RESEARCH ARTICLE

Knowledge and Self-use of Medicinal Plants by Health University Students in Brasília-Brazil [version 1; peer review: 2 not approved]

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Abstract

Background: This article reports an experiment based on the measurement of the academic about the use of medicinal plants is increasing, this article aims to analyze the behavior of future health professionals regarding the use of medicinal plants, since they will be responsible for the orientation and education of patients and the population.

Methods: The present study involved 50 students of the academic health care Anhanguera College of Brasília (Biological Sciences, Biomedicine, Nursing and Pharmacy), selected randomly. Questions about the use of medicinal plants were made and 96% confirmed having used medicinal plants. We used the Descriptive statistic to compare the answers.

Results: Most academics reported self-consumption of medicinal plants, with a positive result after use (*p<0.001). The most used medicinal plants were, in addition to the mixture of herbs, boldo and Mexican tea, for the treatment of stomach pains, headaches, coughs, and colds. Self-usage was mainly due to the recommendation of a family member and most of their knowledge of herbal medicine come from non-evidence based sources. The prevalence of plant use was higher among females(84%) in all undergraduate courses observed when purchased as males (22%).

Conclusions: The consumption of medicinal plants among academics is high, but it is within the literature. However, as the study was conducted among health professionals, they were expected to have greater knowledge of the adverse effects and on the plant to be used.

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Any reports and responses or comments on the article can be found at the end of the article.

Keywords

Medicinal plant, Academic health, Consumption, Knowledge, Students, Herbal

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Introduction

The consumption of plants for medicinal purposes has increased in recent years, a tradition that has been passed from generation to generation. Medicinal plants have therapeutic properties, causing various effects on the human body, induced by phytochemicals. However, several professionals do not learn phytotherapy/herbal medicine as undergraduate students (Jamshed *et al.*, 2016; Lapidus, 2007; Oliveira *et al.*, 2012; Suchard *et al.*, 2004). Different studies showed that physicians and university students studying health related courses do not have adequate knowledge of medicinal plants (Ameade *et al.*, 2015; Frass *et al.*, 2012; Hina *et al.*, 2015; Jamshed *et al.*, 2016; Johnson *et al.*, 2008; Oliveira *et al.*, 2012; Samara *et al.*, 2019; Suchard *et al.*, 2004). Despite this, several studies showed a high level of self-medication with herbal medicines by health students and professionals (Abahussain *et al.*, 2007; Ambrose & Samuels, 2004; Awad *et al.*, 2012; Brambila-Tapia *et al.*, 2016; El Ezz & Ez-Elarab, 2011; Fahmy *et al.*, 2010; Gyasi *et al.*, 2016; Saha *et al.*, 2017; Sawalha *et al.*, 2008; Soroush *et al.*, 2018). This practice is worrying because some of the biologically active compounds of plant origin can be harmful, and cause some adverse and toxic effects (Cheung *et al.*, 2009; Krenzelok & Mrvos, 2011; Ng *et al.*, 2019; Pan *et al.*, 2017; Sriapha *et al.*, 2015; Zamawe *et al.*, 2018). To date, it is not clearly known whether these students search for scientific evidence about herbs before consuming them. Therefore, we seek to analyze the knowledge of university students in health related courses on medicinal plants and their self-use.

Methods

Experimental design

To analyze the knowledge and self-use of medicinal plants, a cross-sectional study was performed with university students in health-related courses. The participants were recruited and selected as follows. Students that were at the university and outside of the classrooms were informed about the intention to conduct the study. The sample size was determined by the number of undergraduate students that: (i) agreed to participate in the study and signed the written informed consent, and met the inclusion criteria. The inclusion criteria for the research participants were being students regularly enrolled in the educational institution, being between 19 and 50 years old, agreeing to participate in the research, signing the Free and Informed Consent Form, and being present on the day of the interview. As a criterion for exclusion from the research were academics who did not agree to participate in the research or to sign the Informed Consent Form.

The students who participated in the research were studying higher education at a private educational institution, in Brasília (Brazil), in the following health courses: Biomedicine (13), Biological Sciences (07), Nursing (13) and Pharmacy (17), coming to 50 students total.

A questionnaire was developed based on earlier studies (Ambrose & Samuels, 2004; Ameade *et al.*, 2015; Nworu *et al.*, 2015) specifically for this study to assess students' knowledge and self-use of medicinal plants. After students signed the

Informed Consent form, the questionnaires were administered from September 2014 to February 2015. The data collection instrument consisted of objective questions and was structured in two sections: in the first, the profile of the interviewees (age, course, and sex) is described; in the second, information related to the use of medicinal plants was described, such as the plants used, the result obtained after consumption, adverse events, previous knowledge about plants, research for knowledge about the plants before their use, and the motivation for the use of medicinal plants. The questionnaire was applied through an interview that lasted between 10 to 15 minutes. Consent forms and the study questionnaire are provided as extended data (Eduardo *et al.*, 2020).

Ethics and consent

This research project was approved by the Research Ethics Committee, registered by the Research Ethics Committees (CEPs) and by the National Research Ethics Committee (CONEP), also known as the CEP / CONEP system (approval number 34629314.2.0000.5372). Written informed consent from all subjects involved was obtained for participation in the study.

Statistical analysis

The IBM Statistical Package for the Social Sciences (IBM 21) and the GraphPad 8.1 Prisma software were used to analyze data (Fisher's tests) on the knowledge and use of medicinal plants by health students (Brambila-Tapia *et al.*, 2016; Eduardo *et al.*, 2019). For all analyses, p values below 0.01 were considered statistically significant.

Results

Descriptive data

The sample size of this study was 50 university students in the health field, 84% of which were female and 16% male. Gender distributions across courses are displayed in Figure 1. The semesters that students were taking in undergraduate health courses were: Biomedicine course - 14% were in the 7th semester and 12% in the 8th semester; Biological Sciences - 2% were in the 3rd semester and 12% were in the 4th; Nursing course - 2% were in the 1st semester and 24% were in the 5th semester;

Figure 1. Distribution of study participants by gender and by undergraduate health course (Biological Sciences, Biomedicine, Nursing and Pharmacy), in the years 2014 and 2015.

and Pharmacy course - 34% were in the 8th semester, as shown in Table 1 (see underlying data (Eduardo *et al.*, 2020)).

Of the total of 50 students, 25 of them were aged 19 to 29, 13 were aged 30 to 39, 18 aged 40 to 49, and 4 aged 50 to 59 (Figure 2). Results show that most respondents 48 (96%; $P < 0.0001$), had at some point in their life used medicinal plants for the alternative treatment of diseases. Of these, 46 ($P < 0.0001$) reported they cured their illnesses, and only 4% did not report a positive effect after using medicinal plants (Figure 3A). In addition, of the individuals who used medicinal plants, 54% said that before using them, they researched the plants, for information such as the indications for use and the adverse effects that they can trigger, whereas 42% do not usually research the plants before ingesting them (Figure 3B). Most of the interviewees (68%) reported that used medicinal plant based on the recommendation of family members (Figure 4).

Regarding the motivations that led to the consumption of medicinal plants, most reported stomach pain (30%), followed by headache, cough, colds, and pain in general (Figure 5).

The medicinal plants most used by academics are shown in Figure 6, where 44% of them mentioned they use a mixture of plants, such as chamomile (*Matricaria chamomilla*), lemon balm (*Melissa officinalis*), fennel (*Pimpinella anisum*) and pomegranate (*Punica granatum*), 30% said they use the

Table 1. Distribution of students per semester of the undergraduate courses that participated in the research, in the years 2014 and 2015.

Courses \ Semesters	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
Biomedicine	-	-	-	-	-	-	7	6
Biological Sciences	-	-	1	6	-	-	-	-
Nursing	1	-	-	-	12	-	-	-
Pharmacy	-	-	-	-	-	-	-	17

Figure 2. Distribution of students participating in the survey by age group.

Figure 3. Distribution of students who had and did not have positive effects on the use of medicinal plants (Figure 3A). Figure 3B shows the distribution of academics who usually research the medicinal plant before ingesting it in the years 2014 and 2015.

Figure 4. Main sources of knowledge of medicinal plants in the alternative treatment of diseases.

Figure 5. Motivations for the use of medicinal plants by students, in the years 2014 and 2015.

Figure 6. Main medicinal plants used by health academics, in the years 2014 and 2015.

boldo (*Peumus boldus*), 12% mentioned the Mexican tea (*Dysphania ambrosioides*). Raw survey results are available as Underlying data (Eduardo *et al.*, 2020).

Discussion

This study showed that although a high percentage of undergraduate students from a private health institution were able to know medicinal plants and use them, a significant fraction did not research before consumption. Only a minority did not obtain a positive result after consuming medicinal plants. These data corroborate the results obtained by several authors, which indicated the effectiveness of using medicinal plants for several problems such as constipation, colds, cough and bacterial infections and pain in general (Ameade *et al.*, 2015; Lee *et al.*, 2005; Nworu *et al.*, 2015; Soroush *et al.*, 2018).

Regarding the indication of plants consumed by students, most of them reported following family traditions. Other studies also showed the influence of family members or friends on the consumption of natural products (Ambrose & Samuels, 2004; Ameade *et al.*, 2015; Gyasi *et al.*, 2016; Lee *et al.*, 2005; Nworu *et al.*, 2015; Saha *et al.*, 2017), particularly parents and grandparents (Oliveira *et al.*, 2012; Otieno & Analo, 2012). These non-academic sources of information and the lack of courses on herbal medicine at the college (Jamshed *et al.*, 2016; Lapidus, 2007; Oliveira *et al.*, 2012; Suchard *et al.*, 2004) may explain why physicians and other health professionals present inadequate knowledge of medicinal plants (Ameade *et al.*, 2015; Frass *et al.*, 2012; Hina *et al.*, 2015; Jamshed *et al.*, 2016; Johnson *et al.*, 2008; Oliveira *et al.*, 2012; Samara *et al.*, 2019; Suchard *et al.*, 2004). When herbal medicine is not taught, the belief that herbal treatment is an effective method becomes lower in senior medical students in relation to younger/1st year students (Akan *et al.*, 2012; Beglaryan & Amirjanyan, 2012; Brambila-Tapia *et al.*, 2016). Consequently, several studies showed a poor self-perceived competence or confidence of physicians and pharmacists in dealing with herbal medicines (Abahussain *et al.*, 2007; Erku *et al.*, 2017;

Kemper *et al.*, 2006; Xu & Levine, 2008). Some studies showed that undergraduate health students who take herbal courses – either because it is mandatory or a well-attended elective – show an increase in the level of knowledge about natural products, herb properties and usage (Cai & Boyd, 2018; Johnson *et al.*, 2008; Karpa, 2012; Larrañeta, 2018; McKennon *et al.*, 2018). However, the level of interest for learning this subject may be low. Medical students have reported poor interest in complementary and alternative medicine (CAM) (Frass *et al.*, 2012), whereas pharmacy students have shown a strong interest in traditional Chinese medicine and medicinal herbalism (Freyman *et al.*, 2006).

The high level of students' self-medication/usage in the present study is in accordance with other studies (Abahussain *et al.*, 2007; Ambrose & Samuels, 2004; Awad *et al.*, 2012; Brambila-Tapia *et al.*, 2016; El Ezz & Ez-Elarab, 2011; Fahmy *et al.*, 2010; Gyasi *et al.*, 2016; Saha *et al.*, 2017; Sawalha *et al.*, 2008; Soroush *et al.*, 2018). University students studying health related courses use at least one herbal substance per year (Johnson & Blanchard, 2006). Actually, this practice may be didactic/instructive since self-experimentation has been shown to improve student learning in relation to active learning approaches (Eduardo *et al.*, 2019).

Our finding that the self-administration of medicinal herbs occurs mostly without searching for more knowledge before their ingestion is in accordance with another study that showed a low percentage of university students that learned from personal research (Mackowiak *et al.*, 2001). Health care professionals use more herbs for which there is scientific evidence of effectiveness (Gardiner *et al.*, 2006) and health students believe one of the main barrier that limit the use of CAM is the lack/deficiency of scientific evidence (Awad *et al.*, 2012; Brambila-Tapia *et al.*, 2016; James & Bah, 2014; Saha *et al.*, 2017; Samara *et al.*, 2019; Zimmerman & Kandiah, 2012). Various articles investigating the source of knowledge/information about herbal medicine and related therapies did not mention scientific journals/magazines (Kilic *et al.*, 2009). A recent study showed that pharmacy students gain most of their information about herbal medicine from non-scientific sources (Ashraf *et al.*, 2019). Actually, scientific journals and academic materials have been classified by university students as of low importance in terms of sources of knowledge regarding herbal medicine-related information (Gyasi *et al.*, 2016) and less than one third of medical students use scientific magazines/journals as sources of information on medicinal plants (Samara *et al.*, 2019). Other recent studies showed that medical and pharmacy students use social media and the internet as the main source of information about herbal medicine (Ashraf *et al.*, 2019; James & Bah, 2014; Kilic *et al.*, 2009; Nworu *et al.*, 2015; Samara *et al.*, 2019; Soroush *et al.*, 2018). As a consequence, health professionals' knowledge about medicinal plants do not come from scientific evidence (Frass *et al.*, 2012; Oliveira *et al.*, 2012). This non-scientific knowledge tend to be propagated by professionals, since consumers often consider pharmacists as a major source of information (Jamshed *et al.*, 2016; Siti *et al.*, 2009). An exception was observed in a study with chinese nursing students, which reported books, news papers and magazines as the most common sources of knowledge (Mei-Ying *et al.*, 2004).

The low interest of health students in seeking scientific information on medicinal plants is worrying because pharmacologically active compounds of natural origin may cause side effects, intoxication/poisoning and death (Cheung *et al.*, 2009; Krenzelok & Mrvos, 2011; Ng *et al.*, 2019; Pan *et al.*, 2017; Sriapha *et al.*, 2015; Zamawe *et al.*, 2018). As discussed before, the offering of courses may improve the knowledge of students. However, courses offered at the university may use non-scientific information. The inclusion of evidence-based information about herbs/CAM into the curriculum in some medical and nursing schools failed to meet accepted standards of evidence-based medicine; the curricula on the integrative medicine were strongly biased in favor of CAM and many references were poor-quality clinical trials (Marcus & McCullough, 2009). A study reported that even after teaching CAM using evidence-based medicine, students showed only a modest increase on their skill level in understanding the medical literature (Forjuoh *et al.*, 2003). However, courses of herbal/natural product that include bibliographic instruction on information seeking/searching skills increase students' knowledge about reputable resources for evidence-based information on medicinal herbs (Diaz-Cruz & Bolten, 2016; Dvorkin *et al.*, 2004; Karpa, 2012; Lapidus, 2007; McKennon *et al.*, 2018). Students that are more familiar with PubMed/Medline databases reported that herbal medicine is applicable to their work (Owen & Fang, 2003). The participation in courses that teach how to search for evidence-based resources regarding herbal medicines make students gain confidence in responding to patient questions (McKennon *et al.*, 2018). Additionally, courses underlying the use of natural products that are improved over the years – providing evidence-based medicine – have been shown to increase health students' skills in providing advice to patients (Geldenhuys *et al.*, 2015). These literature data together with our results corroborate the theory that evidence-based courses of herbal medicine should be offered more to students in health related courses at universities.

The responses of the students regarding the symptoms of the diseases treated with medicinal plants, there was a predominance of stomach pain, headache, and cough, however, some mentioned fever and pain in general. For these ailments, they used a mix of herbs such as chamomile, lemongrass, fennel, and pomegranate, or individual plants such as boldo and Mexican tea. These results corroborate with those obtained from a School of Pharmacy in London, where students mentioned the use of individual herbal remedies and mixed herbal remedies such as ginger, saffron, chamomile and arnica (Freyman *et al.*, 2006), with some plants also mentioned in our study.

Our results indicate that a high proportion of health university students do not research before self-usage of medicinal plants and that most of their knowledge come from non-evidence based sources. This study had some limitations, the main one being the number of students who wanted to participate in the research. Although our sample size was larger than those of other studies (Soroush *et al.*, 2018; Xu & Levine, 2008), the findings of the present study may not reflect general attitudes, and do not permit the generalizability of our results to all university students in

health related courses, even specifically to Brazil. Another limitation of our study is that only health students were investigated. Due to the high prevalence of self-medication among different students of other courses, we consider it important that new studies assess and compare the perceived factors of self-medication among students of different areas.

We conclude that the self-consumption of medicinal plants by academics in health related courses of a private institution in Brasilia is high, with the practice stimulated mainly by family members. However, knowledge of adverse reactions may be limited, as a high proportion of the students do not research the plants before using them. Moreover, most of their knowledge of medicine herbs comes from non-evidence based sources. The use of an evidence-based teaching tool that addresses medicinal plants could be positive for university students in health sciences, as being able to provide information to the population is an essential skill.

Data availability

Underlying data

Figshare: Eduardo *et al.*, 2020 Dataset_Knowledge and self-use of medicinal plants by health university students in Brasília-Brazil. <https://doi.org/10.6084/m9.figshare.11591913.v5> (Eduardo *et al.*, 2020)

This project contains the following underlying data:

- Eduardo *et al.*, 2020 dataset1.xls.xlsx (students' responses to the questionnaire)

Extended data

Figshare: Eduardo *et al.*, 2020 Dataset_Knowledge and self-use of medicinal plants by health university students in Brasília-Brazil. <https://doi.org/10.6084/m9.figshare.11591913.v5> (Eduardo *et al.*, 2020)

This project contains the following extended data:

- Eduardo *et al.*, 2020 Questionnaire - plants.docx (questionnaire)
- Eduardo *et al.*, 2020 Informed Consent - plants.docx (written informed consent)
- Eduardo *et al.*, 2020 Approval by the research ethics committee - plants.docx (approval by the research ethics committee)

Data are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

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Alan Joel Ruiz-Padilla

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The subject and objective are interesting, worth investigating. However, the study lacks a clear and concrete methodological design. There are inconsistencies between methodology, results, and conclusions.

Study design

1. The sample size is too small for a descriptive cross-sectional study.
2. The population studied is not homogeneous and it is not disputed whether these factors could have affected its results.
 - a. Knowledge of plant use and research through scientific information resources may differ between beginner and advanced grade students.
 - b. The differences in proportions of the sex of the participants.
3. There are several factors not included that could intervene with the results of the consumption of medicinal plants, such as the mode, dose, and manner of consumption of medicinal plants, presence of comorbidities, and other medications.
4. In the survey carried out, when they ask who indicated the use of these medicinal plants, they do not offer the possibility that their consumption has been by a health professional indication, they are predetermining that it is self-consumption. This could explain the high percentages of self-consumption in this group of people.

Results

1. Figure 3. The meaning of the areas (black and white) of the graphs is not described.
2. They equate the concept of "curing diseases" with that of "obtaining some positive effect". These concepts are only the authors' interpretation, and they are not supported by the

results of the survey since the question only addresses compliance with the expectations of the respondent.

3. Figures 4 and 6. It is not specified what the Y-axis represents in the bar graph.
4. It would be more interesting if results were presented on the use of medicinal plants for specific symptoms, as well as what was their main source of recommendation.

Discussion and Conclusions

1. An important part of the discussion involves physicians; however, students of this profession were not included in the study population, their inclusion would be very useful.
2. The survey only allows to choose Sources not based on evidence, participants do not have the option to select Sources of Information Based on evidence; therefore the discussion on this point is meaningless.
3. The lack of desire to answer the survey is described as a limitation, it will help to know the proportion of acceptance of participation.
4. It is appropriate to point out that these results cannot be generalized.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pharmaceutical care, Pharmaceutical Care Services, Self-medication, Epidemiology, Natural Products.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 24 September 2020

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Venil Sumantran

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Reported findings may be correct and valid, but the paper is 'Not Approved' because study design and data analysis are weak.

Study design:

1. Since there is no control group—the sample size should have been >50.
2. Did the subjects use herbal drugs along with standard (allopathic) drugs, lifestyle changes, i.e. as a complementary mode of treatment, or were these herbal drugs the sole mode of treatment (Alternative) for a given ailment?
3. The word 'cure' isn't defined. Figure 5 shows that 3 of the 6 ailments involve pain. So, a validated pain score could have been used.

Data analysis:

1. The Authors mention using different statistical tests, but only Figure 2 has a p-value.
2. The Authors do not clearly mention the "cure rate". The data and text imply that 95.80 % were cured and 4% were not.
3. The very high cure rate (96%) could be due to a bias arising from recruiting students who strongly lean towards herbal medicine, and points to a placebo effect. Even though this point is not the focus of their study, authors should discuss reasons for the high 'cure rate'—purely from viewpoint of thorough data analysis.
4. Since the hypothesis states that health professionals should have greater knowledge about these herbs than laymen, a Chi-squared test for association would show if the knowledge source was significantly associated with the major subject studied by students. The Chi-squared test could compare Knowledge Source (Research, Social media, Others) versus students of Biomed Sci + Biol Sci (20) and students of Nursing +Pharmacy (30). Why was this not done?
5. Figure 6 shows the 3 most commonly used herbs in the study. There is no analysis. The Authors could make a Pie chart/Table for each of the 3 herbs. Four parameters could be considered. (1. Herb taken for correct ailment 2. Herb taken for incorrect ailment 3. Expected outcome 4. Actual outcome). Based on these data, additional Chi-squared tests

may be required.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Cell and Cancer Biology, Biochemistry, Pre-clinical studies, Alternative Medicine (Ayurveda)

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

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