Investigation about the consumption of edible flowers in Portugal

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Since the interest in the use of edible flowers for gastronomy has been increased, therefore, the aim of this study was to evaluate the extent to which sociodemographic characteristics influence the knowledge and consumption habits related to edible flowers in a sample of 247 Portuguese adults. The results revealed that this subject is not unknown for the majority of the participants and that they were aware of some of aspects related to the consumption of this kind of product. In general, edible flowers are consumed sporadically, cooked or incorporated in salads, mainly because of their taste. It was also observed that gender as well as the area of work or studies influenced the participants' knowledge and some of the consuming habits related to edible flowers. However, there were still some aspects about which the participants revealed some confusion, such as the risks related to their consumption. Hence, it is important to continue with studies in this area, in order to clarify and deepen the knowledge about the use of edible flowers in gastronomy.

Edible flowers have been used in culinary for thousands of years. Orientals, Romans and even the people of the Mediterranean used them to enhance the taste and beauty of gastronomic dishes, giving a special colour to the meal. Already in the middle ages, some varieties of flowers and herbs were cultivated in the gardens, which were used as ingredients for tea, syrups or infusions. The flowers were used not only in jellies or jams but also as components of more or less elaborate meals, salads, soups, desserts, breads, cakes or cheeses. Besides, they could also be used to flavour liqueurs, vinegar or oils, for example olive oil[1,2]. Nowadays, the use of plant-based products for food, such as edible flowers, is a sector that is under expansion[3].

Edible flowers are flowers that can be safely consumed. They do not present contraindications for humans and therefore can be ingested, because their components can be absorbed by the intestines without provoking toxicity. In addition, edible flowers must be, above all, organic and free from pesticides. In some cases, the whole flower is eaten, in others only some parts of the flower are edible. In the case of the

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pumpkin flower, the whole flower is edible; from the rose, only the petals are consumed and in the saffron the stigmas are used[4–6].

In Portugal, edible flowers have little tradition, apart from their use in herbal teas and healing liqueurs, unlike other countries such as France, Italy or Japan, where they are used very frequently in the culinary preparations[1]. Most of the traditional Portuguese dishes do not mention flowers as part of their ingredients, with the exceptions of cauliflower, broccoli and artichoke. However the young chefs are increasingly introducing flowers into their dishes, often with honours of main ingredient. For this trend to evolve there will have to be an effort to help distinguish which flowers are actually edible and what is their contribution in terms of taste, nutrition, and aesthetics to the culinary art[1].

There are also flowers that, despite being edible, may cause allergic reactions in certain individuals, so special care should be taken when choosing the species. On the other hand, many flowers are poisonous or toxic, containing substances dangerous to humans. Flowers should only be used in the kitchen when one is sure that they are really edible. Many even non-toxic flowers are not necessarily edible, as they may have unpleasant flavours[6–10].

Flowers can carry traces of pesticides and insects. Flowers grown as ornamental garden plants are not intended for food. These flowers may be among the edible but should not be used in the kitchen because they may be contaminated with chemical fertilizers, pest control substances, pesticides or special fertilizers for better blooming. The flowers used in the food should be cultivated by the cook who will use them and who knows what products were used in his garden, or bought from organic vegetable producers[11,12].

Presently, the utilization of edible flowers is essentially been limited to foodservice establishments, which use them as garnish. However, their potential is considerably bigger, taking in consideration their potential health enhancing properties[13,14]. Edible flowers have been evaluated in relation to their phenolic compositions and antioxidant activity, and the results of several studies indicate that edible flowers are rich sources of phenolic compounds with antioxidant, DPPH radical-scavenging activity and reducing power[2,8,10,15].

The investigated hypothesis consisted in evaluating to what extent the sociodemographic characteristics of a sample of the Portuguese population would influence the knowledge and consuming habits related to edible flowers.

Methodology

The instrument used was a questionnaire which included some questions destined to the characterization of the sample (age, gender and place of birth) complemented with a number of questions intended to evaluate the knowledge and consumption habits of the participants regarding edible flowers, namely concerning the identification of the species, the consumption, the knowledge about possible risks associated with their ingestion (which risks and in what way they are perceived), among other variables of interest to the study.

The data collection took place in Portugal, between July 2016 and December 2017. Only adults were included in the study sample and all ethical issues were followed when designing and applying the questionnaire, which was applied only after informed consent. The confidentiality of the answers obtained was strictly guaranteed and the data was used only for statistical purposes, so no individual answers were ever considered.

The sample size was composed of 247 individuals, who were randomly selected to include representation of different age classes and different genders.

All data analysis was done using the IBM software SPSS (version 25). For the treatment of the data basic descriptive statistics was used, complemented with statistical tests, namely crosstabs and chi-square test, to investigate the relations between some of the variables under study. The coefficient Cramer's V was used in some cases to evaluate the strength of the significant relations found between some of the variables for study. This coefficient varies from 0 to 1, and for V≈0.1 the association is considered weak, for V≈0.3 the association is moderate and for V≈0.5 or over, the association is strong[15]. The level of significance considered in the statistical tests was 5%.

Results and Discussion

Socio-demographical characterization of the sample

The sample was composed of 247 participants, from which 74.1% were women and 25.9% were men. The participants were aged between 18 and 84 years old, with an average age of 42.2±13.6 years. The average age of women (41.8±13.3 years) was lower as compared to men (43.3±14.4 years).

Table 1 summarizes the socio-demographical characterization of the sample for study and as it is observed 52.8% of the participants were average adults (31y≤age ≤50y), 21.5% were young adults

Table 1 — Socio-demographical characterization of the sample (N=247)

Sociodemographic Data		N	Percentage (%)
Age group	Young adults (18y ≤ age ≤ 30y)	53	21.5
	Average adults (31y ≤ age ≤ 50y)	130	52.8
	Senior adults (51y ≤ age ≤ 64y)	49	19.9
	Elderly(Age ≥ 65y)	14	5.7
Gender	Women	183	74.1
	Men	64	25.9
Province of Portugal	North	57	23.0
	Centre	169	68.5
	South	17	6.8
	Islands	4	1.7
Living environment	Rural	61	24.7
	Urban	169	68.5
	Suburban	17	6.8
Highest level of education	Primary school (4th grade)	2	0.7
	Basic school (9th grade)	7	2.7
	Secondary school (12th grade)	39	15.6
	University degree	200	81.0

(18y≤age ≤30y), 19.9% were senior adults (51y≤ age≤ 64y) and 5.7% were elderly (age≥65y).

The majority of the participants were from the Centre of Portugal (68.5%) and lived in an urban environment (68.5%).

Regarding the level of education, 81.0% of the participants had a university degree and only 0.7% of them had the primary school as their highest level of education achieved.

Fig. 1 presents the participants' area of work or studies and reveals that nutrition and other areas related to food were the ones with a higher incidence (56.8%), followed by agriculture (28.8%) and finally the hotels and restaurants related areas, with 12.3%. There were chosen those areas of work or studies, because it is important to analyse if the people who have some knowledge in food and production areas are more aware about the potentialities of edible flowers.

Knowledge and habits about edible flowers

From the sample for study, 94.3% of the participants indicated that they had already heard about edible flowers, being this percentage similar for both genders (95.1% for women and 92.2% for men). When seen by age group, it was observed that the level of awareness about this theme was similar for all the age groups (elderly-100%; senior adults–98.0%; young adults–96.2%; average adults–92.3%). As for the living environment, 100% of the participants that lived in rural or suburban surroundings indicated that they had already heard about edible flowers, and 95% of the respondents who lived in urban areas indicated the same. Furthermore, the results also suggested that the level of education increases the familiarity with edible flowers (basic school–75.0%; secondary school–91.3%; university degree–98.3%). Independently of the area of work or studies, the majority of the participants indicated that they were aware about this subject (nutrition/food–98.8%;

Fig. 1 — Participants' area of work or studies

agriculture–97.6%; hotels/restaurants–100%). Moreover, there were no significant differences between groups for any of the variables under study.

Regarding the consumption of edible flowers, 58.5% of the participants had consumed at least once, being this percentage higher for men (65.6%) when compared to women (56.6%). According to age group, it was observed that there was a higher percentage of senior and elderly that consumed edible flowers at least once (71.4% in both cases) when compared to young and average adults, 50.9% and 56.6%, respectively. The knowledge that the participants living in rural areas had about edible flowers did not result in a higher consumption, since only 30.6% of them indicated having already consumed this kind of product, at least once; while this percentage was, respectively, 52.0% and 50.0% for the participants living in urban and suburban areas. Regarding the consumption according to the level of education, a higher percentage of the participants with a university degree, 51.3%, indicated that they already consumed edible flowers at least once, when compared to the other levels of education (primary school–0.0%; basic school–25.0%; secondary school–30.4%). Again, there were no significant differences between the groups of the variables analysed. Kelley and colleagues[16] found that in the USA, people of the female sex, with a higher education level, a higher socioeconomic status, and larger households are more likely to use edible flowers. Moreover, nowadays the practice of gathering wild edible species is more popular among older people[17,18]. On the other hand, for some people the idea of eating edible flowers is still faced with reluctance[7].

It was also analysed the consumption of edible flowers according to the participants' area of work or studies, and it was observed that a higher percentage of the participants who had a profession or studies in the field of nutrition/food (54.2%) indicated that they had already consumed edible flowers as compared to the participants that did not have studies or work in this area (36.5%). The results of the Chi square test revealed that having an activity in nutrition or food areas influenced the consumption of edible flowers (χ^2=4.514; p=0.034), with a weak association between these variables (V=0.176). These trends were similar for the participants who had a profession or studies in the agriculture area and those who had not, with a higher percentage of the participants that had a profession or studies in agriculture, 69.0%, responding that they already consumed edible
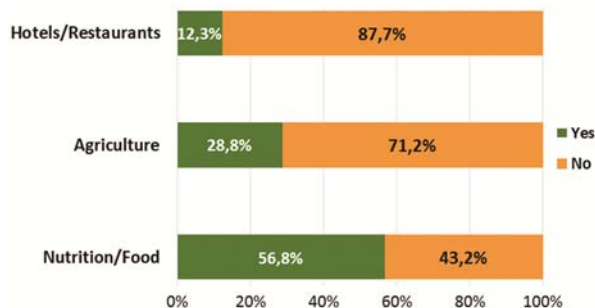
flowers. Again significant differences were found between the two groups (χ^2=11.966; p = 0.001), with a weak to moderate association (V = 0.286). In the case of a profession or studies related to hotels and restaurants, the incidence of the participants who had an activity in this area (46.9%) were similar to those of the participants who had not (44.4%). As it would be expected in view of these results, it was not found an association between these variables (χ^2=0.037; p =0.847).

Edible flowers can be used for different purposes, such as to serve as a garnish and/or trimmings of various meals and cold buffet food, to decorate salads, sweet meals, fruit and ice-cream sundae or even drinks[19]. Table 2 presents the way in which the participants had already consumed edible flowers and the results showed that salads appear as the most frequent way to eat flowers, with 75.2% of the participants confirming this option, being this percentage higher for women (77.7%) when compared to men (69.0%). For men, the most frequent way to use edible flowers was for decoration and confection of dishes, corresponding to 73.8% of the male participants. Furthermore, the results of the Chi square test showed that gender did not influence none of the possible ways to consume edible flowers. In a study performed in Brazil, it was observed that that population is receptive to consume edible flowers, but it needs to improve disclosure and alternative recipes to attract the consumers [20].

There are several kinds of edible flowers available[21]. Therefore one of the questions aimed at knowing which flowers the participants had already consumed, and in first place came camomile with 62.3% of positive answers, followed by sunflower (40.0%), pansy (37.2%), rose (35.9%), pumpkin flower (33.1%), others (24.9%), marigold (19.3%) and finally orchid (4.1%). The results are not surprising since camomile is one of the most consumed herbal tea in Europe[22].

Fig. 2 presents the frequency of consumption of edible flowers and the majority of the participants, 70.3%, indicated that they consume edible flowers sporadically, this percentage being similar for men and women (69.0% and 70.9%, respectively). In another study it was also found that in general, women are more likely to purchase edible flowers than men[16]. Nevertheless, the results of the Chi square test revealed that gender did not significantly influence the frequency of consumption of edible flowers (χ2 =0.048; p =0.827).

The frequency of consumption of edible flowers was also analysed according to age groups, living environment and area of work or studies. According to age groups, 74.1% of the young adults answered that they eat edible flowers sporadically, this percentage being 72.6% for average adults, 68.6% for senior adults and 50.0% for the elderlies. As for the living environment, 100% of the participants who lived in rural, urban or suburban areas consumed edible flowers sporadically. It was also observed that regardless the profession or area of studies, the participants consumed edible flowers sporadically. The results of the Chi square test showed that none of these variables significantly influenced the frequency of consumption of edible flowers.
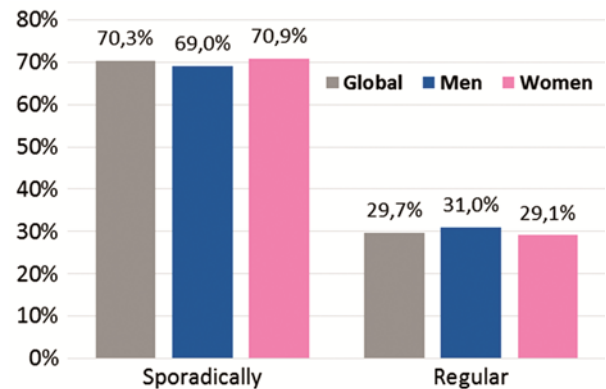

Fig. 2 — Participants' frequency of consumption of edible flowers

Table 2 — Possible ways to consume edible flowers, according to gender

Possible ways to consume edible flowers	Global		Women		Men		Chi square test		Cramer's coefficient
	Yes (N, %)	No (N, %)	Yes (N, %)	No (N, %)	Yes (N, %)	No (N, %)	χ^2	p	V
In salads	109, 75.2	36, 24.8	80, 77.7	23, 22.3	29, 69.0	13, 31.0	1.188	0.276	0.091
In starters	70, 48.3	75, 51.7	54, 52.4	49, 47.6	16, 38.1	26, 61.9	2.454	0.117	0.130
In jams	30, 20.7	115, 79.3	21, 20.4	82, 79.6	9, 21.4	33, 78.6	0.020	0.888	0.012
As aroma intensifiers	67, 46.2	78, 53.8	44, 42.7	59, 57.3	23, 54.8	19, 45.2	1.741	0.187	0.110
Decoration/confection of dishes	102, 70.3	43, 29.7	71, 68.9	32, 31.1	31, 73.8	11, 26.2	0.340	0.560	0.048
Others	14, 20.3	55, 79.7	11, 20.4	43, 79.6	3, 20.0	12, 80.0	(a)	1.000	0.004
(a) Fisher's exact test									

As it can be observed in Table 3 the main reason that led to the consumption of edible flowers was taste, with 61.4% of positive answers, followed by decoration and nutritional value (both with 48.3% of positive answers), aroma (42.1%), novelty (35.2%) and finally the antioxidant activity (28.3%). In another study performed in Taiwan, it was found that curiosity and aroma were the main influences on consumers' attitudes towards the consumption of edible flowers[5].

When seen by gender, taste also seems to justify for both men and women the option of eating edible flowers (69.0% of positive answers for men and 58.3% of positive answers for women). As for the association between the variables Participants' reasons for eating edible flowers *versus* gender, there were no significant differences between these two variables.

There were also investigated other possible associations, namely the influence of variables like age groups and area of studies or work on the participants' reasons for eating edible flowers. Regardless of the age groups, the participants' main reason for eating edible flowers was taste (young adults: 55.6%, average adults: 61.6%; senior adults: 62.9% and elderly: 70.0% of positive answers for taste). However, when analysed by the area of work or studies, the results were quite different, and the majority of the participants, independently the profession or studies area, indicated that the main reason for eating edible flowers was decoration (nutrition/food areas: 75.6%, agriculture: 75.9%, hotels/restaurants areas: 100%, of positive answers for decoration). In fact, the interest in edible flowers is growing, especially among culinary chefs, which use them to innovate their menus and sophisticate their receipts[23]. Nevertheless, none of the variables influenced the participants' reasons for eating edible flowers.

Most of the participants, 49.7%, indicated that they consumed edible flowers for the first time in their homes, 37.9% in a restaurant, 11.0% in other places and only 1.4% of the participants ate edible flowers for the first time in a café. When analysed by the area of work or studies, the results were somewhat different (Table 4). For those who had a profession or studies in the field of nutrition or food sciences, the most selected option was the restaurant (55.6%), being this percentage similar for the participants who had not studies in the field of nutrition or food sciences (65.2%). In this case, the results revealed that there were no significant differences between the participants who had a profession or studies in nutrition/food areas and those who had not, as to the place where they ate edible flowers for the first time. These results were similar for the participants who

Table 3 — Participants' reasons for eating edible flowers

Reasons for eating edible flowers	Global		Women		Men		Chi square test		Cramer's coefficient
	Yes (N, %)	No (N, %)	Yes (N, %)	No (N, %)	Yes (N, %)	No (N, %)	χ^2	p	V
Decoration	70, 48.3	75, 51.7	53, 51.5	50, 48.5	17, 40.5	25, 59.5	1.440	0.230	0.100
Taste	89, 61.4	56, 38.6	60, 58.3	43, 41.7	29, 66.0	13, 31.0	1.467	0.226	0.101
Aroma	61, 42.1	84, 57.9	43, 41.7	60, 58.3	18, 42.9	24, 57.1	0.015	0.902	0.010
Nutritional value	70, 48.3	75, 51.7	48, 46.6	55, 53.4	22, 52.4	20, 47.6	0.399	0.528	0.052
Antioxidant activity	41, 28.3	104, 71.7	27, 26.2	76, 73.8	14, 33.3	28, 66.7	0.746	0.388	0.072
Novelty	51, 35.2	94, 64.8	37, 35.9	66, 64.1	14, 33.3	28, 66.7	0.088	0.767	0.025
Others	11, 15.9	58, 84.1	9, 16.7	45, 83.3	2, 13.3	13, 86.7	(a)	1.000	0.038

(a)　　Fisher's exact test

Table 4 — Places where people eat edible flowers, according to the area of work or studies.

Area of work/studies		Places where people eat edible flowers (N, % of answers)			Chi square test		Cramer's coefficient
		Restaurant	Home	Other	χ^2	p	V
Nutrition/Food areas	Yes	25, 55.6	10, 22.2	10, 22.2	1.916	0.384	0.168
	No	15, 65.2	6, 26.1	2, 8.7			
Agriculture areas	Yes	12, 41.4	9, 31.0	8, 27.6	6.657	0.036	0.313
	No	28, 71.8	7, 17.9	4, 10.3			
Hotels/restaurants areas	Yes	4, 50.0	3, 37.5	1, 12.5	1.008	0.604	0.122
	No	36, 60.0	13, 21.7	11, 18.3			

had work or studies in hotels or restaurant areas and those who had not. However, there were found significant differences among the participants who had a profession or studies in agriculture and those who had not (χ^2=6.657; p =0.036), meaning that this area of work/studies influenced the place where the participants consumed edible flowers for the first time. More specifically, a higher percentage of the participants that did not have studies or work in agriculture areas indicated that they ate edible flowers for the first time in a restaurant, 71.8%, when compared to those who had studies or work in agriculture (41.4%). Furthermore, the results of the Cramer's V coefficient showed that the association between the two variables was moderated (V=0.313).

When the participants were asked if they use edible flowers in their culinary practices, 57.9% answered yes against 42.1% that answered no. The use of edible flowers was more popular among men (64.3% of positive answers), the elderly (90.0% of positive answers), for those who had not a profession or studies in nutrition/food area (30.4% of positive answers) and also for the participants who had studies or a professional activity in agriculture. Surprisingly, the use of edible flowers in culinary practices was more common among the participants who had not a work or studies in hotels or restaurant areas (28.3% of positive answers), when compared to those who had (25.0% of positive answers). Moreover, there were no significant differences between the different groups of the variables under study.

As for the form of consumption of edible flowers, the results showed that the participants preferred to eat them cooked, 82.1% of positive answers, while only 50.0% of the participants responded yes to the consumption in fresh. In previous studies it was found that the most frequent way to consume edible flowers is in the fresh form, dried, in ice cubs in cocktails, canned in sugar and preserved in distillates[24,25].

For the sample in study, the most common place for buying this product for culinary purposes was the supermarket (79.8% of positive answers), followed by home cultivation (45.2%) and finally the collection of edible flowers in the wild (35.7%). Only a few of the participants indicated that they buy edible flowers a flower shop (6.0%). When these results are seen according to the area of work or studies, it seems that home cultivation and the collection in the wild are the preferred ways for obtaining edible flowers in the case of the participants who had a profession or studies in the fields of nutrition/food and agriculture (Table 5). On the other hand, most of the participants who had studies or work in hotels/restaurants indicated that they purchase edible flowers for culinary purposes in the supermarket (100% of positive answers). Regardless the profession or areas of studies, there were no significant differences between groups. According to previous scientific research, for people's safety it is essential the correct identification of edible flowers[12] and it is not recommended the consumption of edible flowers from non-tested cultivars and bought in flower shops, because they could be contaminated by fertilizers, herbicides and other pesticides, which may lead to toxic effects and some allergic reactions[19,26].

Despite the growing interest in the market of edible flowers, these products still receive less attention than other ones, such as for example vegetables and fruits[27]. Not surprisingly, the majority of the participants in this survey, 91.9%, considered that there is not enough information about this subject. As it can be observed in Table 6, independently of the profession or field of studies, the participants believed that there is still a lack of information about edible flowers, with no significant differences between the participants who had a profession or studies in the areas of nutrition/food, agriculture or hotels/restaurants and those who had not.

Table 5 — Places where people can purchase edible flowers, according to the area of work or studies.

Place of purchase of edible flowers		Nutrition/Food areas		Agriculture areas		Hotels/restaurants areas	
		Yes	No	Yes	No	Yes	No
Supermarket	Yes (N, %)	6, 50.0	1, 14.3	4, 44.4	3, 30.0	2, 100.0	5, 29.4
	No (N, %)	6, 50.0	6, 85.7	5, 55.6	7, 70.0	0, 0.0	12, 70.6
Home cultivation	Yes (N, %)	7, 58.3	2, 28.6	6, 66.7	3, 30.0	1, 50.0	8, 47.1
	No (N, %)	5, 41.7	5, 71.4	3, 33.3	7, 70.0	1, 50.0	9, 52.9
Flower shop	Yes (N, %)	0, 0.0	2, 28,6	0, 0.0	2, 20.0	0, 0.0	2, 11.8
	No (N, %)	12, 100.0	5, 71,4	9, 100.0	8, 80.0	2, 100.0	15, 88.2
In the wild	Yes (N, %)	7, 58.3	5, 71.4	6, 66.7	6, 60.0	1, 50.0	11, 64.7
	No (N, %)	5, 41.7	2, 28.6	3, 33.3	4, 40.0	1, 50.0	6, 35.3

The majority of the participants, 77.7%, considered that it is interesting to use edible flowers for gastronomic purposes, while 19.8% answered maybe/no opinion and only a few, 2.4%, of the respondents showed no interest in using edible flowers in gastronomy. This tendency was similar for both men and women (women: yes–78.7%, maybe/no opinion–19.1%, no – 2.2%; men: yes–75.0%, maybe/no opinion–21.9%, no–3.1%), with no significant differences between genders (χ^2=0.439, p=0.804).

As it can be observed in Table 7, the participants who had work or studies in the areas of nutrition/food, agriculture or hotels/restaurants revealed a greater interest in the use of edible flowers for gastronomic purposes when compared with those who had not. However, there were only significant differences between the participants who had a profession or studies in the field of nutrition/food and those who had not (χ^2=6.479, p=0.039), meaning that this activity influenced the interest in the use of edible flowers for gastronomy. The results of the Cramer's V test showed that the association between the variables was moderate (V=0.211).

It was also investigated if the participants believed that the consumption of edible flowers involved risks and the results showed that only 34.2% of them responded affirmatively, 33.2% answered "no" and 32.4% chose "maybe/no opinion". When these results were analysed by gender, it was observed that a higher percentage of women answered yes when compared to men (women: yes–38.8%, no–31.1%, maybe/no opinion–30.1%; men: yes–21.9%, no–39.1%, maybe/no opinion–39.1%), with significant differences among genders (χ^2=6.029, p=0.049) and a weak association (V=0.156). As for the degree of awareness regarding the level of education, it was found that a higher education degree did not resultina higher level of awareness about the risks involved in the consumption of edible flowers (Fig. 3), and in view of these results there were no significant differences between the different levels of education (χ^2=5.836, p=0.442).

Table 8 presents the participants' perception about the risks associated with the consumption of edible flowers, according to the area of work or studies and it seems that the participants who had a profession or studies in nutrition/food were more aware about the risks involved in the consumption of this type of product (22.2%) when compared to the participants
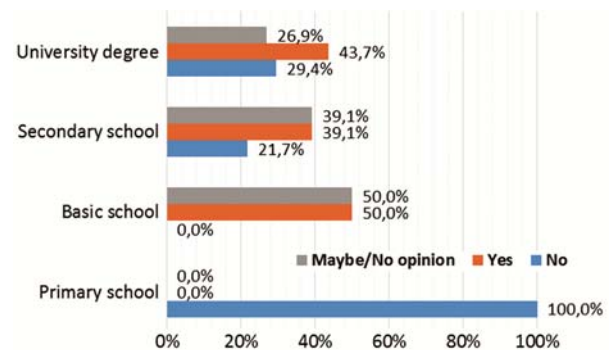

Fig. 3 — Participants perception about the risks associated with the consumption of flowers, according to the level of education

Table 6 — Participants' perceptions about edible flowers information, according to the area of work or studies.

Area of work/studies		Do you think there is enough information about edible flowers?		Chi square test		Cramer's coefficient
		Yes (N, %)	No (N, %)	χ^2	p	V
Nutrition/Food areas	Yes	5, 6.0	78, 94.0	(a)	0.236	0.111
	No	1, 1.6	62, 98.4			
Agriculture areas	Yes	3, 7.1	39, 92.2	(a)	0.355	0.097
	No	3, 2.9	101, 97.1			
Hotels/restaurants areas	Yes	1, 5.6	17, 94.4	(a)	0.553	0.027
	No	5, 3.9	123, 96.1			
(a) Fisher's exact test						

Table 7 — Participants' interest in the use of edible flowers for gastronomy, according to the area of work or studies

Area of work/studies		Interest in using edible flowers for gastronomy			Chi square test		Cramer's coefficient
		Yes (N, %)	No (N, %)	Maybe/No opinion (N, %)	χ^2	p	V
Nutrition/Food areas	Yes	72, 87.6	3, 3.6	8, 9.6	6.479	0.039	0.211
	No	45, 71.4	2, 3.2	16, 25.4			
Agriculture areas	Yes	37, 88.1	1, 2.4	4, 9.5	2.368	0.306	0.127
	No	80, 76.9	4, 3.8	20, 19.2			
Hotels/restaurants areas	Yes	17, 94.4	1, 5.6	0, 0.0	4.172	0.124	0.169
	No	100, 78.1	4, 3.1	24, 18.8			

who had not (22.2%). Furthermore, there were found significant differences between these two groups (χ =18.816, p=0.000), which means that having a work or studies in nutrition or food area influenced the knowledge about the risks associated with the consumption of edible flowers, with a moderate association between the variables (V=0.359). These results were similar in the case of agriculture areas, so that also having a professional activity or studies in agriculture influenced the awareness about the risks associated with the consumption of edible flowers ($\chi2$=8.531, p=0.014), with weak associations between the variables. In the case of the hotels/restaurants, the results showed that a higher percentage of the participants who had not a professional activity or studies in this area, 44.5%, were aware about the risks involved in the consumption of edible flowers, when compared to those who had a work or studies in hotels/restaurants, 27.8%. Again there were significant differences ($\chi2$=6.746, p=0.034) with a weak association between the variables (V=0.215).

As to the type of risks, the majority of the respondents considered that the major risk is the presence of pesticides (90.4% of positive answers), while toxicity was considered a real threat for 85.7% of the participants.

Since access to the purchase edible flowers conditions their usage, it was also investigated the participants' opinions regarding the easiness to get edible flowers. The results showed that a considerable percentage of the respondents, 47.8%, did not

manifest their opinion, 28.3% considered that it is difficult to obtain this kind of flowers and 23.9% indicated that it is easy to get them. When analysed by the area of work or studies (Table 9), it was observed that 49.4% of the participants who had a professional activity or studies in the field of nutrition/food believed that it is difficult to get edible flowers, while 66.7% of the participants who had not a profession/studies in nutrition/food area did not manifest their opinion. The Chi square test showed that the differences between these two groups were statistically significant ($\chi2$=16.001, p=0.000), with a moderate association (V=0.331). These results were similar for the participants who had work or studies in agriculture and those who had not, and again were found significant differences ($\chi2$=9.858, p=0.007), but in this case with a weak association (V=0.260). On the contrary, 55.6% of the participants who had studies or work in hotels/restaurant areas did not manifest their opinion, being this percentage similar for the participants who had not work or studies in this area (50.8%). In this case, there were no significant differences between the two groups.

When the participants were asked if they think that the consumption of edible flowers should be frequent, most of them, 58.3%, answered "maybe/no", 32.4% answered yes and only 9.3% of the participants considered that edible flowers should not be a part of a regular diet. As it can be seen in Table 10, this trend was transversal to all areas of work or studies and independently of the area of work or studies the majority of the participants selected the option

Table 8 — Participants' perception about the risks associated with the consumption of flowers, according to the area of work or studies.

Area of work/studies		Risks associated with the consumption of flowers			Chi square test		Cramer's coefficient
		Yes (N, %)	No (N, %)	Maybe/No opinion (N, %)	χ^2	p	V
Nutrition/Food areas	Yes	48, 57.8	16, 19.3	19, 22.9	18.816	0.000	0.359
	No	14, 22.2	25, 39.7	24, 38.1			
Agriculture areas	Yes	24, 57.1	5, 11.9	13, 31.0	8.531	0.014	0.242
	No	38, 36.5	36, 34.6	30, 28.8			
Hotels/restaurants areas	Yes	5, 27.8	3, 16.7	10, 55.6	6.746	0.034	0.215
	No	57, 44.5	38, 29.7	33, 25.8			

Table 9 — Facility to access edible flowers, according to the area of work or studies

Area of work/studies		Answers			Chi square test		Cramer's coefficient
		Yes (N, %)	No (N, %)	Do not know (N, %)	χ^2	p	V
Nutrition/Food areas	Yes	9, 10.8	41, 49.4	33, 39.8	16.001	0.000	0.331
	No	10, 15.9	11, 17.5	42, 66.7			
Agriculture areas	Yes	5, 11.9	23, 54.8	14, 33.3	9.858	0.007	0.260
	No	14, 13.5	29, 27.9	61, 58.7			
Hotels/restaurants areas	Yes	2, 11.1	6, 33.3	10, 55.6	0.157	0.924	0.033
	No	17, 13.3	46, 35.9	65, 50.8			

Table 10 — Participants' opinion regarding the consumption of edible flowers, according to the area of work or studies

Area of work/studies		Answers			Chi square test		Cramer's coefficient
		Yes (N, %)	No (N, %)	Maybe/No opinion (N, %)	χ^2	p	V
Nutrition/Food areas	Yes	16, 19.3	12, 14.5	55, 66.3	0.377	0.828	0.051
	No	12, 19.0	7, 11.1	44, 69.8			
Agriculture areas	Yes	9, 21.4	5, 11.9	28, 66.7	0.223	0.895	0.039
	No	19, 18.3	14, 13.5	71, 68.3			
Hotels/restaurants areas	Yes	2, 11.1	3, 16.7	13, 72.2	0.966	0.617	0.081
	No	26, 20.3	16, 12.5	86, 67.2			

maybe/no opinion. In view of these results, there were no differences between the participants who had a profession or studies in the areas mentioned and those who had not.

Conclusion

It can be concluded from this work that the majority of the participants have heard about edible flowers and that more than a half of them already consumed or used this type of product for gastronomy purposes. In general, participants consumed edible flowers sporadically, mostly cooked and preferably in salads. Edible flowers are particularly appreciated due their taste and for most of the participants the best way to get them was in supermarkets. For the majority of the participants the main risk associated to the consumption of edible flowers was the presence of pesticides.

The results of this study showed that some sociodemographic characteristics influenced the participants' knowledge and consuming habits related to edible flowers. There were significant differences in the consumption of edible flowers regarding the area of work or studies, being the consumption of this product higher for the participants who had work or studies in nutrition/food or agriculture areas, when compared to those who had not a profession or studies in that areas. There were also found significant differences between the participants who had a profession/studies in agriculture area and those who had not, regarding the place where they consumed edible flowers for the first time. For the participants who had work or studies in agriculture area the place where they ate edible flowers for the first time was their homes and for those who had not was at a restaurant. Having a professional activity in nutrition/food area also provedto influence the interest in the use of edible flowers for gastronomic purposes. On the other hand, there were found significant differences between genders and also among the participants who had work or studies in nutrition/food, agriculture or hotels/restaurants areas and those who had not, regarding the awareness about the risks involved in the consumption of edible flowers, with women and those who had work or studies in those particular areas being more aware about the risks.

In general, there seems to be a confusion regarding the easiness to get edible flowers, and again were found significant differences between the participants who had work or studies in food/nutrition or agriculture areas and those who had not, with a higher percentage of the participants in this areas considering that it is difficult to obtain this product.

Overall, this study highlighted the need to clarify some aspects related to the use of edible flowers in gastronomy, namely the risks associated with its consumption and their potential as an ingredient in different recipes.

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Declaration

Authors hereby declare that there is no conflict of interests in this paper.

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