RESEARCH ARTICLE

The PlantLIBRA consumer survey: Findings on the use of plant food supplements in Italy

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Abstract

Background

Food supplements, and in particular those containing botanicals (plant food supplements, PFS), have in recent decades been of great interest both to consumers and to food/pharmaceutical industries.

Objectives

The aim of this paper is to examine replies by Italian consumers to the PlantLIBRA consumers' survey in order to: 1) assess the behaviour of an Italian population with respect to the use of plant food supplements in Italy, PLoS ONE 13 (1): e0190915. https://doi.org/10.1371/journal.pone.0190915

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Data Availability Statement: All relevant data necessary to replicate the reported study findings are included within the paper. Original data (2359 filled questionnaires) and tables of elaborations are available to interested researchers with approval from the Ethics Committee from the University of Barcelona (cbub@ub.edu <mailto:cbub@ub.edu>) responsible for the survey and the Università degli Studi di Milano (comitato.etico@unimi.it <mailto:comitato.etico@unimi.it>) responsible for the whole EU Project. Further information regarding ethics of the study is available from the independent ethical board.
Conclusions

The results provide new insights on the socio-economic characteristics and lifestyle of Italian PFS consumers, on their reasons for and pattern of use, and on their behaviour and expectations. The value of this information is not restricted to the specific country (Italy) but allows for a more general evaluation of the pattern of use, according to habits and geographical area.

Introduction

Food supplements, especially those containing botanicals, named plant food supplements (PFS), have been of increasing interest in recent decades to consumers and food/pharmaceutical industries [1–2]. The relative market has greatly increased in all five continents, becoming an important economic business in the area of human health.

The range of products presented in different distribution channels (supermarkets, pharmacy, herbal shops, internet) and their self-prescription raised concerns about the balance between risk and benefit [3–4], and some research projects have been funded to produce reliable data on this topic. Among the others, a European project called PlantLIBRA (Plant Food Supplements: Levels of Intake, Benefit and Risk Assessment) was financed within the 7th Framework Programme under grant agreement n. 245199.

The first consideration was the classification (and selection for survey) of categories where botanicals can be present as ingredients: i.e. foods, food supplements, herbal medicinal products (traditional medicine), homeopathic products, cosmetics, etc. In Italy, as well as in European Union (EU), most products containing botanicals are sold as food supplements and regulated under the food law [5–6]; as defined by the project, the category of Plant Food Supplements (PFS) was the only one included in the recruitment of consumers.

In agreement with EFSA, in the PlantLIBRA Consumer Survey, “Botanical” meant either raw material or derived preparations made from plants, algae, fungi or lichens (http://www.efsa.europa.eu/en/topics/topic/botanicals). The botanicals to be included in the survey were clearly defined at the outset; PFS were defined as the "foodstuffs the purpose of which is to supplement the normal diet and which are concentrated sources of botanical preparations that have nutritional or physiological effect, alone or in combination with vitamins, minerals and other substances which are not plant-based". Herbal remedies, other medicinal products based on botanicals, herbal teas and juices were excluded [7].

Survey data collection and the main objectives of the consumer survey have been described in a previous paper by Garcia-Alvarez et al [7]. The main goals of this paper were: 1) the assessment of the pattern of PFS use in Italy in comparison with the other 5 European countries (Finland, Germany, Romania, Spain and the United Kingdom) involved in the whole survey; 2) the identification of different consumption habits in the 4 Italian cities selected according to their geographical distribution (Milan, Venice, Rome and Catania); and 3) the collection of information to verify the actual intake of PFS and consumers’ behaviour.

Materials and methods

The PlantLIBRA Consumer Survey was conducted in 6 European countries (Finland, Germany, Italy, Romania, Spain and the United Kingdom), and recruitment of participants occurred in 4 cities for each country. In Italy, the cities included were selected as a reference
for different geographical areas: Milan for northern region, Venice for northern-eastern region; Rome for central region, and Catania for southern region/islands.

In order to obtain a sample of approximately 400 Italian consumers (as established), 1951 individuals were pre-screened [7]. Consumers were eligible if in the previous 12 months their PFS consumption was at least 1) one daily dose for at least 2 consecutive or non-consecutive weeks; or 2) one or more doses per week for at least 3 consecutive weeks; 3) one or more doses per week for at least 4 non-consecutive weeks.

Eligible consumers completed a detailed questionnaire on PFS usage, providing product/plant names, form of dosage, frequency of use, reasons for use, adverse effects, places and patterns of purchase and information sources on products. Data on a maximum of five different PFS for each consumer was recorded; when PFS were more than 5, their inclusion was based on the frequency of use. Responders’ socio-demographic data, including age, gender, level of education and employment status, as well as height, weight and health-related lifestyle information, were also collected. Further details on the survey have been published previously [7]. The composition of each PFS was obtained from the label, if available or, when only the name was known, by searching the PFS ingredients in the producers’ website.

**Ethical aspects**

Approval of the survey protocols was obtained from the Ethics Committee of the Università degli Studi di Milano, Italy. The approval required submitting all survey material to the members for evaluation. Furthermore, the ethical aspects were considered in the European Commission Consolidated Review Report dated 30th September 2013 and evaluated as "ethical issues regarding the surveys have been handled appropriately".

Informed consent was obtained from survey participants verbally after they had read the survey information sheet. The data were collected anonymously on paper questionnaires and then transferred to an electronic database; all respondents were assigned an ID number prior to data analyses.

**Statistical analysis**

All data were entered into the statistical package Statistical Package for Social Science (SPSS) for Windows v. 18 (IBM Corporation, Somers, NY, USA), which was used for analysis. Respondent data were recorded in a separate database and a number of variables were created and/or recoded to facilitate reporting and analysis.

Absolute frequencies and percentages for each of the variable categories were used to describe the qualitative nominal/ordinal and discrete quantitative survey data. In turn, all data have been stratified by gender, age range and country—also using absolute frequencies and percentages and 95% confidence intervals. When describing the association between two qualitative variables (nominal or ordinal), contingency tables were used. The continuous quantitative variables (e.g. BMI, alcohol) were recoded into categorical variables. For details about the statistical analysis and data organization see the paper by Garcia-Alvarez et al [7].

**Results**

**Description of the consumer sample**

Data included in this paper were collected during the main survey of the European Project PlantLIBRA and are here focused on the behaviour and perception of Italian PFS consumers.

The PlantLIBRA Consumer Survey included approximately 400 consumers for each country (Finland, Germany, Italy, Romania, Spain, UK) for a total of 2359 individuals. In Italy, the
consumers enrolled were 378, 187 males (49.5%) and 191 female (50.5%). Details about sample distribution among the 4 Italian cities are reported in Table 1. The population was ranked in two age groups: 1) 18–59 years including 284 people (75.1%) and 2) >60 years including 94 consumers (24.9%). The distribution of consumers by sex and age groups was established, as inclusion criteria, in the survey protocol [7]. As for the European sample (ES), the high school was the educational level (medium) reached by the majority of Italian consumers involved in the survey (58.7% vs 65.7% of the ES); the lowest level (primary school) was attained by 19.1% of the Italian and 10.6% of the ES. The distribution was similar at local level, and the percentage of people who reached the medium education level ranged between 52.1% (Catania) and 68.8% (Rome). Catania was the city with the highest percentage of graduate consumers enrolled (36.5%).

Most of the Italian consumers included were employed (58.5 vs 57.5% of ES); compared to the European one, the Italian sample included fewer retired people (13.2 vs. 21.1%), while students and people doing housework were more represented. Although with some variability for the percentage of students and unemployed persons, the distribution of consumers of the 4 Italian cities among the employment status was similar.

Overall and for the 4 cities, approximately 70% of Italian consumers declared their health status as good or very good (Table 2); only two respondents reported it bad (nobody very bad), both located in Catania. Most Italian respondents (87.8%) declared a low/moderate amount of physical activity (Table 2), whereas in the European sample as a whole (ES) it was moderate/high (81.5%). No significant difference was observed between Italian cities. Despite the lower physical activity, 65.1% of Italian respondents reported a BMI (Body Mass Index) as normal (18.5–25.0 kg/m²), while only 47.1% of the ES fell into this category, and only 5.8% of the Italian sample was obese, versus 15.1% in the ES.

Table 1. PlantLIBRA Italian consumer survey sample—socio-economic characteristics, overall and by city.

| Characteristic | All countries | Italy | Milan | Venice | Rome | Catania |
|----------------|---------------|-------|-------|--------|-------|---------|
| Consumer sample |               |       |       |        |       |         |
| Total           | 2359          | 378   | 96    | 90     | 96    | 96      |
| Male            | 1141          | 187   | 39    | 46     | 52    | 50      |
| Female          | 1218          | 191   | 57    | 44     | 44    | 46      |
| Age             |               |       |       |        |       |         |
| m±SD 18–59 years| 46.4±15.6     | 44.0±16.2 | 46.8±15.3 | 40.43±16.2 | 45.8±15.7 | 42.8±17.2 |
| >60 years       | 595           | 94    | 27    | 17     | 25    | 25      |
| Education*      |               |       |       |        |       |         |
| Low             | 249           | 72    | 25    | 22     | 14    | 11      |
| Medium          | 1549          | 222   | 54    | 52     | 66    | 50      |
| High            | 561           | 84    | 17    | 16     | 16    | 35      |
| Employment status|             |       |       |        |       |         |
| Employed        | 1357          | 221   | 13    | 10     | 15    | 12      |
| Retired         | 498           | 50    | 13.5  | 11.1   | 15.6  | 12.5    |
| Student         | 187           | 47    | 5.2   | 14.5   | 12.5  | 16.7    |
| Housework       | 157           | 39    | 10.4  | 15.6   | 6     | 8       |
| Unemployed      | 142           | 21    | 7.3   | 5.6    | 2     | 7       |
| Other           | 18            | 0     | 0     | 0      | 0     | 0       |

* Low education level = Primary school; Medium education level = High School; High education level = Graduation

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Most Italian consumers were non-smokers and approximately 50% of them had never smoked (Table 2). A significant percentage (41.3%) of Italian consumers declared a consumption of an alcoholic beverage more than once a day, compared to the ES (12.6%). The difference observed with the whole survey was probably due to the fact that consumption of wine during meals is considered positively by Italian society and there is consequently no reluctance in declaring it. The large majority of Italians do not use food supplements other than PFS, or complementary and alternative medicines (CAM) such as acupuncture, chiropractic, or massage therapy.
Pattern of PFS consumption in Italy

Similarly to the ES, more than 90% of the Italian subjects consumed one PFS, and only 0.8% (ES 4%) more than two PFS (Table 3). The number of consumers taking one PFS was higher in Central/Southern Italy (Rome 97.9% and Catania 93.8%), where no respondent declared the use of more than two PFS. As in the whole survey, solid forms (capsules, pills, tablets, lozenges) were the most frequently used in Italy, followed by liquid forms, which were more often cited by Venice respondents. Regarding the pattern of use (Table 3), 70% of Italian respondents claimed to use PFS only periodically or when their health status worsened; use “whenever/sporadically” was fairly frequently cited by consumers from Milan (30.2%) and rarely by those from Rome (2%).

The percentage of consumers using PFS all the year round was low in the whole survey (4.4% of the ES and 2.6% of the Italian respondents), but the pattern of use during the year showed several interesting differences (Fig 1). While the ES showed a quite constant pattern of use during the year, Italian consumers increased their use of PFS in spring and reduced it in summer; this pattern is particularly evident for males, while no important difference was seen between the two age groups. The pattern of consumption differs among the four Italian cities, with opposite profiles when Venice and Catania are considered. These data suggest that geographical area and climatic conditions can modulate the habits of PFS consumers.

With regard to the reasons of use (Table 4), the three most reported items by Italian respondents were, in decreasing order of importance: 1) stomach/digestive function; 2) energy and tonics; and 3) relaxing; the last item was less cited by ES in favour of ‘boosting the immune system’. The ranking of reasons for use in Rome and Catania was similar to the average for all Italian respondents, but for Milan the three most important items were: 1) digestive function, 2) immune system, and 3) hair/skin; and for Venice 1) digestive function, 2) energy/tonics, and 3) body weight control. More details on reasons of use in the whole survey (6 countries), in Italy, and in the four cities are listed in Table 4. The difference between the number of reasons

Table 3. PlantLIBRA Italian PFS consumer survey—PFS usage pattern and form, overall and by city.

| Characteristic          | All countries | Italy | Milan | Venice | Rome | Catania |
|------------------------|---------------|-------|-------|--------|------|--------|
| **Number of PFS used** | n = 2359      | n = 378 | n = 96 | n = 90 | n = 96 | n = 96 |
| 1                      | 1 975         | 343   | 76    | 79     | 94    | 90     |
|                        | 12.3          | 90.7  | 90.7  | 87.9   | 97.9  | 93.8   |
| 2                      | 289           | 32    | 16    | 11     | 54    | 6      |
|                        | 12.2          | 8.5   | 16.7  | 11.2   | 55.1  | 6.3    |
| 3–5                    | 95            | 3     | 4     | 0      | 0     | 0      |
|                        | 4.0           | 0.8   | 4.2   | 0      | 0     | 0      |
| **Form of PFS**        | n = 2874      | n = 417 | n = 116 | n = 101 | n = 98 | n = 102 |
| Capsules               | 1 101         | 144   | 46    | 32     | 36    | 30     |
|                        | 38.3          | 34.5  | 39.7  | 31.7   | 36.7  | 29.7   |
| Pills/Tablets/Lozenges | 1 057         | 126   | 29    | 25     | 33    | 39     |
|                        | 36.8          | 30.2  | 25.0  | 24.8   | 33.7  | 38.6   |
| Liquid                 | 513           | 110   | 33    | 28     | 34    | 23     |
|                        | 17.9          | 26.4  | 33.7  | 23.3   | 33.7  | 19.8   |
| Ampoules               | 104           | 13    | 2     | 3      | 2     | 6      |
|                        | 3.6           | 3.1   | 1.7   | 3.0    | 2.0   | 5.9    |
| Other                  | 99            | 24    | 6     | 5.2    | 7     | 4.1    |
|                        | 3.4           | 5.7   | 7.9   | 4.1    | 6.9   | 5.9    |
| **Pattern of use**     | n = 2874      | n = 417 | n = 116 | n = 101 | n = 98 | n = 102 |
| Whenever/sporadically  | 568           | 73    | 35    | 15     | 2     | 21     |
|                        | 19.8          | 17.5  | 30.2  | 14.9   | 2.0   | 20.6   |
| Periodically           | 1 072         | 172   | 33    | 45     | 54    | 40     |
|                        | 37.3          | 41.3  | 28.4  | 44.6   | 55.1  | 39.2   |
| Worsening health status| 638           | 128   | 37    | 38     | 20    | 33     |
|                        | 22.2          | 30.7  | 31.9  | 37.6   | 20.4  | 32.3   |
| Other reasons          | 512           | 32    | 11    | 3      | 12    | 6      |
|                        | 17.8          | 7.7   | 9.5   | 3.0    | 12.2  | 5.9    |
| Uncertain              | 84            | 12    | 0     | 0      | 10    | 2      |
|                        | 2.9           | 2.9   | 0     | 0      | 10.2  | 2.0    |

*Numbers and percentages are referred to the total PFS used and not to the total consumer samples

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for use of PFS given by the responders (in Italy 417) and the number of total counts (549) shows that, generally speaking, more than one reason of use was reported for most PFS.

**Place of purchase and sources of information**

In the whole survey and in Italy, the most usual places of purchase were, in decreasing order of importance: 1) health/herbal shops, 2) pharmacy, and 3) supermarket/grocery stores (Table 5). Supermarkets were not as frequently cited by Italian respondents as in the whole survey (7.9% vs. 13.2%), and in Milan was not ranked even at the third position, being cited only three times.

As shown in Table 6, the most frequently reported sources of recommendation in Italy were, in decreasing order of citation: 1) herbal shop assistants, 2) friends and relatives, and 3) nobody/myself. Italian consumers cited herbal shop assistants more frequently than the rest of the ES (39.7% vs 15.3%). The special trust in the expertise of these professionals is probably due to the fact that most of them are graduates in "herboristic sciences and technologies", a three-year course offered by the Faculty of Pharmacy. In Rome and Catania, the third item listed was not "nobody/myself" but "pharmacist" and "internet/social groups", respectively.
### Table 4. Reasons of use, overall and by city<sup>a,b,c</sup>.

| Reason of use                      | Europe |         | Italy |         | Milan |         | Venice |         | Rome |         | Catania |        |
|-----------------------------------|--------|---------|-------|---------|-------|---------|--------|---------|------|---------|---------|---------|
| Stomach/Digestive function        | 386    | 13.4%   | 80    | 19.2%   | 24    | 20.7%   | 20     | 19.8%   | 17   | 17.3%   | 19      | 18.6%   |
| Energy/Tonics                     | 480    | 16.7%   | 61    | 14.6%   | 19    | 16.4%   | 10     | 9.9%    | 15   | 15.3%   | 17      | 16.7%   |
| Relaxing                          | 266    | 9.3%    | 48    | 11.5%   | 9     | 7.8%    | 9      | 8.9%    | 13   | 13.3%   | 17      | 16.7%   |
| Immune system                     | 578    | 20.1%   | 38    | 9.1%    | 17    | 14.7%   | 7      | 6.9%    | 5    | 5.1%    | 9       | 8.8%    |
| Body weight                       | 253    | 8.8%    | 34    | 8.2%    | 10    | 8.6%    | 14     | 13.9%   | 5    | 5.1%    | 5       | 4.9%    |
| Sleeping                          | 196    | 6.8%    | 33    | 7.9%    | 10    | 8.6%    | 4      | 4.0%    | 8    | 8.2%    | 11      | 10.8%   |
| Hair/skin                         | 309    | 10.8%   | 32    | 7.7%    | 15    | 12.9%   | 7      | 6.9%    | 4    | 4.1%    | 6       | 5.9%    |
| Hearth/blood circulation          | 223    | 7.8%    | 27    | 6.5%    | 12    | 10.3%   | 7      | 6.9%    | 6    | 6.1%    | 2       | 2.0%    |
| Joint and bones                   | 258    | 9.0%    | 26    | 6.2%    | 8     | 6.9%    | 2      | 2.0%    | 12   | 12.2%   | 4       | 3.9%    |
| Flu/cold                          | 310    | 10.8%   | 24    | 5.8%    | 6     | 5.2%    | 7      | 6.9%    | 4    | 4.1%    | 7       | 6.9%    |
| Mood                              | 206    | 7.2%    | 24    | 5.8%    | 7     | 6.0%    | 8      | 7.9%    | 4    | 4.1%    | 5       | 4.9%    |
| Antioxidant intake                | 189    | 6.6%    | 18    | 4.3%    | 11    | 9.5%    | 2      | 2.0%    | 4    | 4.1%    | 1       | 1.0%    |
| Memory                            | 236    | 8.2%    | 17    | 4.1%    | 5     | 4.3%    | 5      | 5.0%    | 4    | 4.1%    | 3       | 2.9%    |
| Cholesterol                       | 164    | 5.7%    | 16    | 3.8%    | 3     | 2.6%    | 3      | 3.0%    | 4    | 4.1%    | 6       | 5.9%    |
| Urinary tract                     | 137    | 4.8%    | 14    | 3.4%    | 5     | 4.3%    | 4      | 4.0%    | 1    | 1.0%    | 4       | 3.9%    |
| Vision or hearing                 | 67     | 2.3%    | 6     | 1.4%    | 2     | 1.7%    | 0      | 0.0%    | 3    | 3.1%    | 1       | 1.0%    |
| Menopause                         | 168    | 5.8%    | 5     | 1.2%    | 4     | 3.4%    | 0      | 0.0%    | 0    | 0.0%    | 1       | 1.0%    |
| General health                    | 84     | 2.9%    | 1     | 0.2%    | 2     | 1.7%    | 3      | 3.0%    | 5    | 5.1%    | 3       | 2.9%    |
| Other                             | 265    | 9.2%    | 45    | 10.8%   | 11    | 9.5%    | 10     | 9.9%    | 16   | 16.3%   | 8       | 7.8%    |
| Uncertain                         | 9      | 0.3%    | 0     | 0.0%    | 0     | 0.0%    | 0      | 0.0%    | 0    | 0.0%    | 0       | 0.0%    |
| **Total PFS used**                | n = 2874 |         | n = 417 |         | n = 116 |         | n = 101 |         | n = 98 |         | n = 102 |        |
| **Total counts of reasons**       | n = 4784 |         | n = 549 |         | n = 180 |         | n = 122 |         | n = 130 |         | n = 129 |        |
| **Total counts/Total PFS**        | 1.7    | 1.3%    | 1.6    | 1.2%    | 1.3    | 1.3%    |         |         |         |         |         | 1.3%    |

<sup>a</sup> Grey cells indicate the three most reported reasons of use

<sup>b</sup> The consumer could indicate several reasons of use; percentage are referred to the total PFS used

<sup>c</sup> Reasons of use are listed according to the decreasing order of reply coming from the Italian respondents

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### Table 5. Places of purchase, overall and by city<sup>a,b,c</sup>.

| Place of purchase                      | Europe |         | Italy |         | Milan |         | Venice |         | Rome |         | Catania |        |
|---------------------------------------|--------|---------|-------|---------|-------|---------|--------|---------|------|---------|---------|---------|
| Health/herbal shop                     | 1537   | 53.5%   | 271   | 65.0%   | 76    | 65.5%   | 74     | 73.3%   | 61   | 62.2%   | 60      | 58.8%   |
| Pharmacy                              | 781    | 27.2%   | 99    | 23.7%   | 28    | 24.1%   | 13     | 12.9%   | 24   | 24.5%   | 34      | 33.3%   |
| Supermarket/grocery store             | 379    | 13.2%   | 33    | 7.9%    | 3     | 2.6%    | 7      | 6.9%    | 12   | 12.2%   | 11      | 10.8%   |
| Internet                              | 197    | 6.9%    | 13    | 3.1%    | 4     | 3.4%    | 3      | 3.0%    | 1    | 1.0%    | 5       | 4.9%    |
| Other                                 | 186    | 6.5%    | 10    | 2.4%    | 5     | 4.3%    | 1      | 1.0%    | 2    | 2.0%    | 2       | 2.0%    |
| Friends/relatives                     | 29     | 1.0%    | 5     | 1.2%    | 4     | 3.4%    | 1      | 1.0%    | 0    | 0.0%    | 0       | 0.0%    |
| Uncertain                             | 192    | 6.7%    | 5     | 1.2%    | 0     | 0.0%    | 1      | 1.0%    | 3    | 3.1%    | 1       | 1.0%    |
| Gym                                   | 36     | 1.3%    | 3     | 0.7%    | 2     | 1.7%    | 1      | 1.0%    | 0    | 0.0%    | 0       | 0.0%    |
| **Total PFS used**                    | n = 2874 |         | n = 417 |         | n = 116 |         | n = 101 |         | n = 98 |         | n = 102 |        |

<sup>a</sup> Grey cells indicate the three most reported places of purchase

<sup>b</sup> The consumer could indicate several places of purchase for each PFS; percentages are referred to the total PFS used

<sup>c</sup> Places of purchase are listed according to the decreasing order of reply coming from the Italian respondents

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Table 6. Reported sources of recommendation, overall and by city\(^{a,b,c}\).

| Source                         | Europe    |        | Italy     |        | Milan    |        | Venice    |        | Rome     |        | Catania  |        |
|--------------------------------|-----------|--------|-----------|--------|----------|--------|-----------|--------|----------|--------|----------|--------|
|                                | n         | %      | n         | %      | n        | %      | n         | %      | n        | %      | n        | %      |
| Health/herbal shop assistant   | 440       | 15.3   | 145       | 34.8   | 46       | 39.7   | 37        | 36.6   | 29       | 29.6   | 33       | 32.4   |
| Friends/relatives              | 1066      | 37.1   | 128       | 30.7   | 38       | 32.8   | 28        | 27.7   | 31       | 31.6   | 31       | 30.4   |
| Nobody/myself                  | 618       | 21.5   | 62        | 14.9   | 22       | 19.0   | 17        | 16.8   | 8        | 8.2    | 15       | 14.7   |
| Pharmacist                     | 279       | 9.7    | 56        | 13.4   | 12       | 10.3   | 8         | 7.9    | 16       | 16.3   | 18       | 17.6   |
| Family doctor                  | 302       | 10.5   | 52        | 12.5   | 8        | 6.9    | 5         | 5.0    | 13       | 13.3   | 26       | 25.5   |
| Internet/social group          | 179       | 6.2    | 13        | 3.1    | 1        | 0.9    | 1         | 1.0    | 0        | 0      | 11       | 10.8   |
| Homeopath                      | 144       | 5.0    | 13        | 3.1    | 4        | 3.4    | 5         | 5.0    | 2        | 2.0    | 2        | 2.0    |
| Magazine/newspaper             | 220       | 7.7    | 7         | 1.7    | 1        | 0.9    | 2         | 2.0    | 1        | 1.0    | 3        | 2.9    |
| Nutritionist/dietician         | 234       | 8.1    | 5         | 1.2    | 2        | 1.7    | 1         | 1.0    | 1        | 1.0    | 1        | 1.0    |
| Paramedic personnel\(^d\)      | 36        | 1.3    | 5         | 1.2    | 1        | 0.9    | 1         | 1.0    | 1        | 1.0    | 2        | 2.0    |
| TV/Radio                       | 59        | 2.1    | 4         | 1.0    | 0        | 0      | 2         | 2.0    | 0        | 0      | 2        | 2.0    |
| Gym trainer                    | 8         | 0.3    | 4         | 1.0    | 2        | 1.7    | 0         | 0      | 1        | 1.0    | 1        | 1.0    |
| Uncertain                      | 32        | 1.1    | 1         | 0.2    | 0        | 0      | 0         | 0      | 1        | 1.0    | 0        | 0      |
| Brochure/Leaflet               | 37        | 1.3    | 0         | 0      | 0        | 0      | 0         | 0      | 0        | 0      | 0        | 0      |
| Books/scientific journals      | 3         | 0.1    | 0         | 0      | 0        | 0      | 0         | 0      | 0        | 0      | 0        | 0      |
| Telemarketing/Network marketing| 12        | 0.4    | 0         | 0      | 0        | 0      | 0         | 0      | 0        | 0      | 0        | 0      |
| CAM\(^e\) Therapist            | 10        | 0.3    | 0         | 0      | 0        | 0      | 0         | 0      | 0        | 0      | 0        | 0      |
| Total PFS used                 | n = 2874  |        | n = 417   |        | n = 116  |        | n = 101   |        | n = 98   |        | n = 102  |        |

\(^{a}\)grey cells indicate the three most reported sources of recommendation
\(^{b}\)the consumer could indicate several sources of recommendation for each PFS; percentage are referred to the total PFS used
\(^{c}\)reported sources of recommendation are listed according to the decreasing order of reply coming from the Italian respondents
\(^{d}\)including nurses, opticians, physical therapists
\(^{e}\)CAM = Complementary and Alternative Medicine

Consumer perception and behaviour

As illustrated in Table 7, Italian respondents believed that consumption of PFS had helped their health always (31%) or sometimes (57%), with an opposite trend in the ES (57% always, 31% sometimes). A certain percentage of consumers (9.4%) was not satisfied with the efficacy of PFS, and replied to the question “Did the PFS help you?” with the items “rarely” or “not at all”. Venice and Catania showed the lowest and the highest number of sceptical consumers, respectively. Most Italian consumers had not informed the family doctor (73.6%) or the pharmacist (63.5%) about their use of PFS despite more than 50% of respondents not feeling well-informed. Catania consumers had more frequently informed the family doctor (37.3%) or the pharmacist (48%). Only 5 consumers (1.2%) reported adverse effects: 2 from Milan, 1 from Rome and 2 from Catania (Table 7). The cases are summarized below; details and comparison with other countries can be found in the paper by Restani et al. [9]:

1. A consumer with a history of allergic reactions experienced difficulty in swallowing after consumption of a PFS containing *Foeniculum vulgare* (fennel);
2. A consumer with a history of heart disease described an adverse effect (dizziness) due to a PFS containing *Paullinia cupana* (guarana);
3. A consumer reported an unspecified adverse effect due to a PFS containing *Aloe barbadensis* (aloe) and *Harpagophytum procumbens* (devil’s claw);
4. A consumer experienced tachycardia after the intake of a PFS containing *Panax ginseng* (ginseng);

5. A consumer reported discomfort (mainly nausea) associated with a PFS containing *Cynamopsis tetragonoloba* (guar).

**The 20 most frequently used botanicals**

Table 8 lists the botanicals most frequently used in Europe (6 countries), Italy and the 4 Italian cities; botanicals in the three first positions are highlighted (grey cells) in each list. In Italy, the botanicals in the three first positions are: 1) *Aloe vera* (aloe); 2) *Foeniculum vulgare* (fennel); and *Valeriana officinalis* (valerian). All of them are among the European top 20 botanicals, but in lower position (5, 6 and 7, respectively). In the four Italian cities:

1. Aloe is always in the first position;
2. Fennel is in the second position everywhere apart from Catania, where the second most used botanical is valerian;
3. Different botanicals are placed in the third position: ginseng and *Passiflora incarnata* (purple passion flowers) for Milan; *Vaccinium myrtillus* (blueberry) for Venice and Rome; and ginseng for Catania.

**Consumers’ habits**

Analysis of the Italian consumers’ habits by sex or age group (Table 9) reveals some interesting differences:

1. Females showed the same pattern of preferences of the whole Italian sample with an exception in the third position in favour of blueberry;

2. Males showed a preference for PFS containing, in decreasing order: aloe, ginseng and *Melissa officinalis* (lemon balm);

3. Younger consumers ranked ginseng in third position;

4. Consumers aged over 60 years cited purple passion flowers in the third position.

**Discussion**

One of the most debated topics about PFS is their actual intake by consumers; reliable available data are relatively few [10–12], limited to a specific country [13–14], and usually include all...
types of food supplements [10, 15–17]. In a study on the use of food supplements in Italy published by Giammarioli et al [18], data were collected sending a questionnaire by mail to 10,000 Italian citizens. According to the 1722 questionnaires received back, vitamin and/or mineral supplements were the most used (61%), followed by PFS (28%).

A paper by European Advisory Service—EAS [19] reported information on the European market and its regulation and evidenced the need for new data in order to plan, monitor and evaluate PFS intake with the objective of assessing their benefits and risks. The European project PlantLIBRA defined, as one of its most important aims, the collection of information to fill this gap. Data from the whole survey has been published previously [7]; this paper analyses in more detail the situation in Italy, one of the six countries involved in the PlantLIBRA PFS consumers’ survey. In some ways, the survey in Italy was easier than in other European countries since most products containing botanicals are classified as food supplements, and are very rarely associated with the traditional or other alternative medicines (CAM). In other words, Italian consumers use PFS for improving their health, sometimes in the hope of obtaining a specific beneficial activity (e.g. on hypercholesterolemia, heart diseases, immune disorders)

In Italy, the interest for PFS (food supplements containing botanicals) is high, in fact:

1. In the PlantLIBRA Italian sample, the calculated weighted prevalence of “regular” PFS consumers was 22.7%, indicating that approximately one out of four Italians uses PFS during the year (periodically or when there is a worsening of the health status);

2. The number of products taken by 387 Italian consumers was 289.

Table 9. The top 20 consumed plants in Italy by sex and age**

| Latin name | Common name | ITALY | MALE | FEMALE | 18–59 yrs | > 60 yrs |
|------------|-------------|-------|------|--------|-----------|---------|
| 1          | Aloe vera   | 44    | 11.6 | 27     | 14.4      | 17      |
| 2          | Foeniculum vulgare | 29    | 7.7  | 12     | 6.4       | 17      |
| 3          | Valeriana officinalis | 29    | 7.7  | 14     | 7.5       | 15      |
| 4          | Panax ginseng | 28    | 7.4  | 20     | 10.7      | 8       |
| 5          | Vaccinium myrtillus | 28    | 7.4  | 13     | 7.0       | 15      |
| 6          | Passiflora incarnata | 26    | 6.9  | 12     | 6.4       | 14      |
| 7          | Melissa officinalis | 25    | 6.6  | 16     | 8.6       | 9       |
| 8          | Paulinia cupana | 23    | 6.1  | 14     | 7.5       | 9       |
| 9          | Taraxacum officinale | 21    | 5.6  | 9      | 4.8       | 12      |
| 10         | Cynara scolymus | 20    | 5.3  | 9      | 4.8       | 11      |
| 11         | Sena alexandra | 19    | 5.0  | 9      | 5.0       | 10      |
| 12         | Ginkgo biloba | 17    | 4.5  | 8      | 4.3       | 9       |
| 13         | Centella asiatica | 15    | 4.0  | 7      | 3.7       | 8       |
| 14         | Rosa canina | 15    | 4.0  | 5      | 2.7       | 10      |
| 15         | Silybum marianum | 15    | 4.0  | 11     | 5.9       | 4       |
| 16         | Eleutherooccus senticosus (Ruup. & Maxim.) Maxim | 14    | 3.7  | 11     | 5.9       | 3       |
| 17         | Glycyrrhiza glabra | 14    | 3.7  | 4      | 2.1       | 10      |
| 18         | Malpighia glabra | 14    | 3.7  | 9      | 4.8       | 5       |
| 19         | Cuminum cyminum | 13    | 3.4  | 5      | 2.7       | 8       |
| 20         | Harpagoptyum procumbens (Burch.) DC. ex Meisn | 13    | 3.4  | 6      | 3.2       | 7       |

*grey cells indicate the botanicals in the three first positions

since PFS can contain more than one ingredient, the total counts are higher than the total PFS referred; percentages refers to the total consumers’ samples

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Among Italian consumers, some differences were observed when four selected cities were considered separately:

1. The pattern of use during the year is specific for each city, with opposite trends for example in July;
2. Milan consumers reported reasons of use significantly different from those of the whole Italian sample and did not indicate supermarkets as an important place of purchase;
3. Respondents from Rome and Catania more frequently used family doctors and pharmacists as a source of recommendation;
4. Significant differences among cities, sex and age groups were observed when the botanicals were ranked in order of frequency of use.

Conclusions

Data from this paper provides new insights on the socio-economic characteristics and lifestyle of Italian PFS consumers, on the reasons and pattern of use, and finally details on their behaviour and expectations. New information was collected on the frequency of use of botanicals, including the specific pattern of 4 major Italian cities. Even though it is difficult to estimate the actual dose of PFS/botanical ingredient consumed (due to the limited information included in the labelling), new data are now at our disposal for future discussion and assessment on the risk and benefits associated with the increasing use of PFS.

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