

## **The characteristics of the consumption of medicinal herbs**

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## **Abstract**

*Introduction:* Our research we aimed to examine a topic that has so far not been explored. In our study we analysed consumer habits related to herbs in Hungary.

*Methods:* The national representative questionnaire involved 1050 individuals in Hungary between 2015 and 2016. Several multivariable statistical techniques were applied for the analysis of the data: Principal Component Analysis (PCA), cluster analysis.

*Results:* In our analysis we found that one third of the respondents are regular consumers. Typically, they turn to herbs for colds, flu or stomach upsets. The most popular are chamomile, rosehip, and lime flowers (consumed in the form of dried or essential oils). As a new element in our research, we studied health attitudes to the use of medicinal herbs. Based on health attitudes, we identified a total of 5 influencing factors: health awareness, sport, healthy nutrition, medical check-ups and the presence of some illness. A total of 5 clusters were defined for these factors.

*Conclusion:* The most important element of our conclusions is that strengthening preventive healthcare can be one of the key factors in the growth of medicinal herb consumption. Medical feedback about the state of health makes people more willing to purchase herbs. The expert recommendation as the key communication channel is an important element too.

*Keywords:* herbals; consumption habits; CAM; Hungary

## **1. Introduction**

### *1.1 The role of medicinal herbs in the CAM system*

The US National Institute of Health Center for Complementary and Alternative Medicine (NCCAM) classifies Complementary and Alternative Medicine (CAM) treatments in 5 categories: (i) alternative medical systems (such as homeopathy or traditional Chinese medicine); (ii) mind-body medicine (activities such as meditation, prayer, art, dance and music); (iii) biologically based therapies (such as plants, dietary supplements); (iv) manipulative and body-based therapies (such as chiropractic massage); and (v) energy therapies (such as Qi gong, Reiki, healing touch) [1, 2].

Herbal medicines and remedies are the most commonly used CAM therapies, together with other homeopathic interventions. Herbs are known as useful ingredients, and they are used in medicine. However, their use is limited due to individuals' consumption patterns and goals. Societies have different beliefs and applications concerning the consumption of herbs, depending on their sociocultural status [3].

According to the WHO, the use of medicinal plants for treating diseases is probably the oldest existing method that humanity has used to try to cope with illness. For this reason, medicinal plants have been used therapeutically all around the world, constituting an important aspect of various traditional medicine systems. From Ayurveda to Chinese traditional medicine, from Unani to Tibetan Medicine, from Amazonian to African Medicine, all systems of traditional medicine, although based on different theoretical and cultural models, integrate phytotherapy into their doctrine. In high-income countries, the widespread use of phytotherapy declined at the end of the first part of the twentieth century, due to the development and production of synthetic medicines. During the past few decades, however, phytotherapy has started to be increasingly used, even in industrialized countries. In low- and middle-income countries, it never stopped being important, often representing the only therapeutic system to which certain people can turn [4].

### *1.2 Production of medicinal herbs in certain countries*

The most comprehensive picture of European herb production can be obtained from the EUROPAM (European Herbs Growers Association) report [5].

In the Netherlands relatively few species are grown, but they are grown in large areas. Presently, valerian and parsley are grown in large quantities. Yew specifically for pharmaceutical use is grown on plantations and cut twice a year. In Austria, the main crop is cumin and skinless pumpkin. In Bulgaria, 60 to 70 species are produced as medicinal herbs, with 80 to 85% of these being produced in the wild, and 90% of the drugs produced are exported. In France, the main plant is lavender. The role of organic farming is growing, but the volume sold on the market is still not significant. Production is basically falling. In Germany today, herbs for healing and spices are grown on a total of 10,000 hectares. Camomile enjoys the greatest demand, and indeed could even justify a doubling in production. The demand for organic products is growing steadily. In Greece, about 10-15 herb species are grown. The most important is saffron, with the whole crop exported at a good price. In Italy, the most important medicinal and aromatic crops are: coriander,

peppermint, lavender, chamomile, Sicilian oregano. The production area is 7190 ha, and 41% of this area is organic. Poland's production include 2000 ha of peppermint. Cultivation of valerian on 1000 ha yields about 2.5 tons of produce, which goes to Russian and German markets. Wild harvesting is still significant, especially in the northeast, but is constantly decreasing. There is hardly any bio-production. In Switzerland, one of the largest domestic users is the Ricola sweets factory which, wherever possible, uses local production. Almost 150 small farmers are grouped together within the Bergkräuter company. In the UK, in practice it is only East European settlers who are engaged in the cultivation of medicinal herbs. In Hungary approximately 70% of the total herbal drugs by weight (i.e. the dried part of the crop) produced comes from the collection and primary processing of wild-growing stocks. In Hungary, about 110 domestic plant species are collected and cultivated [5].

The most widely marketed medicinal plants in Europe are Ginkgo Biloba, horse chestnut, hawthorns, St. John's Wort, nettle and lady's thistle. 39% of plant-derived products are marketed in Germany, and 21% in France [6]. The so-called "underdeveloped countries" – China, India and Mexico – supply the world with herbaceous plants, "while the majority of consumers" are Western countries [7].

The sales of over the counter (OTC) herbal products alone are estimated at almost \$ 5 billion. Importantly, Germany and France are the two major stakeholders in herbal remedies – more precisely, 50% of Germans have shown confidence in herbal drugs for healing diverse diseases. Similarly, the use of herbal products as household remedies is very common in different Asian and African countries [8].

### *1.3 Characteristics of the consumption of medicinal herbs in certain countries - social characteristics, habits of use, attitudes*

The World Health Organization (WHO) reported that approximately 80% of individuals worldwide primarily use herbal products [9]. On the basis of the WHO data, in addition to countries which have long used traditional medicine, most of the countries with advanced pharmaceutical industries have also greatly increased the use of alternative, mostly herbal remedies. Thus, in Germany, 80% of the population, in Canada 70%, in France 49%, in Australia 48%, and in the United States 42%, use alternative treatment at least once a year. Increasing use is also motivated by the fact that, as a result of intensive research on plant material, new herbal resources or model materials have been discovered in therapeutic areas which are difficult to cure with synthetic chemicals today. These include Catharanthus roseus which contains alkaloids with a unique effect on the treatment of white blood cells, the materials in Echinacea spp. which stimulate the immune system, the active geriatric-related terpenoids in Ginkgo biloba, the antimigraine agents in Chrysanthemum parthenium, or the drug Cavinton, half-synthesised from vinyl alkaloids. Another successful herb is yew (Taxus brevifolia) whose active ingredients – taxol and its derivatives – have been shown to be uniquely active in cancer therapy [6].

According to a survey conducted in Hungary in 2014, out of the 390 patients who completed the questionnaire, 7.2% used herbal medicines, 3.6% of them two weeks before their hospitalization. The majority of those who have ever consumed herbs are women, and/or have completed secondary or tertiary education; more than half of them suffer from

tumorous diseases and only a quarter of them informed their physician about their use of herbal medication of their own accord [10]. Furthermore, another significant survey was conducted in Hungary, and found that 15-20% of the population had already used CAM [11].

In the USA CAM is typically used by a characteristic group of patients: among its users, the number of women is significantly higher and its use is directly proportional to the patient's level of education and income (higher) as well as to the severity of their clinical and health condition [12]. Kennedy [13] achieved similar results. In their US study, 19% of respondents reported that they had used some kind of medicinal herb product in the previous year. Consistent with other CAM studies, socioeconomic status showed a positive correlation with use of medicinal herbs. Use was more pronounced among women and middle-aged adults, and those with higher education and higher incomes. The most frequently used herbs were echinacea, ginseng, ginkgo and garlic supplements. Head or chest colds and stomach or intestinal diseases are the most commonly referred diseases that are usually treated with medicinal herbs. It should be emphasized that herbal consumption has shown a relationship with positive health values such as exercise and smoking. Attitude studies have shown that most people use medicinal herbs as complementary to traditional medicines, as an alternative treatment [13].

According to an Australian study almost a quarter of survey participants had used at least one medicinal herb in the preceding 12 months. Aloe vera, garlic and green tea were the most popular, each used by about 10% of participants. Over 90% considered their herbal medicine to be very or somewhat helpful. Less than half the users were aware that there were potential risks associated with herbal medicine. Relatively high proportions of female users had taken herbal medicines whilst pregnant (14.4%) and/or whilst breast feeding (10.0%). Over half of herbal medicine users had also used Western medicine for the same medical condition in the 12-month period. Almost the same proportion had used both forms of medication on the same day. In deciding whether or not to use herbal medicine, the vast majority of survey participants indicated that they would accept the advice of their medical practitioner [14].

It can be generally stated that there is a positive relationship between herbs and consumption attitudes, and a certain type of belief about health, and this is supported by several studies. In research conducted by Samojlik et al. [15] more than three quarters of participants considered the use of herbal medicine and herbal dietary supplement to be harmless, and this opinion is in accordance with the common attitude that what is "natural" can only be good, and that the use of herbal medicine is therefore risk-free. Yilmaz et al. [16] found that about one-third of herbal users interviewed believed that "herbs are healthy" and beneficial when added to medicines. Of the herb users asked by Kennedy [13] more than half said that herbs and natural products were important to their health and well-being. Other researchers have also supported these consumer attitudes. Among others, Marinac et al. [17] also stated that the preservation of health was by far the most predictive indicator for use of herbal products and dietary supplements. Furthermore, health enhancement was the most common reason for herbal medicine use in Zhang et al.'s [14] research, although relatively high proportions of users sought relief for specific medical conditions. According the findings of Klepser et al. [18], compared with nonusers, individuals who reported herb use tended to have a less positive perception of the safety of prescription agents and a more

positive belief concerning the safety of herbal products, including a more favourable attitude regarding the impact of herbs on their health.

Kennedy [13] also found a positive association between herbal use and the use of conventional drugs that might suggest that most consumers use herbs as a complement rather than an alternative to conventional medical treatment. According to Bamidele et al. [19], Nigerian urban residents showed positive attitudes towards alternative medicines, including herbal remedies. Alternative methods were considered to be cheaper, more accessible and more acceptable than Western medicines. A half of the sample in Bamidele et al.'s [19] study evaluated that only alternative methods could help in their healing, although nearly the same thought that they could be harmful to health.

In our research, we aimed at examining a topic that has so far not been investigated, which may fill a gap in a better understanding of the consumption and purchase of herbs. When analysing the data, answers to one particular question were sought:

Can consumer segments in terms of consumers of herbs be formed based on motivational and health attitudes?

## **2. Materials and Methods**

### *2.1 Sampling and questionnaire*

The data collection took place between November 2015 and February 2016 with the involvement of a market research firm. The sample included 1050 people; the base population was 14 years of age or older. In the composition of the sample the population of Hungary was faithfully represented by those in the over-14 age group, distributed according to sex, age and region. Representativeness for regions and for types of settlement was ensured by the applied quoted sampling method. The sample pattern met the quotas previously defined by the Hungarian Central Statistical Office (HCSO). In the assigned settlements a random walking method was used to ensure total randomness in selection. In the second step the interviewed individual within a household/family was selected by using the so-called birthday-key. With this method randomness was ensured in the second step as well.

The surveys were based on a standard questionnaire (personal interviews, in the respondents' homes), the interviewer was asked to pass a so-called "set of cards" to the selected individual that included the possible answers to each question. Participation was voluntary and anonymous. The answer given by the respondent was entered into the questionnaire by the interviewer. We asked interviewers not to enter the interviewees' personal data in any way on the questionnaire. Also, respondents were informed before giving answers that the data would only be reported in an aggregate form. All procedures were performed in compliance with relevant laws.

The questionnaire to be used during the research was finalized by interviewing several target individuals (pre-test phase). In the course of the investigation, a total of 7 questions were asked of the respondents involved. The first question was to filter respondents who had bought herbs or herbal supplements for whatever reason. It is important to note that in the case of further responses, we only analysed the responses of those who answered this first filter question affirmatively, i.e. who had previously purchased medicinal

herbs and herbal preparations. The number of these respondents was 363. The other questions dealt with which health problems might need herbal preparations, which herbal varieties are preferred, what form herbal medicines are bought in and where they are bought, whether their doctor has suggested the consumption of a herbal remedy for some reason and if so, whether this advice has been followed.

In the second part of the study, we formulated statements about healthiness, and the respondents indicated their agreement on a scale of one to five, in which one represented complete disagreement, and five full agreement. Table 1 shows the sample distribution.

**Table 1**

Sample distribution according to the most important background variables

In the second part of the results we compared the buying and consumption habits of medicinal herbs with the health attitudes of the Hungarian population. The latter was measured by a series of statements adapted to Hungarian conditions by Szántó [20] on a five point Likert scale. In the course of the study, we measured the degree of agreement with the statements, with 1 being “I totally disagree”, and 5 “I totally agree”.

## *2.2 Data Analysis*

In the first section of the results we present descriptive statistics describing the distribution of responses. In addition to the overview of the frequencies, we present the significant correlations of individual variables with background variables. In the second part of the presentation of the results we examine the correlations with multivariate statistical methods.

Cluster analysis: among the traditional methods k-means and the hierarchical Ward’s method are the most commonly used and are easily implemented, but they also have the drawback that they can only separate linearly separable clusters [21]. K-means and Ward’s method had poor performance on a large amount of binary data in our case. On the other hand, novel Kernel-based algorithms have been shown to perform very well on binary and multiclass classification problems [22-24]. Von Luxburg [25] suggests that results obtained by spectral clustering often outperform the traditional approaches, and the algorithm has a simple and efficiently solved implementation by standard linear algebraic methods. Based on the points mentioned above, we decided to apply Spectral clustering to our binary data [26, 27]. In this algorithm, data are first represented as a graph where samples are the nodes, and similarities between samples are edge weights. Spectral clustering obtains information from the pairwise similarity matrix of the data and uses eigenvectors to create a lower-dimensional representation of the data, such as Principal Component Analysis. In this lower-dimensional space data are clustered according to a standard k-means clustering using the eigenvectors, and there is no need for a previous assumption of the shape of the clusters. We used the Kernlab software package in R 3.0.3 especially designed for spectral clustering. This package contains a wide range of kernel methods for spectral clustering, among which String kernel was chosen. String kernels provide a novel way to handle binary data as a text

of 0 and 1 [28]. They can be treated as a similarity measure between two series of 0 and 1 characters  $x$  and  $x^*$  with the same length of  $n$  and defined by the following equation [21]:

$$k(x, x^*) = \sum_{s \in A} num_s(x) \cdot num_s(x^*) \cdot \lambda_s, \text{ where } k \text{ denotes the string kernel, } A \text{ represents the set}$$

of all non-empty strings of 0 and 1 with a given length,  $\lambda_s$  is a weight factor and can be different for each  $s$  substring, and  $num_s(x)$  is the number of the occurrences of substring  $s$  in string  $x$ . We set  $\lambda_s = 0$  for all substrings of length greater than  $n$ .

**Categorical Principal Component Analysis:** standard principal component analysis (PCA) often does not show representative results on Likert scale data, especially when there is a low number of observed subjects, or the assessment is run on many variables. Optimised scaling for categorised data provides an acceptable solution to avoid these problems. Principal component analysis was performed by using the categorised PCA model (CATPCA), applying the SPSS 23.0 software. Firstly, CATPCA rescales the categorised data to a numerical variable applying the optimal scaling method, and then performs a reduction on the number of variables in the data as described above, similarly to standard PCA. Optimised scaling assigns numerical values for each category. These optimally scaled values can be used during PCA assessment as they provide metric characteristics for the given variable. The values are assigned to the categories during an iterative method, the so-called ALS - Alternating Least Squares. Different measurement level variables – both nominal and ordinal levels – can also be included in the CATPCA assessment without any preliminary restrictions. The relevance of the analysis and the internal reliability of questions are tested by the Chronbach-alpha coefficient, which gave an excellent value of 0.974. We applied CATPCA in order to reveal the background variables that influence attitudes towards healthiness. Principal components are variables that are suitable for the analysis of variance (ANOVA), as the principal components generated become normal distribution. Respondents had to assess 23 items on a 5 point Likert scale in terms of how important a given factor is for them in connection with a healthier lifestyle. Altogether, 5 principal components were formed from the original items. Principal component analysis requires the number of observations to be 3-10 times more than the number of variables. The sample contained over a thousand valid observations, which in this sense is more than enough, as there were nearly 45 observations for each item. We were able to preserve the majority of the information during the principal component analysis; the principal components preserved 68.1% of the information during the 5-component solution. An essential step of the analysis is to estimate principal component weights based on the observed values of the original variables. The principal weights of principal components show the degree to which one principal component influences the same variable. Variables with an absolute weight value of less than 0.50 are not identified with the examined principal component.

### 3. Results

The results are presented in two main sections. In the first part we analyse the answers by presenting the frequency distributions and the significantly related background variables.

In the second step, we look at the specificities of the consumption of the herbs of each attitudinal group in clusters, based on statements related to health.

### *3.1 Consumer characteristics in the herb market*

Approximately one third (34.6%, 363 individuals) of those involved in the research are active in the herb market. On the basis of socio-demographic criteria, users of medicinal herbs and herbal preparations can be characterized as follows:

- There is a higher proportion of women (42.3%) who reported using herbs than men (25.9%) ( $p < 0.001$ ).
- Among those under 29 years, the proportion of those using herbs is significantly below the average: 14-18 years: 20.0%; 19-29 years: 26.2%; 30-39 years: 37.2%; 40-49 years: 34.3%; 50-59 years: 38.4%; 60 and older: 38.8% ( $p < 0.05$ ).
- An increasing level of qualification increases the demand for herbs: up to eight years of general education: 22.7%; vocational school, specialist school: 35.4%; secondary school leaving certificate: 35.4%; university degree: 51.9% ( $p < 0.001$ ).
- In segments based on employment, the proportion of users is as follows: active physical worker: 27.7%; active intellectual worker: 43.3%; those on maternity leave or receiving child benefit: 44.1%; retired: 37.9%; student: 25.7%; keeping house: 70.0%; unemployed: 31.4%; other inactive job searchers: 35.0% ( $p < 0.01$ ).
- It is mainly people with the highest incomes who can afford the use of herbs and herbal remedies (able to live very well and put some money aside: 48.8%, able to survive (but only able to save a little): 40.4%, earn just enough to live on (but cannot save): 33.7%, sometimes do not have quite enough to live (24.3%), have regular problems with daily living (35.0%) ( $p < 0.01$ ).
- The more health conscious the respondent, the more they choose these products: not at all health conscious: 15.9%; mostly not health conscious: 16.5%; sometimes health conscious, but not always: 34.5%; mostly health conscious: 40.4%; very health-conscious: 47.0% ( $p < 0.001$ ).
- In addition to health consciousness, commitment to a healthy environment has a positive impact on the use of herbs: not at all environmentally conscious: 15.0%; mostly not environmentally conscious: 28.0%; sometimes environmentally conscious, but not always: 31.1%; mostly environmentally conscious: 36.9%; very environmentally conscious: 43.1% ( $p < 0.05$ ).

Using Table 2, we summarize for which illnesses respondents buy herbs.

**Table 2**

Frequency of use of herbs for various health problems (N = 363)

According to the results of the research, herbs are used primarily for colds (81.4%), influenza (23.2%), stomach- (19.9%) and joint complaints and pains (15.9%); of these, colds is far the most common, accounting for 80%. It is also worth highlighting intestinal

disorders, which was identified by 9.0% of the respondents as a reason for the use of herbs. For other health problems, the proportion of people using herbs is insignificant. Table 3 lists the most frequently purchased medicinal herbs.

**Table 3**

Regularly purchased medicinal herbs (N = 363)

Chamomile is the most common herb, as almost three quarters of the interviewees (72.6%) regularly buy chamomile preparations. Rosehips and lime tree flowers are also popular among the target group, with 55.9% mentioning the former and 44.9% the latter. Approximately one quarter (24.6%) of respondents enjoy products made from nettle, while one-fifth (18.3%) prefer elderflower-based herbs. Other herbs are mentioned by fewer than 10%. In summary, chamomile, rosehip, lime flower, nettle and elderflower are the most common herbs.

Table 4 provides an overview of the form in which the respondents purchase the herbs and herbal remedies.

**Table 4**

Forms of Herbs, Herbal Preparations (N = 363)

The vast majority of interviewees (86.3%) usually buy dried herbs and herbal products, followed – at a significant distance - by essential oils (13.3%). Cosmetics and foods were mentioned by 7.4%. Even fewer look for herbal drugs produced as pharmaceutical formulations (6.8%) and dietary supplements (6.6%). There were also respondents who gather their own herbs (1.6%).

#### *Dried*

- Only 42.9% of people with daily financial survival problems buy herbs in dried form. We can observe average results among the higher income earners: able to live very well and put some money aside: 90.5%, able to survive (but only able to save a little) 87.0%: earn just enough to live on (but cannot save): 87.6%, sometimes do not have quite enough to live 85.7% ( $p < 0.05$ ).

#### *Essential oil*

- Women prefer essential oils (17.8%) much more than men (5.5%) ( $p < 0.01$ ).
- The popularity of essential oils increases in direct proportion to educational qualifications: up to eight years of education: 2.7%; vocational school, specialist school: 5.9%; secondary school leaving certificate: 15.3%; higher education degree: 23.2% ( $p < 0.01$ ).

#### *Cosmetics*

- The purchase of cosmetics from medicinal herbs is also affected by the education level: up to eight years of education: 2.7%; vocational school, specialist school: 3.0%; secondary school leaving certificate: 6.9%; higher education degree: 13.7% ( $p < 0.05$ ).

*Food (medicinal and health food)*

- Interestingly, many more men (11.7%) are looking for herbs as food than women (4.7%) ( $p < 0.05$ ).

Below, we examine how consumers typically purchase herbal preparations (Table 5).

**Table 5**  
Typical Purchase Locations for Herbarium (N = 363)

Herbal preparations are typically purchased from a herbal shop (40.6%), but also a significant proportion – close to 30% (29.6%) – buy them from the pharmacy. There are also a wide range of herbal medicines in drug stores, so it is not surprising that 10.5% of respondents indicated this was their place of purchase. The number of people who produce herbal products themselves is also not negligible (8.3%). Larger-sized grocery stores also offer these products, so buyers have the option to purchase medicinal herbs with their daily shopping, and 6.9% of them do this. Online shopping is less typical among respondents (2.3%). There is a significant difference between income and shopping venues. While the proportion of those using grocery stores grows in parallel with rising incomes, it is decreasing among those who buy herbs in a pharmacy. It can also be said that people in difficult financial situations prefer to prepare their own herbal supplements ( $p < 0.001$ ).

Finally, we were interested to know if any herbal products were recommended by the respondent's physician in order to improve her health. Only 6.5% of respondents said that their doctor had already recommended a herb, and most of these respondents (75.0%) accepted the doctor's recommendation.

### *3.2 Relationship between health problems and herbal remedies*

The first step was to identify the factors that can be formed on the basis of health attitudes, the results of which are summarized in Table 6.

**Table 6**  
Factors that can be formed based on the health attitudes of the Hungarian population  
(N = 1050)

According to our results, a total of 5 factors determine the health attitudes of the Hungarian population. The first factor is health consciousness, which includes variables such as gathering active information on general health status and investing a substantial proportion of available resources (time, money) on health. As a second factor, sport clearly stood out. This involves variables expressing the importance of the active presence of physical activity for both individuals and families. The third factor is healthy nutrition that particularly gathers together the variables related to following a diet considered to be healthy. The fourth factor is medical check ups. This factor are characterised by participation in a doctor's screening tests, primarily on a voluntary basis. The last, fifth factor is the existence of a health problem.

Comparison of factors with demographic background variables was performed by ANOVA, which revealed the following characteristics. *Health consciousness* was more typical of women (Mean score = 0.10 vs. -0.11,  $F(1.1048)=11.9$ ,  $p=0.001$ ), those with at least a higher educational qualification or school leaving certificate (Mean score = 0.42 and 0.19 vs -0.26 and -0.38,  $F(3.1046)=34.4$ ,  $p<0.001$ ), and also those who buy medicinal herbs to improve their health (Mean score = 0.13 vs. -0.07, ( $F(1.1048)=10.1$ ,  $p=0.002$ ). Regarding age, this factor was more typical of those between 19 and 29, and 30 and 39 (Mean score = 0.17 and 0.20 vs -0.19, ( $F(5.1044)=4.2$ ,  $p=0.001$ ) and not of those in older age groups. *Sport* as a factor was more typical of men (Mean score = 0.13 vs. -0.11,  $F(1.1048) = 15.7$ ,  $p<0.001$ ), as well as of those with a secondary school or higher education qualification (Mean score = 0.15 and 0.26 vs. -0.3 and -0.1,  $F(3.1046)=17.9$ ,  $p<0.001$ ). In the case of this factor the use of medicinal herbs also appears (Mean score = 0.10 vs. -0.05, ( $F(1.1048) = 5.5$ ,  $p=0.019$ ). The *healthy nutrition* factor appears primarily in women (Mean score = 0.13 vs -0.15,  $F(1.1048)=20.7$ ,  $p<0.001$ ) who have at least a secondary school higher education qualification (Mean score = 0.07 and 0.22 vs -0.16 and -0.12,  $F(3.1046)=6.8$ ,  $p<0.001$ ). With this factor, there is no specific doctor's recommendation, and yet advice is still followed (Mean score = 0.18 vs. -0.43,  $F(1.66)=4.6$ ,  $p=0.035$ ) and there is also a marked increase in consumption of herbs (Mean score = 0.29 vs. -0.16,  $F(1.1048) = 52.1$ ,  $p<0.001$ ). The presence of *medical check ups* as a factor is more specific to women (Mean score = 0.13 vs. -0.15,  $F(1.1048)=20.2$ ,  $p<0.001$ ), especially for those with higher education (Mean score = 0.35 vs -0.05, -0.06, -0.16,  $F(3.1046)=9.9$ ,  $p<0.001$ ). This factor is strongly characteristic of older people aged 50-59 years and over 60 (Mean score = 0.18 and 0.21 vs. 0.02, -0.22, -0.26, -0.18,  $F(5.1044)=8.5$ ,  $p<0.001$ ). The presence of a *health problem* as a factor was not linked to gender but at the same time it is clearly evident in those with lower educational qualifications (up to 8 years of education, skilled workers, and those who had attended vocational schools: Mean score = 0.46 and 0.05 vs -0.16, -0.18,  $F(3.1046) = 17.6$ ,  $p<0.001$ ). With this factor it is only the medical recommendation which can be observed (Mean score = 0.32 vs. -0.02,  $F(1.1048)=7.5$ ,  $p = 0.006$ ). Factor values differed significantly between those who consumed herbal medicines and those who did not (Mean score = 0.08 vs. -0.04,  $F(1.1048)=3.8$ ,  $p=0.050$ ). This factor is also characteristic of older age groups (50-59 years old - 60 years and older - Mean score = 0.10 and 0.73 vs. -0.29, -0.39, -0.48, -0.43,  $F(5.1044)=50.3$ ,  $p<0.001$ ).

In the next step, based on the answer to the first question on herbal medicines (Do you use herbs and herbal preparations for any reason?) we formed clusters with spectral clustering.

The established clusters can be characterized by the following demographic parameters (Table 7).

**Table 7**

Demographic characteristics of clusters of those buying herbs (%) (N = 363)

In the *first cluster*, men and women appear in an approximately similar ratio, so in this respect the group is fairly balanced. Typically, it is those in the 30-49 age group and those older than 60 that make up the cluster, nearly half of whom could not judge their health

consciousness while, at the same time, almost the same number said they were health conscious, although they felt environmentally conscious to a greater degree. Among these the proportion of those with a vocational education and those who are married are the highest. The *second cluster* is predominately women, nearly two thirds of whom are over the age of 50. The group considers its decisions to be mostly environmentally- and health-conscious. These people have the highest proportion of those with tertiary education and they are typically married or widowed. The *third cluster* is also mainly women, though it is less typically so than the previous group. In terms of average age, this group is the second oldest after cluster two, with half of the cluster belonging to the 50-year-old age group. From the point of view of both the environment and health consciousness, this group sees itself committed to these areas. They typically have secondary school qualifications and the proportion of those married/cohabiting is the highest in this cluster. The *fourth cluster's* gender composition is almost identical to that of the previous cluster, i.e. two-thirds of the group are women. This cluster can be considered the youngest, 42.3% of them are under the age of 39. They describe themselves as environmentally conscious rather than health conscious, and this cluster has the highest proportion of those with a secondary school qualification and those living alone.

In the following, the clusters developed were compared with the health attitudes, and an ANOVA analysis was also performed to discover which factor causes a significant difference between the clusters. The results are summarized in Table 8.

**Table 8**

Clusters based on the purchase of medicinal herbs and their relationship with factors of health attitudes (N = 1050)

According to our results, those purchasing medicinal herbs formed 5 distinct groups, mainly around the health awareness, medical check ups and healthy nutrition factors. The largest cluster is No. 5 (Non-users), which includes non-purchasers. The analysis then categorized the remaining 363 respondents (who buy medicinal herbs) into four additional categories. *Cluster one* encompasses respondents who typically seek to restore their state of health through sport and healthy eating because of an existing illness, and we called the group “*comprehensive regenerators*”. The *second cluster* represents a health-conscious group, for whom the feedback from regular medical check ups is of the utmost importance; the group was named “*seeking objective control*”. For the *third cluster*, this health consciousness is complemented by medical feedback and by the presence of regular sports, the group being called “*comprehensive health consciousness*”. The *fourth cluster* also combines those with already existing illnesses who, unlike the first cluster, only consider a healthy diet important, and so they are called “*regenerating with food*”.

In addition to these characteristics, it is important to note that in the case of the first and the fourth clusters, given that they have an already existing illness, recovery of good health is the main focus, while in cluster two and three the presence of illness is not characteristic, i.e. health consciousness is a preventative health behaviour. Since cluster five covers non-users of herbs, in what follows we will analyse the number of herbal users (N = 363) classified in the groups 1 to 4.

In the following analysis, we sought to find out what kind of illnesses users try to treat with medicinal herbs in the different individual clusters. The results are summarized in Table 9.

**Table 9**

Typical illnesses for which herbs are used in the individual clusters (%) (N = 363)

According to our results, the *first cluster* only uses herbal preparations for skin complaints, so they are considered the least active of the four groups in terms of herbal use. *Cluster two* can in some respects be interpreted as a counterpoint to the first cluster, because here respondents mention the greatest number of different illnesses for which they use herbs or herbal products. The *third cluster* can be regarded as a restrained herbal users, with only three health problems mentioned for which they consider the use of herbs to be justified. The *fourth cluster* was found to be the second most significant herbal consumer, using herbs for 5 health problems.

In the next step of the analysis, we sought to find out which medicinal herbs are generally used by the individual clusters for the treatment of the typical illnesses described above. These results are shown in Table 10.

**Table 10**

Typical herbs used in each cluster (%) (N = 363)

According to our results, the *first cluster* mostly uses chamomile, although on rare occasions rosehip and lime flowers are purchased. As expected from the previous results, for the *second cluster*, six different herbs are regularly used. In their case, chamomile, nettle, rosehip, elderberry, elderflower and lime flower are also used regularly. The *third cluster* regularly uses chamomile, rosehip and lime flowers, while *cluster four* uses chamomile and rosehip.

#### **4. Discussion**

Before evaluating our results, it should be noted that, due to the pioneering nature of our research, we did not find any international literature on the basis of which we could make comparable statements. Based on our results, four clearly distinct groups can be formed as regards the purchase of herbs, mainly grouped around health awareness, medical check ups and healthy nutrition factors.

*Cluster 1*, designated as “*comprehensive regenerating*”, includes respondents who – because of an existing illness - typically seek to restore their state of health through sport and healthy eating. In this cluster, the sex ratio is approximately the same. They are typically middle-aged (30-49 year-olds), but those above 60 are also found in this group. Slightly less than half of the “*comprehensive regenerating*” cluster members are more health conscious, and most of them are ecologically aware. According to our results, of the four groups they are the least active in herbal use. Only two or three medicinal herbs (chamomile, lime tree flowers and rosehip) are purchased by this group.

*Cluster 2*, which is called “*seeking objective check ups*”, is a very health conscious group for whom regular medical checks are of paramount importance. This cluster is predominantly made up of women, and almost two thirds of them belong to the age group of over 50. The group thinks its decisions are mostly based on an environmentally aware and health-conscious approach. It should be emphasized that this cluster has the highest proportion of those with higher education qualifications. Members of the “*seeking objective check ups*” cluster appear in some aspects as counterparts to the “*comprehensive regenerating*” group as here we find medicinal herbs or preparations used to treat the greatest number of illnesses. In their case, six different herbs (chamomile, nettle, rosehip, elderberry, elderflower and lime flowers) are regularly used.

For cluster 3, i.e. “*comprehensive health consciousness*”, in addition to medical feedback, health consciousness also means regular sporting activity. The “*comprehensive health consciousness*” cluster is mainly made up of women, and is the second oldest in its average age. This group is most committed in terms of both environmental awareness and health consciousness. Members of cluster 3 are considered to be restrained consumers of medicinal herbs, with only three health problems being considered for treatment with herbs (chamomile, rosehip and lime flower).

Cluster 4 - “*regenerating with food*” - also includes those with existing illnesses, but in contrast to cluster 1, they only consider healthy eating to be important. The gender composition of cluster 4 is almost identical to that of the previous cluster, i.e. two thirds of the group are women. This cluster is considered to be the youngest, typically under the age of 39. They describe themselves as more eco-conscious than health conscious. The “*regenerating with food*” cluster is the second most significant group of consumers of medicinal herbs, and its members list five health problems that they attempt to cure by herbs. Cluster 4 regularly uses chamomile and rosehip.

To conclude, Hungary lags behind the comparable indicators of North American or Western European countries to a significant degree, with a 34.6% of their typical comparable consumption figures. This contrast becomes even more marked if we take into account that the country has a leading position in the production of raw ingredients. There is a clear majority of women among regular herbal consumers, which, according to our results, is associated with a higher level of health awareness. During the purchases, it is clear that specialty shops are preferred by respondents who buy herbs in dried form. The results clearly show that health awareness is the most important factor in purchasing, which in very few cases involves a specific medical recommendation. The consumer groups identified by us clearly see medicinal herbs as supplementary means to preserve/recover their health, which also involves other health-promoting activities. It has also become very clear that herbs are typically used in cases where the use of herbs has a long history, such as for colds, flu, allergies, and skin problems.

## **5. Conclusions**

Based on our results we can conclude that the consumption of medicinal herbs, if it is not a part of a medical treatment, is still based on knowledge related to folk traditions and customs. It is also clear that the proportion of people who feel less need to use these herbal drugs is more significant, and more than two thirds of the sample said they were non-

consumers. It is important to note that those groups who are committed to environmental and health consciousness, and among them those committed to preventing illness, are significantly greater consumers of medicinal herbs. An important strategic goal for the industry can be to reinforce preventive health behaviour as an approach that can have a positive impact on the consumption of products. This group carries the greatest potential for future sales growth.

Those who are regenerating after an illness are also clearly present. This group was so clearly defined that we could separate it into two clusters based on their unique characteristics. That is, people who wish to regain health after the illness currently represent the biggest target group for herbal products, among which those in the “comprehensive regenerating” group are clearly the most intense users. In their case, knowledge of the effects of herbs can be useful.

The third key point is that those who are expecting continuous external (medical) feedback about their state of health are also more willing purchasers of these products, and purchase more intensively, especially for preventive purposes. In their case, therefore, the expert recommendation is an important element, therefore the key communication channel for product manufacturers is the family doctor as part of the network of screening activities.

We hope that our study may be the first, thought-provoking piece of an international research series which will be followed by many others, thus helping one of the most prominent representatives of alternative therapies – the use of medicinal herbs – to be extended even further.

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### **References**

- [1] National Center for Complementary and Alternative Medicine. What Is Complementary and Alternative Medicine. <http://nccam.nih.gov/health/whatiscom/D156.pdf>. (accessed 4 November 2006) in Turhan, A.B., Bör, Ö. (2016): Use of herbs or vitamin/mineral/nutrient supplements by pediatric oncology patients. *Complement. Ther. Clin. Pract.* 23. p. 69–74
- [2] Turhan, A.B., Bör, Ö. (2016): Use of herbs or vitamin/mineral/nutrient supplements by pediatric oncology patients. *Complement. Ther. Clin. Pract.* 23. p. 69–74
- [3] Albright, N.S. (1997): A review of some herbal and related products commonly used in cancer patients. *J. Am. Diet. Assoc.* 97. p. 208–215
- [4] WHO, WHO guidelines for assessing quality of herbal medicines with reference to contaminants and residues. 2007. p. 1–118
- [5] Czirbus, Z. (2013): Nemzetközi kitekintés a gyógynövényágazat helyzetére. *Agrofórum.* 24. p. 37–41
- [6] Bernáth, J., Gosztola, B., Kindlovits, S., Pluhár, Zs., Radácsi, P., Sárosi, Sz., Varga, L., Zámboriné Németh, É. (2012): *Korszerű gyógynövénytermesztési ismeretek.* Corvinus Egyetem. Budapest.

- [7] Kralovánszky, U.P. (2011): *Érvek gyógynövénytermelésünk fejlesztése érdekében*, Agrofórum. 22. p. 10–11
- [8] Khan, H., Rauf, A. (2014): *Medicinal Plants: Economic Perspective and Recent Developments*. World. Appl. Sci. J. 31. p. 1925–1929
- [9] Sulaiman, N.A., Ming, L.C. (2016): *Use of herbal products in Southeast Asian countries*. Arch. Pharm. Pract. Supplement. 7. p. 1–4
- [10] Soós, S.Á., Jeszenői, N., Darvas, K., Harsányi, L. (2015): *Herbal medicine use by surgery patients in Hungary: a descriptive study*. BMC Complement. Alternat. Med. 15. p. 358
- [11] Buda, L., Lampek, K., Tahin, T. (2002): *Correlations of alternative medicine, health status and health care in Hungary*. Orv. Hetil. 143. p. 891–896 [Hungarian] in Soós, S.Á., Jeszenői, N., Darvas, K., Harsányi, L. (2015): *Herbal medicine use by surgery patients in Hungary: a descriptive study*. BMC Complement. Alternat. Med. 15. p. 358
- [12] Eisenberg, D.M., Kessler, R.C., Foster, C., Norlock, F.E., Calkins, D.R., Delbanco, T.L. (1993): *Unconventional medicine in the United States. Prevalence, costs, and patterns of use*. N. Engl. J. Med. 328. p. 246–252
- [13] Kennedy, J. (2005): *Herb and supplement use in the US adult population*. Clin. Therap. 27. p. 1847–1858
- [14] Zhang, A.L., Story, D.F., Lin, V., Vitetta, L., Xue, C.C. (2008): *A population survey on the use of 24 common medicinal herbs in Australia*. Pharmacoepidemiol. Drug. Saf. 17. p. 1006–1013
- [15] Samojlik, I., Mijatović, V., Gavarić, N., Krstin, S., Božin, B. (2013): *Consumers' attitude towards the use and safety of herbal medicines and herbal dietary supplements in Serbia*. Int. J. Clin. Pharm. 35. p. 835–840
- [16] Yilmaz, M.B., Yontar, O.C., Turgut, O.O., Yilmaz, A., Yalta, K., Gul, M., Tandogan, I. (2007): *Herbals in cardiovascular practice: are physicians neglecting anything?* Int. J. Cardiol. 122. p. 48–51
- [17] Marinac, J.S., Buchinger, C.L., Godfrey, L.A., Wooten, J.M., Sun, C., Willsie, S.K. (2007): *Herbal products and dietary supplements: a survey of use, attitudes, and knowledge among older adults*. J. Am. Osteopath. Assoc. 107. p. 13–23
- [18] Klepser, T.B., Doucette, W.R., Horton, M.R., Buys, L.M., Ernst, M.E., Ford, J.K., Hoehns, J.D., Kautzman, H.A., Loqemann, C.D., Swegle, J.M., Ritho, M., Klepser, M.E. (2000): *Assessment of patients' perceptions and beliefs regarding herbal therapies*. Pharmacotherapy. 20. p. 83–87
- [19] Bamidele, J.O., Adebimpe, W.O., Oladele, E.A. (2009): *Knowledge, attitude and use of alternative medical therapy amongst urban residents of Osun State, southwestern Nigeria*. Afr. J. Tradit. Complement. Altern. Med. 6. p. 281–288
- [20] Szántó, Á. (2008): *Egészségpiac és egészségtudatosság*. PhD disszertáció, Miskolci Egyetem. p. 1–155
- [21] Karatzoglou, A., Feiner, I. (2007): *Text Clustering with String kernels in R*. in: Decker, R., Lenz, H.J. (Eds.) *Advances in Data Analysis*. Springer. Berlin. Heidelberg. p. 91–98
- [22] Freund, Y., Schapire, R.E. (1999): *Large margin classification using the Perceptron algorithm*. Mach. Learn. 37. p. 277–296
- [23] Crammer, K., Singer, Y. (2003): *Ultraconservative online algorithms for multiclass problems*. J. Mach. Learn. Res. 3. p. 951–991

- [24] Kivinen, J., Smola, A., Williamson, R. (2004): Online learning with kernels. *IEEE Trans. Signal. Process.* 52. p. 2165–2176
- [25] von Luxburg, U. (2007): A tutorial on Spectral Clustering. *Stat. Comput.* 17. p. 395–416
- [26] Ng, A.Y., Jordan, M.I., Weiss, Y. (2001): On Spectral Clustering: Analysis and an Algorithm. *Adv. Neural. Inf. Process. Syst.* 14. p. 849–856
- [27] Shi, J., Malik, J. (2000): Normalized Cuts and Image Segmentation. *IEEE Trans. Pattern. Anal. Mach. Intell.* 22. p. 888–905
- [28] Lodhi, H., Saunders, C., Shawe-Taylor, J., Cristianini, N., Watkins, C. (2002): Text Classification Using String Kernels. *J. Mach. Learn. Res.* 2. p. 419–444

**Table 1**

Sample distribution according to the most important background variables

Name	Sample distribution		Census ratios *
	Individual	%	%
<b>All respondents</b>			
Total	1050	100.0	
<b>By sex</b>			
Men	494	47.0	46.9
Women	556	53.0	53.1
<b>By age</b>			
14-18 years	65	6.2	6.6
19-29 years	164	15.6	15.8
30-39 years	187	17.8	18.4
40-49 years	175	16.7	15.3
50-59 years	164	15.7	16.7
60 years and older	294	28.0	27.1
<b>By highest educational qualification achieved</b>			
Maximum 8 years of primary education	164	15.6	31.7
Vocational school, specialist school	334	31.8	21.3
Secondary school leaving certificate	370	35.2	30.1
Higher education diploma/degree	183	17.7	17.0

\* Based on the census data of 2011, the distribution of census data is also shown for the age group of 14 or older

**Table 2**

Frequency of use of herbs for various health problems (N = 363)

Illness	Herb used	
	Individuals	%
Cold	296	81.4
Flu	84	23.2
Upset stomach	72	19.9
Arthritis, pain	58	15.9
Other*	44	12.2
Intestinal disorder	33	9.0
Anxiety	20	5.6
Skin problems / diseases	20	5.4
Hypertension	18	5.0
Frequent migraine, headache	14	3.9
Vascular Disease	12	3.3
Seasonal allergy (pollen)	11	3.0

\* 10 types of additional health problems were mentioned by below 3%.

**Table 3**

Regularly purchased medicinal herbs (N = 363)

<b>Herb</b>	<b>Individual</b>	<b>%</b>
Chamomile	264	72.6
Rosehip	203	55.9
Lime Flower	163	44.9
Nettle	89	24.6
Other*	69	19.0
Elderflower	66	18.3
Lavender	35	9.7
Poppy	35	9.7
Elder Berry	35	9.6
Lavender	34	9.4
Milfoil	33	9.2
Pumpkin (also seeds)	32	8.9
Savory	26	7.1
Aniseed	22	6.1
Cumin	22	5.9
Mustard	21	5.7
Horsetail	20	5.5

\* 40 types of additional herbs were mentioned by below 5%.

**Table 4**

Forms of Herbs, Herbal Preparations (N = 363)

<b>Form</b>	<b>Individuals</b>	<b>%</b>
Dried	313	86.3
Essential oil	48	13.3
Cosmetics	27	7.4
Food (medicinal and health foods)	27	7.4
Pharmacy preparation (tablets, capsules)	25	6.8
Dietary supplement (capsule, powder, etc.)	24	6.6
Other	22	6.0

**Table 5**

Typical Purchase Locations for Herbarium (N = 363)

<b>Place of purchase</b>	<b>Individual</b>	<b>%</b>
Herbal Shop, Herbaria	147	40.6
Pharmacy	107	29.6
Drugstore	38	10.5
Own preparation	30	8.3
Grocery	25	6.9
Internet/webshop	8	2.3
Other	4	1.2

**Table 6**

Factors that can be formed based on the health attitudes of the Hungarian population  
(N = 1050)

	<b>Component</b>				
	<b>Health- consciousness</b>	<b>Sport</b>	<b>Healthy nutrition</b>	<b>Medical check up</b>	<b>Health problem</b>
I know and use many sources of information from which I can find out about a healthy (health conscious) lifestyle.	.680				
It feels good if I can set money aside for my health, even if it is at the expense of other purchases.	.666				
I try to find out where to go for sports and to buy healthy foods.	.665				
Much of my money is spent on protecting my health.	.656				
I try to find out what I can do to preserve / restore my health.	.649				
I spend most of my spare time on caring for my health.	.638				
It feels good if I can dedicate time to my health, even if it is at the expense of my free time.	.600				
I pay attention to my weight because it is important for my health.	.532				
I regularly go to do sports / some kind of exercise.		.882			
I try to choose a sport / movement activity that will help me to preserve my health.		.862			
I feel good when I move enough / do enough sport.		.853			
Physical activity for health is important in our family.		.547			
If I make / buy food for myself or my family, I look for healthy food.			.715		

Health is a central value for our family.	.692	
At every meal I try to eat healthy foods.	.674	
It is important for me to preserve my health.	.600	
My parents have always watched what foods and food types we eat.	.579	
I also go for screenings that are not obligatory.		.715
I visit my general practitioner regularly, even if I have no health problem.		.650
I regularly visit my dentist even if I have no complaint.		.606
I go to a screening test as soon as I am notified.		.563
I have a lot of free time.		.781
I've had a health problem that affects my current state of health.		.766

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**Table 7**

Demographic characteristics of clusters of those buying herbs (%) (N = 363)

Background factor		Cluster			
		1. Compre hensive regenera ting	2. Seeking objective check ups	3. Comprehensive health consciousness	4. Regenerati ng with food
Gender asked:	men	46.8	22.2	34.4	33.7
	women	53.2	77.8	65.6	66.3
Age group	14-18 years	5.3		4.4	4.7
	19-29 years	14.9	8.6	10.0	14.1
	30-39 years	20.2	14.8	18.9	23.5
	40-49 years	16.0	16.0	16.7	17.6
	50-59 years	13.8	21.0	21.1	14.1
	60 years and older	29.8	39.5	28.9	25.9
Level of health awareness	I don't know	1.1			
	Not health conscious at all	1.1	4.9	1.1	1.2
	Mainly not health conscious	6.4	4.9	5.5	7.1
	Only sometimes health conscious	47.9	39.0	31.9	42.4
	Mainly health conscious	35.1	40.2	47.3	37.6
	Very health conscious	8.5	11.0	14.3	11.8
Environmental awareness level	I don't know / no answer				
	Not environmentally conscious at all	1.1	3.7		
	Mostly not environmentally conscious	6.5	7.4	3.3	9.3
	Only sometimes environmentally conscious	32.3	28.4	28.9	27.9
	Mostly environmentally conscious	51.6	45.7	51.1	46.5
	Very environmentally conscious	8.6	14.8	16.7	16.3
The highest level of education	Maximum 8 years primary	11.7	9.8	6.7	10.6
	Vocational school, specialist school	35.1	24.4	25.6	22.4
	Secondary school leaving certificate	30.9	23.2	44.4	48.2
	Higher education degree	22.3	42.7	23.3	18.8
	Married	49.5	40.7	46.7	29.1

Family situation	Living with partner	10.8	13.6	15.6	18.6
	Widow/er	6.5	19.8	15.6	12.8
	Unmarried, single	19.4	13.6	11.1	20.9
	Divorced	14.0	12.3	11.1	18.6

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