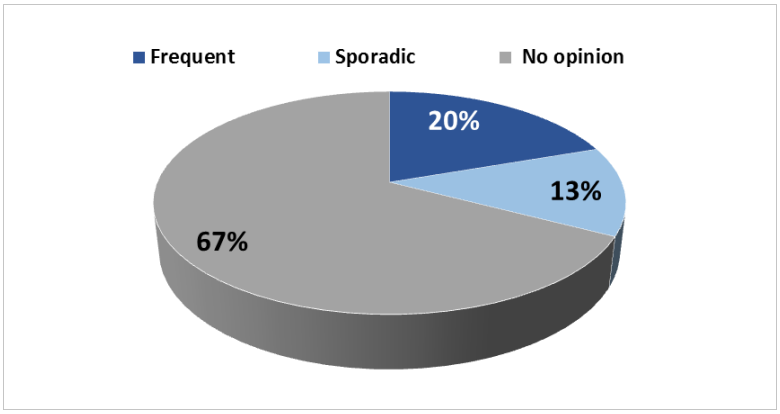

Figure 9. Recommendation about the frequency of consumption of edible flowers.

4. CONCLUSIONS

The present work allowed concluding that presently edible flowers have an expression in modern gastronomic trends. Furthermore, people start consuming this type of product more frequently, mostly in the fresh state and particularly for salads. Edible flowers are appreciated due to their decorative aptitude and for being considered a novelty. However, there are some risks associated to their consumption, such as pesticides and toxicity, but fortunately the Portuguese consumers are aware of this problem.

The market of edible flowers is expanding, but for that to happen it must be facilitated the access to them, and people have to be further informed. Restaurants appear as important links on the chain of edible flowers consumption, but to incentive the home preparation of recipes with edible flowers, it is necessary to provide cookbooks that include more edible flowers as ingredients in their recipes.

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