



## Edible Flowers: Knowledge and Consumption Habits

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**Received:** June 24, 2017; **Published:** July 18, 2017

### Abstract

The objective of this study was to investigate the level of knowledge about edible flowers and to what extent these are or not consumed. A questionnaire survey was undertaken in the district of Viseu, Portugal, to a sample of 100 possible consumers aged between 20 and 84 years old. The instrument included questions aimed at characterizing the sample together with questions about the knowledge relative to edible flowers, their identification, their consumption, whether there are risks associated with their ingestion, which are those risks and how the consumers face the consumption of edible flowers. The results showed that the participants consider that flowers should be included more frequently in daily foods, both in the fresh form or cooked, given their appreciated organoleptic and decorative characteristics, as well as nutritional and bioactive properties.

**Keywords:** Edible Flowers; Food Security; Gourmet Kitchen; Knowledge; Questionnaire Survey

### Introduction

With its different, original flavours, texture and colour, edible flowers have gained popularity as a creative and innovative ingredient in the culinary world (Figure 1). They are added to foods to provide flavour, aroma and colour [1]. Flowers have recently gained interest in the field of nutraceutical research, focusing on new agronomic and economic horizons. Their rich pigmentation, which evolved to attract pollinators, suggests a high antioxidant activity that is of interest for human nutrition. Anthocyanin pigments are pigments with important antioxidant activity turning flowers into an unexplored resource [2-4].

The flowers have been used for hundreds of years to make teas, wines and as supplements of butters, jams, marinades and sauces. Since ancient times they are dried and used as medicines or herbs, others are crystallized and used as dessert or accessories for desserts [5].

There are many ways to use flowers in culinary. They are used as food in the solid or almost solid forms (culinary dishes of various types, such as roasts, stews, salads, soups and jams) as well as in liquid form (as alcoholic beverages and alcoholic or aqueous infusions) or even in the form of flavourings (as constituents of olive oils, other oils and vinegars. The easiest way to use flowers for beginners is to spread them in salads, especially in the summer, while young Chefs can mix them with sugar and serve them with candies [5,6].

Although in recent times edible flowers are already relatively used, it is also true that most people still face with some mistrust the use of flowers in culinary. The fact that it is sometimes difficult to know which flowers can be ingested without problems makes it even more confusing to use them. Although the interest in this matter is increasing, the greatest difficulty results from some ignorance about the flowers which are actually edible, since some may present toxicity when ingested by humans. On the other hand, flowers used in cooking or other food preparations should be from organic farming [7,8].

There are flowers that are entirely edible, others in which we must only use some of its components (only the petals, only the stigmas, and so on...). It is also important to take into account the quantity consumed, because some flowers can only be used in small quantities to eat, such as linden flowers (*Tilia* spp.) which are only safe in small quantities each time and if the consumption is high it may cause damage to the heart. On the other hand, there are toxic flowers that are easily confused with edible varieties, and to confuse them might be a risk. Finally, there are some safe and harmful species that can share a common name, thus making it difficult for the inexperienced to differentiate. Several nontoxic plants, even if they are edible, can cause severe allergies in some people, such as the daisy that causes allergy in people suffering from asthma [5,9,10].

In order to try to understand the knowledge of the population and their habits related to edible flowers, a questionnaire survey was carried out, with an instrument purposely developed for the study.

### Material and Methods

The instrument used was developed purposely for this study and included three questions aimed at characterize the sample plus sixteen questions evaluate the knowledge and habits of the respondents about edible flowers: their identification, their consumption, whether or not there are risks associated with their ingestion, what those risks are and how they perceive them, and finally what are the consumers' issues and concerns related to the consumption of flowers.

The data collection was essentially in the district of Viseu, between July and September 2016, by direct interview after informed consent, guaranteeing the confidentiality of the answers obtained. 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 100 individuals, who were randomly selected as potential consumers of edible flowers as well as regular citizens.

The data were processed using the SPSS program, version 24 from IBM, Inc.

### Results and Discussion

#### Sample Characterization

The participants in the study were aged between 20 and 84 years, with an average age of 44 years old (Table 1). The women who participated in this study were slightly older, in general, when compared to the men.

Regarding gender, the majority of the participants were women (64%) while only 36% of men participated in the survey.

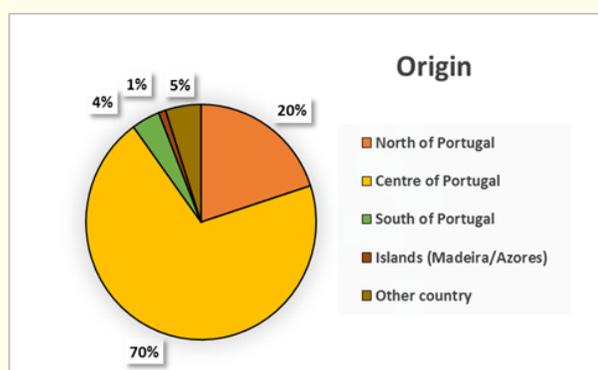


Figure 1: Geographical Origin of the Participants

Group	Percentage	Age (Years)		
		Minimum	Maximum	Mean ± Standard deviation
Women	64	21	83	45.98 ± 14.20
Men	36	20	84	40.58 ± 14.15
Global	100	20	84	44.04 ± 14.34

Table 1: Age of the Participants by Gender.

Figure 1 shows that 70% of the participants were original from the Central Region of Portugal, and 20 % are from the North, which is natural considering that Viseu district stands on the Centre-North of Portugal.

#### Knowledge and Habits Regarding Edible Flowers

When asked if they have already heard about edible flowers, 91% of the participants responded positively, thus meaning that most people are familiar with this concept. However, the women were more familiar when compared to men, with percentages of 92.2% and 88.9%, respectively.

Regarding the consumption of edible flowers, 76.81% had consumed at least once, and again the differences between genders are minimal: women with 77.8% and men with 75.0%.

Also the way in which the participants had already consumed the edible flowers was investigated and the results are shown in Figure 2. To add flowers into salads appears as the most frequent positive answer, with 72.4% of participants confirming this option. Following comes the use of flowers with decorative purposes, 57.9%, and as aroma intensifiers, 42.1%. The use of flowers in jams is less frequent, with only 15.8% of the participants replying positively.

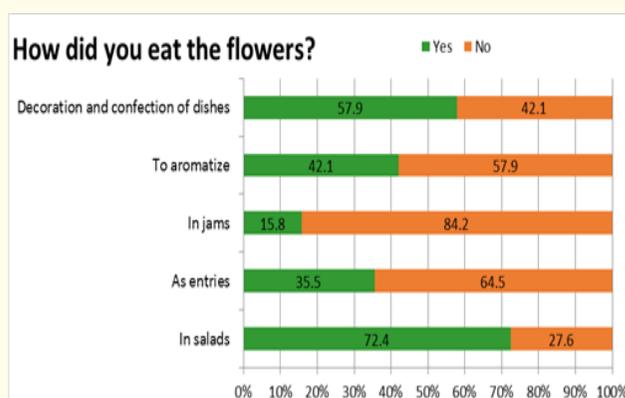


Figure 2: Possible Ways to Consume the Edible Flowers.

Figure 3 shows for some types of flowers usually consumed whether the participants had already tried them. Broccoli and cauliflower have been consumed by 100% of the participants, since they are regularly seen more like a vegetable. From the other flowers, camomile (60.5%) and sunflower (47.4%) appear as those more consumed, while orchid is the flower least consumed (2.6%).

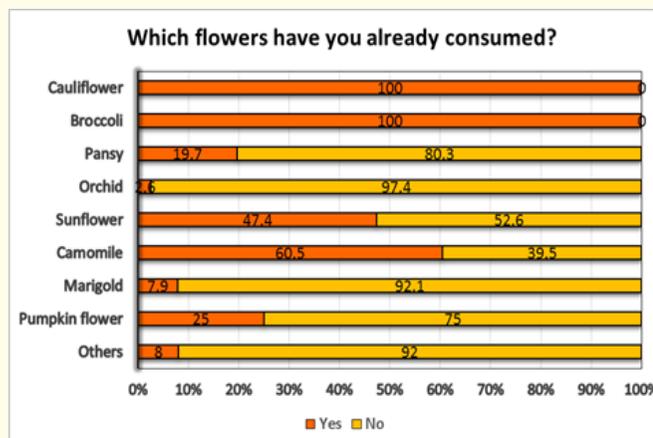


Figure 3: Some of the Types of Flowers Consumed.

Regarding the frequency of consumption of edible flowers, 43.4% assume it is sporadically while 56.6% eat flowers on a regular basis.

The reasons for consuming edible flowers are presented in Figure 4 and nutrition seems to justify for most people the option of eating flowers. In fact, flowers have many colours, many times owing to the presence of pigments like anthocyanins, which are powerful antioxidant compounds with antioxidant activity. However, not many people are aware of the fact, given that only 27.6% point that as a reason to eat flowers. Novelty does not influence people to consume edible flowers. Many researchers have demonstrated the high antioxidant activity of edible flowers [2-4, 11].

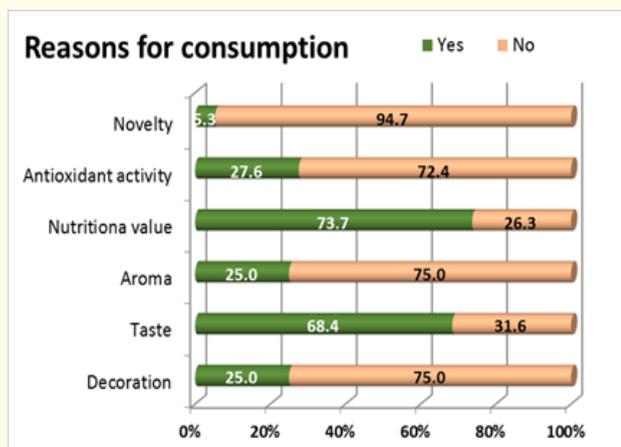


Figure 4: Reasons for Consuming Edible Flowers.

Most of the participants ate for the first time edible flowers in their own homes (76%), while restaurants comes in second, with 21% of the answers (Figure 5). Interestingly, 84.2% use regularly edible flowers in their culinary practices, against only 15.8% who do not.

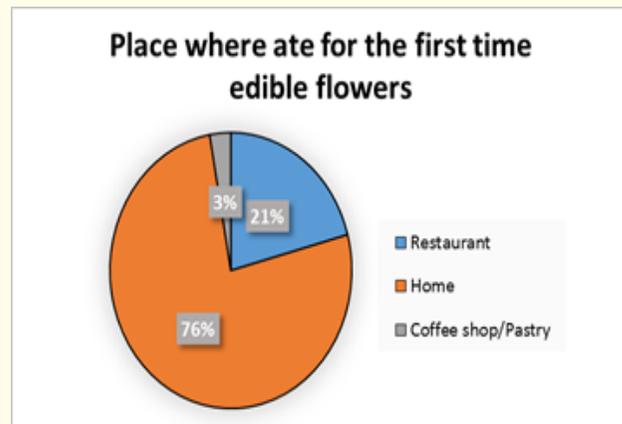


Figure 5: Places where People Eat Edible Flowers

The most common form of consumption of edible flowers is cooked (98.4%) while in fresh it represents only 43.8% (Figure 6). The fresh form allows a better preservation of the nutritional and bioactive properties of the flowers, as well as aromas and taste, so to maximise health effects and organoleptic characteristics it would be better to privilege the consumption in the fresh form.

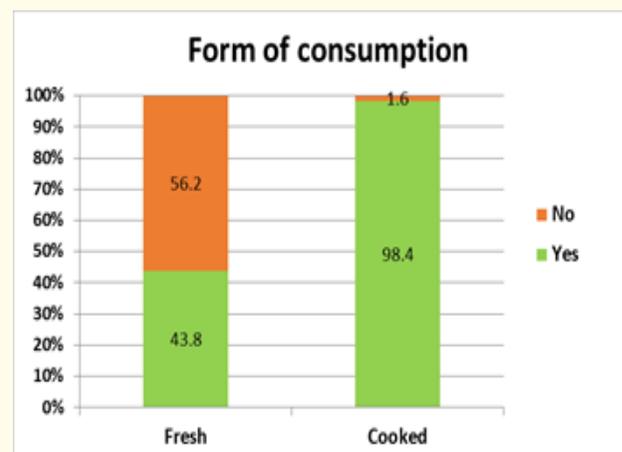


Figure 6: Form of Consumption of Edible Flowers.

Most of the participants buy the flowers for culinary purposes in the supermarket (93.8%), but an important part already cultivate their own flowers for gastronomy (45.3%), which is a positive indicator (Figure 7). To buy flowers for eating in flower shops is a wrong practice, because those flowers might be cultivated with pesticides and harmful chemicals, and it is positive to see that in the sample at study only a small part of the participants use that source to get the flowers.

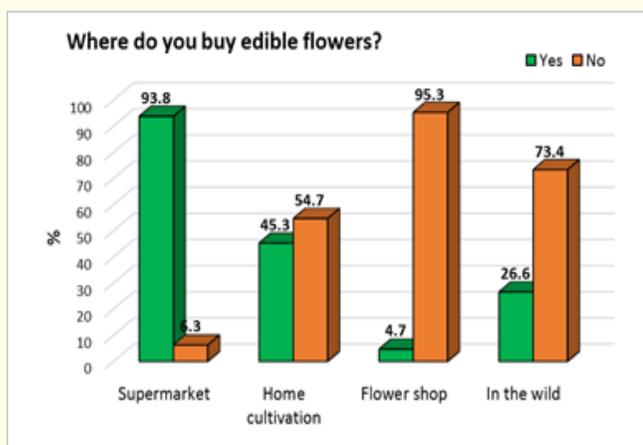


Figure 7: Place of Buying Edible Flowers.

Most people believe that there is not enough information about edible flowers (86%), and this might be a problem when trying to incentive their usage. The majority of the participants consider interesting to use edible flowers for gastronomic purposes, 74%, and this may contribute for the rapid development of this area (Table 2).

Group	Answers		
	Yes	No	Maybe
Women	75.0	0.0	25.0
Men	72.2	2.8	25.0
Global	74.0	1.0	25.0

Table 2: Do You Consider Interesting the use of Edible Flower in Gastronomy?

Regarding the risks associated with the consumption of edible flowers, some problems may exist, because the results of this study indicate that only a very small part of the participants are aware of the potential risks (22.0%), which is frankly low. As to the types of risks, most people consider the presence of pesticides a real threat

(86.4%) while the toxicity is identified as a risk by 59.1% of the participants (Figure 8).

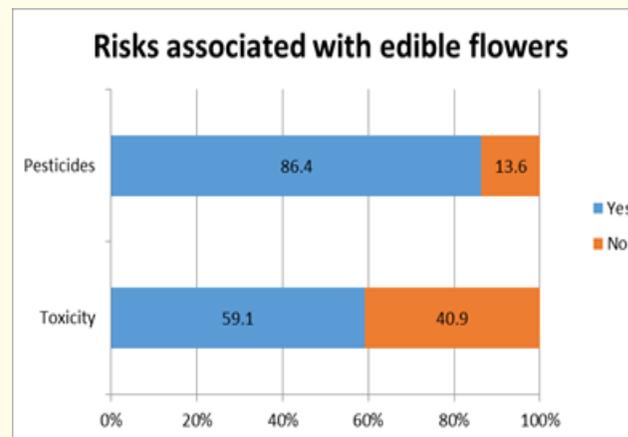


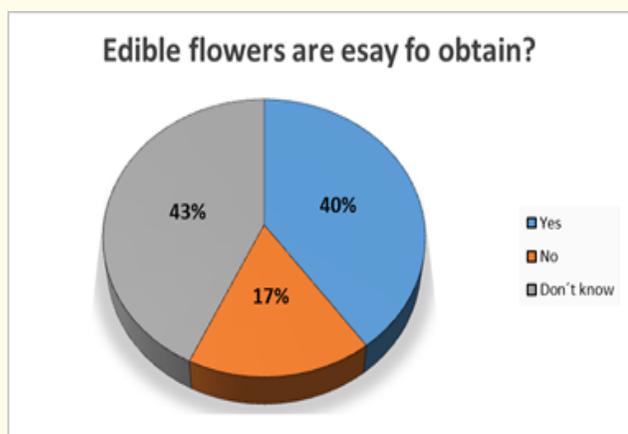
Figure 8: Types of Risks Associated with the Consumption of Flowers.

Group	Answers		
	Yes	No	Maybe
Women	25.0	39.1	35.9
Men	16.7	44.4	38.9
Global	22.0	41.0	37.0

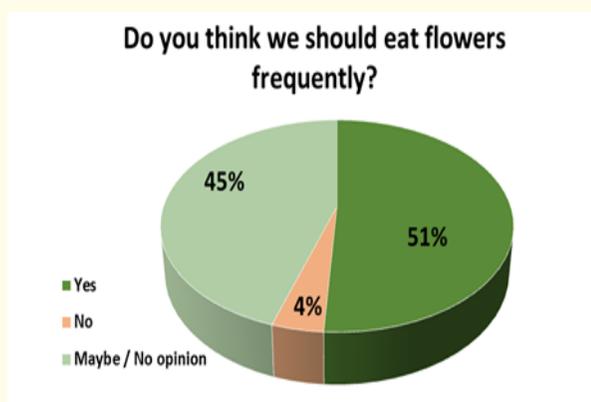
Table 3: Existence of Risks Associated with Consumption of Edible Flowers.

The easy access to buy edible flowers certainly conditions their usage. While 40 % of the participants consider that is is easy to get the flowers, 43% consider the contrary (Figure 9).

From the people enquired, only 4% consider that edible flowers should not be a part of our regular diets, while 51% are in favour of eating flowers regularly (Figure 10).



**Figure 9:** Easiness of Access to Edible Flowers.



**Figure 10:** Opinion Regarding the Frequency of Consumption of Edible Flowers.

## Conclusions

The results of the study revealed that today there are many people who know the edible flowers and how they can be used in the gastronomy, but it is necessary to deepen more the studies about this subject. However, there are still many facts related to edible flowers that need to be clarified, such as the risks inherent in its consumption and what are actually the flowers that are edible, because there are similar species for which one is edible and the other is not.

It is extremely important to remember that the flowers used as food are not those sold in flower shops, gardens or for ornamentation, which are grown with chemicals harmful to our health. Edible flowers should not have any kind of toxicity or chemical treatment, such as the use of pesticides, and hence they must be cultivated in an entirely organic way.

The flowers add a very great visual value to dishes and therefore are valuable for gastronomy, and the interest in edible flowers is increasing. Any flower used as food, even if it is known to be consumed, must always be tried to test its taste before being used on a dish or drink.

The results from the questionnaire survey showed that the Portuguese know and consume flowers, but are not yet comfortable with this theme. More specific questions such as what flowers to eat or the potential risks are not yet properly consolidated.

There is a niche of consumption for edible flowers, but for this market to expand there must be more studies, more research and more dissemination on the knowledge and consumption of edible flowers.

It is also important to make reference to the fact that in addition to the dissemination of knowledge, you also need cookbooks that include more and more edible flowers as ingredients in their recipes. New cooks would feel much bolder if they could have more information on this subject, which would allow them to know which flowers to eat, where to buy them or how to grow them, and lastly how to use them in a practical and tasty way.

## Acknowledgment

This work was financed by FCT - Fundação para a Ciência e Tecnologia, I.P., project UID/Multi/04016/2016.

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**Volume 1 Issue 3 July 2017**

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