

# Phytotherapy: knowledge, experience and prescription in oral healthcare. A cross-sectional survey of dental practitioners

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## ABSTRACT

Herbal medicine is widely used as an integrative complementary treatment for common chronic diseases, yet potential risks include adverse effects and coprescription. **Aim:** This exploratory survey assessed Brazilian dentists' knowledge, attitudes, and practices regarding phytotherapy. **Materials and Method:** This study used a consecutive sample of registered dentists who were active in clinical practice and attending advanced training for complex oral rehabilitation at a leading dental school in Latin America. Participants responded to a semi-structured 38-item instrument designed to collect data on sociodemographic, professional and health variables, and on their knowledge, use, prescription and opinions of phytotherapy. Quantitative data were analyzed with descriptive and inferential statistics. Qualitative data were described and analyzed with a thematic approach. **Results:** A total 53 dentists responded the survey (88.3% response rate). Six dentists reported formal education in phytotherapy and 33 had informal knowledge. Twenty-one dentists (39.6%) reported using herbal medicine, and 17 (32.1%) prescribed phytotherapy to their patients, mostly traditional medicinal plants. A logistic regression model showed that post-graduate degree and personal use of phytotherapy were associated with phytotherapy prescription. Opinions on how to improve the rational use of phytotherapy included the need for research evidence, specific academic education, and knowledge dissemination to clinicians. As a clinical recommendation, it was proposed that questions on herbal medicine should be asked during the dental patient's anamnesis. **Conclusions:** Dentists with post-graduate degrees and personal use of phytotherapy prescribe herbal medicines for their patients in real-world clinics, regardless of formal education on the subject. Qualitative findings indicate the need to implement scientific initiatives.

**Keywords:** herbal medicine - oral health - perception - phytotherapy

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## Conhecimento, experiência e prescrição de fitoterapia em saúde bucal: Um levantamento transversal com dentistas clínicos

### RESUMO

A fitoterapia é amplamente utilizada como um tratamento integrativo e complementar para doenças crônicas comuns, mas os riscos potenciais incluem efeitos adversos e co-prescrição. **Objetivo:** Esta pesquisa exploratória avaliou o conhecimento, as atitudes e as práticas de cirurgiões-dentistas brasileiros sobre fitoterapia. **Materiais e Método:** Uma amostra consecutiva foi composta por dentistas com registro profissional, que eram ativos em prática clínica e frequentavam treinamento avançado para reabilitação oral complexa em uma das principais escolas de odontologia da América Latina. Os participantes responderam a um instrumento semiestruturado de 38 itens para coletar dados sobre variáveis sociodemográficas, profissionais e de saúde, bem como conhecimento, uso, prescrição e opiniões sobre fitoterapia. Os dados quantitativos foram analisados com estatística descritiva e inferencial. Os dados qualitativos foram descritos e analisados com abordagem temática. **Resultados:** Um total de 53 dentistas respondeu à pesquisa (taxa de resposta de 88,3%). Seis cirurgiões-dentistas relataram formação em fitoterapia e 33 possuíam conhecimento informal. Vinte e um dentistas (39,6%) relataram o uso de fitoterápicos e 17 (32,1%) prescreveram fitoterapia para seus pacientes, principalmente plantas medicinais tradicionais. Um modelo de regressão logística mostrou que pós-graduação e uso pessoal de fitoterapia estiveram associados à prescrição de fitoterapia. As opiniões para melhorar o uso racional da fitoterapia incluíram a necessidade de evidências de pesquisa, formação acadêmica específica e disseminação do conhecimento para os clínicos. Como recomendação clínica, foram propostas questões sobre fitoterapia para a anamnese odontológica do paciente. **Conclusões:** Cirurgiões-dentistas com pós-graduação e uso pessoal de fitoterapia prescrevem mais medicamentos fitoterápicos para seus pacientes em clínicas do mundo real, independentemente da educação formal sobre o assunto. Os resultados qualitativos indicam a necessidade de iniciativas de implementação científica.

**Palavras-Chave:** medicamentos fitoterápicos - saúde bucal - percepções - fitoterapia

## INTRODUCTION

Herbal medicines and medicinal plants are widely used for preventive or therapeutic reasons in many ways, including local traditional medicine, prescription by healthcare professionals, self-medication and dietary supplements. A global report by the World Health Organization (WHO) in 2019 showed that 124 Member States (64%) had laws or regulations on herbal medicines within a national policy on traditional, complementary, integrative medicine<sup>1</sup>. Thus, knowledge on traditional medicine and clinical phytotherapy have been incorporated as a complementary practice into public and private health systems to provide comprehensive health care, especially for prevention and management of lifestyle-related chronic diseases in ageing populations<sup>2</sup>. However, natural products are not always safe, and medicinal plants and herbal medicines may negatively impact health due to misuse. There are potential adverse effects and interaction of herbal medicines with other herbal products or synthetic drugs<sup>3,4</sup>, resulting in unintentional decreased, exacerbated or null effect of the target pharmacological therapy, with possible health risks. Another common challenge is coprescription with synthetic drugs that could induce polypharmacy<sup>5</sup>. These problems are common in adults, and particularly relevant for elderly patients, who often have comorbidities, use multiple medications, or self-medicate inappropriately<sup>5-7</sup>. Additionally, in contrast to synthetic drugs with isolated bioactive chemicals, herbal medicines have a system of phytochemicals with multi-target and multi-pathway actions, which can be problematic if not recognized. Therefore, the healthcare provider must assess patients' use of medicinal plants and herbal medicines prior to treatment in order to fully understand their clinical conditions.

In dentistry, the literature has shown an increasing interest in herbal medicine for several oral health problems<sup>8,9</sup>, but also reported adverse effects of herbal products in the oral cavity<sup>10</sup> and potential interaction with blood coagulation<sup>11</sup> and anesthesia<sup>12</sup>. Nevertheless, the internationally indexed literature is limited regarding the knowledge and opinions on phytotherapy indication, safety, and effectiveness among dentists in different settings of developing countries that have great biodiversity and traditional knowledge<sup>13-15</sup>, and developed countries with profitable herbal industries<sup>16,17</sup>. In Brazil, previous

studies have interviewed only a few dentists working in multi-professional teams of the public health system<sup>15,18,19</sup>, where national programs on integrative and complementary practices in primary care have been available since the late 2000s, though not fully implemented. However, private clinicians involved in oral rehabilitation are usually the ones who treat older patients with complex oral deficiencies and chronic health problems who use multiple medications. After treatment, these patients often return to the same professional for life-long maintenance and oral health care. However, this group of dental clinicians has not yet been assessed regarding their experience with phytotherapy. We hypothesize that sociodemographic (gender, age) and professional factors (post-graduate degrees, education in phytotherapy), and personal use of herbal medicine are associated with phytotherapy prescription by dentists.

The aim of this cross-sectional survey was thus to evaluate the knowledge and perceptions of oral rehabilitation practitioners on medicinal plants and herbal medicine, as well as their experiences with phytotherapy for personal use and clinical prescription in dental practice.

## MATERIALS AND METHOD

The research design is an observational, cross-sectional, survey-type, descriptive-analytic, mixed methods study. This exploratory study with dental clinicians is part of an umbrella research project on phytotherapy in dentistry. The research protocol was approved by the university's research ethics committee, in compliance with the Declaration of Helsinki, as revised in 2000, and the Brazilian regulations for research in human beings, and registered prospectively in a national system (Plataforma Brasil, CAAE: 58861222.8.0000.0075, Parecer 5.509.538).

### Participants

A consecutive non-randomized sample was obtained from the population of dentists attending clinical courses for professional development at the School of Dentistry of the University of São Paulo, a public state university located in São Paulo, the largest city in Brazil.

Dentists were recruited and selected according to the study eligibility criteria, during the second semester

of 2022. Inclusion criteria were: adults with no restriction of gender and age, who were registered as dentists in the national professional council, active in clinical practice, and attending advanced-level clinical courses to treat adult patients with major oral rehabilitation needs and/or orofacial pain. Dentists were excluded if they were unwilling to participate or unable to respond to a questionnaire.

### Survey instrument and procedures

Eligible dentists were recruited in person to participate in the study voluntarily, and those who accepted the invitation signed an informed consent form, after verbal explanation of the research protocol and before the survey. Data were collected while the dentists were attending their in-person clinical courses, from August to November 2022. Each participant answered a hard copy self-administered, semi-structured, 38-item questionnaire in Portuguese language, in privacy and with no time limit. A three-part research instrument, with closed and open-ended questions, was developed for this research, based on previous literature<sup>15,18</sup>. The content validity was verified by senior dentists and researchers with expertise in complementary and integrative medicine, research methods and ethics. The first part of the instrument consisted of 13 items to collect quantitative information on demographic and socioeconomic profile, access to and use of health services, and self-perception of general, mental and oral health. Part 2 included 14 items to collect quantitative and qualitative data on the personal use of and perception of synthetic drugs, medicinal plants and herbal medicines. Part 3 contained 11 questions to collect quantitative and qualitative data on dental clinical practices and prescription of medicinal plants and herbal medicines, as well as perceptions of use, effects, benefits and risks. At the end of Part 3, there was an open question for any suggestions to improve the rational use of phytotherapy in dental clinics. Participants could leave any question unanswered for any reason. The researchers were always available to clarify any doubt. Data obtained from completed forms were entered anonymously in a spreadsheet for analysis.

### Quantitative Data Analysis

Data were analyzed with the software JASP (Version 0.17.1) (<https://jasp-stats.org>) (<https://github.com/jasp-stats/jasp-desktop>). Descriptive statistics were

used to summarize quantitative results. Exploratory inferential statistics were used to analyze the outcome measure 'phytotherapy prescription' as a function of selected independent variables. Initially, bivariate tests (chi-squared and Fisher's exact tests) were used to calculate crude odds ratios. Multivariable logistic regression was used to analyze the factors jointly, and all variables potentially associated with 'phytotherapy prescription' were included in the final model after preliminary analysis.

### Qualitative Data Analysis

Qualitative data from open-ended questions included participants' personal use and clinical prescription of herbal medicines and medicinal plants, as well as their opinions on how to improve the rational use of phytotherapy in dentistry. Data on reported use of herbal medicines and medicinal plants were described in relation to product/preparation used or prescribed, posology, and target health problem or condition. A semantic analysis was conducted with participants' surface word meanings.

Qualitative data on dentists' opinions were encoded and analyzed using thematic analysis<sup>20,21</sup>, with inductive approach of participants' narrative and deductive refinement by researcher's interpretation. Data were analyzed by using a codebook, which was prospectively developed through engagement with the dataset. All themes (shared meanings) were obtained directly from the data for interpretation and analytic narrative. Representative excerpts were identified to illustrate each theme.

### RESULTS

A consecutive sample of 60 eligible dentists was recruited, of whom 53 responded to the survey, yielding a response rate of 88.3%. Seven dentists declined the study invitation because they did not wish to or had no time to answer the questionnaire. Descriptive statistics of sociodemographic, professional and health characteristics of the participants (Table 1) showed that participants' ages ranged from 22 to 70 years (mean age 38.8±13.5 years), and time from dental graduation from 1 to 42 years. Most dentists had excellent or good general health, oral health, and mental health. A total 33 dentists (62.3%) reported taking medications for one or more health problems, such as hypertension, hypercholesterolemia, back pain, diabetes, etc. Related to the participants' knowledge, attitudes,

**Table 1. Respondents' sociodemographic, professional and health characteristics (n=53).**

VARIABLE	Frequency	Percent	Mean	SD	95% CI
<b>Sociodemographic variables</b>					
Gender					
Male	21	39.6			
Female	32	60.4			
Age (years)					
22 to 40	28	52.8			
41 to 70	25	47.2			
Ethnic group					
White	33	62.3			
Black/Mulatto	6	11.3			
Asian	14	26.4			
<b>Professional variables</b>					
Time from dental graduation (years)			14.7	12.8	10.7 – 17.3
Dental post-graduate degree					
Yes	29	54.7			
No	24	45.3			
Workplace (as a dentist)					
Private practice only	40	75.4			
Private practice and university	9	17.0			
Private practice and public service	2	3.8			
Only public service or university	2	3.8			
<b>Health variables</b>					
Perception of general health					
Excellent – Good	47	88.7			
Average	6	11.3			
Bad – Very poor	0	0			
Perception of oral health					
Excellent – Good	52	98.1			
Average	1	1.9			
Bad – Very poor	0	0			
Perception of mental health					
Excellent – Good	41	77.4			
Average	7	13.2			
Bad – Very poor	3	9.4			

and practices regarding phytotherapy in dentistry (Table 2), a few dentists reported formal education (courses, classes) in phytotherapy for oral health care (2) or use of herbal medicine in general (4). Most dentists (33) had informal knowledge from family, friends, neighbors, and colleagues. A total 21 dentists reported using phytotherapy for personal health issues. Out of 17 dentists who prescribed phytotherapy, 14 reported doing so occasionally, and only one prescribed herbal medicine frequently. Table 3 shows the results of exploratory inferential statistics for phytotherapy prescription by dentists as a function of the variables 'gender', 'age', 'post-graduate degree', 'formal education in phytotherapy', and 'personal use of phytotherapy'. Bivariate Fisher's exact tests showed significant effect for the binary variables 'age', 'post-graduate

degree', and 'personal use of phytotherapy'. In the final logistic regression model ( $P=0.002$ ; Cox & Snell  $R^2=0.312$ ), 'post-graduate degree completed' and 'personal use of phytotherapy' were significant for the outcome 'phytotherapy prescription'. Dentists with post-graduate degrees were 7.2 times more likely to prescribe phytotherapy than those without. In relation to 'personal use of phytotherapy', dentists who used herbal medicine were 6.1 times more likely to be prescribe phytotherapy than those who did not.

A total 21 dentists (39.6%) reported using herbal medicine, and 12 described the specific plant and health indication. The most frequently cited plants for personal use were chamomile, lemongrass and passionfruit. Seventeen dentists (32.1%) reported prescribing phytotherapy for their patients, and seven

**Table 2. Respondents' knowledge, attitudes and practices regarding phytotherapy in dentistry.**

ITEM	FREQUENCY (%)		
	Yes	No	Do not know / no response
<b>Knowledge</b>			
Formal education in clinical phytotherapy for oral health care (graduate and/or post-graduate courses in dentistry)	2 (3.8)	50 (94.3)	1 (1.9)
Formal education on herbal medicine and medicinal plants (extension courses, events)	4 (7.5)	40 (75.5)	9 (17.0)
Informal knowledge on herbal medicine and medicinal plants (from family, friends, colleagues, etc.)	33 (62.3)	11 (20.7)	9 (17.0)
Self-learning knowledge on clinical phytotherapy (from the literature, internet, videos, etc.)	9 (17.0)	35 (66.0)	9 (17.0)
Knows that there is a potential risk of using herbal medicine or medicinal plant concurrently with synthetic drug	19 (35.85)	19 (35.85)	15 (28.3)
<b>Attitudes</b>			
Personal use of herbal medicines and medicinal plants	21 (39.6)	32 (60.4)	0
Believes that herbal medicine is better than synthetic drug for			
Cost	21 (39.6)	9 (17.0)	23 (43.4)
Ease of procurement	7 (13.2)	22 (41.5)	24 (45.3)
Safety	17 (32.1)	10 (18.9)	26 (49.0)
Efficacy	4 (7.55)	19 (35.85)	30 (56.6)
Speed of effect	1 (1.9)	21 (39.6)	31 (58.5)
Duration of effect	5 (9.4)	16 (30.2)	32 (60.4)
<b>Practices</b>			
Asks dental patients whether they use any medicinal plant or herbal medicine (in clinical anamnesis)	3 (5.7)	50 (94.3)	0
Prescribes phytotherapy for oral health care at the clinics	17 (32.1)	36 (67.9)	0

**Table 3. Results of bivariate tests and multivariable logistic regression model for the outcome measure 'phytotherapy prescription' by dentists (n=53).**

VARIABLE		Phytotherapy prescription (Yes)		Fisher's exact test		Logistic regression model	
		N	%	Odds ratio	P	Odds ratio (95%IC)	P*
<b>Gender</b>	Male	5	29.4	.		.	
	Female	12	70.6	0.640	0.374	3.022 (-0.460;2.671)	0.166
<b>Age (years)</b>	22 to 40	5	29.4	.		.	
	41 to 70	12	70.6	1.417	0.037	1.417 (-1.256;1.953)	0.670
<b>Post-graduate</b>	No	3	17.6	.		.	
	Yes	14	82.4	1.841	0.008	8.261 (0.266;3.957)	0.025
<b>Education in phytotherapy</b>	No	14	82.4	.		.	
	Yes	3	17.6	0.809	0.379	1.205 (-1.853;2.225)	0.858
<b>Personal use of phytotherapy</b>	No	5	29.4	.		.	
	Yes	12	70.6	1.930	0.002	7.120 (0.444;3.482)	0.011

\*Wald test

described some details of herbal prescription. The most frequently prescribed plants were passionfruit and mallow. Only two dentists reported adverse effects when patients used prescribed phytotherapy: one patient had a drop in blood pressure, while the other had stained teeth after treatment for bad breath

and aphtha. Table 4 presents the description of herbal medicines and medicinal plants used by the participants for personal reasons and professional prescription.

Table 5 shows the themes obtained from participants' opinions on how to improve the rational use of

**Table 4. Respondents' reports on herbal medicines and medicinal plants (in alphabetical order) for personal use and clinical prescription at dental clinics.**

HERBAL MEDICINE / MEDICINAL PLANT Popular name (Scientific name)	INDICATION FOR USE	PRODUCT	POSOLOGY
<b>Personal use</b>			
Anise ( <i>Pimpinella anisum</i> )	Insomnia, anxiety	Infusion	Continuous use
Bilberry ( <i>Peumus boldus</i> )	Gastritis, reflux, pain	Infusion	During event 5-10 days
Chamomile ( <i>Matricaria chamomilla</i> )	Insomnia, anxiety Gastritis, reflux, pain	Infusion	Daily, 1 per day Continuous use 5-10 days
Maytenus ( <i>Maytenus ilicifolia</i> )	Gastritis, reflux, pain	Infusion	During event
Garlic ( <i>Allium sativum</i> )	Fever, cold, sore throat	Capsule	2 months
Ginger ( <i>Zingiber officinale</i> )	Fever, flu, cold, sore throat Increase immunity Weight loss	Decoction	During event
Ginseng ( <i>Panax ginseng</i> )	Increase immunity Weight loss		
Green tea ( <i>Camellia sinensis</i> )	Increase immunity Weight loss	Tea	Daily, 1 per day Continuous use
Lavender ( <i>Lavandula sp</i> )	Insomnia	Oil	
Lemongrass ( <i>Melissa officinalis</i> )	Insomnia, anxiety Gastritis, reflux, pain Fever, cold Increase immunity	Infusion	Daily, 1 per day During event 5-10 days
Linseed ( <i>Linum usitatissimum</i> )	Xerostomia, hyposalivation	Oil	
Passionfruit ( <i>Passiflora incarnata</i> )	Insomnia, anxiety	Infusion Industrialized tablet	Daily, 1 per day During event
Sunflower ( <i>Helianthus annuus</i> )	Cutaneous wound	Oil	
Wolfberry ( <i>Lycium barbarum, Lycium chinense</i> )	Increase immunity Weight loss		
<b>Prescription for dental patient</b>			
Arnica ( <i>Arnica montana</i> )	Post-surgery care, toothache	Industrialized tablet	2 per day
Lemongrass ( <i>Melissa officinalis</i> )	Burning mouth, mucositis, stomatitis, aphtha, ulcer	Infusion (7 leaves in 1 L water)	Mouthwash (cold)
Mallow ( <i>Malva sylvestris</i> )	Gingival inflammation, mucositis, stomatitis, aphtha, ulcer	Industrialized solution	Mouthwash
Passionfruit ( <i>Passiflora incarnata</i> )	Pre-treatment anxiety	Industrialized tablet, solution	2 per day; or one tablet the night before and another one hour before the dental session
Sweet potato leaf ( <i>Ipomoea batatas</i> )	Gingival inflammation, toothache	Infusion	Mouthwash, 2 per day

phytotherapy in dentistry, as well as representative excerpts of data. Twenty participants expressed their opinions on the subject, from which three themes were derived: 1) 'Evidence on effectiveness, benefits and risks', representing the importance of sound

evidence from scientific research and traditional practices; 2) 'Specific education in graduate and post-graduate courses', denoting the need for formal education on the topic during academic courses; and 3) 'Improved communication to dental

**Table 5. Themes derived from respondents' opinions to improve the rational use of phytotherapy in dentistry and some representative excerpts.**

THEMES	Representative excerpts of respondents' opinions
Evidence on effectiveness, benefits and risks (11 code citations)	<i>(more) Studies, articles that prove the effect, the results. Awareness of the benefits (of phytotherapy) compared to synthetic drugs.</i>
Specific knowledge education in graduate and post-graduate courses (8 code citations)	<i>Need for dental undergraduate classes and postgraduate courses in pharmacology about this topic. Address this subject during the academic course, indicating its effectiveness for dental treatment.</i>
Improved communication to dental practitioners (8 code citations)	<i>We need greater dissemination about its use and application. This subject should be publicized by the Dental Councils, providing more information for us, dental clinicians, in the daily clinics.</i>

practitioners', meaning that sustained dissemination of qualified information to professionals is a priority.

## DISCUSSION

This exploratory study found that almost one third of the respondents reported prescribing herbal medicine in their clinical practice. Dentists with post-graduate degrees and personal use of phytotherapy were more likely to prescribe herbal medicine to their patients, regardless of formal education on the subject. Phytotherapy was mostly prescribed to control patients' anxiety before their dental visit, and for painful intraoral complaints in mucosa, gingiva or tongue. In addition, sociocultural factors seemed to drive dentists' attitudes and practices regarding phytotherapy, as most of them had informal knowledge on herbal medicine from family, friends, neighbors and colleagues. These findings are important to understand the use of phytotherapy by dental practitioners since the literature contains little information on prescription of herbal medicine as a first-line or complementary treatment in dentistry. To the best of authors' knowledge, no previous study has conducted an in-depth assessment of clinical dentists' knowledge, attitudes and practices in phytotherapy. Previous surveys have explored the opinions of some dentists on phytotherapy, such as the use of herbal medicine in public primary health care<sup>15,18,19</sup>, and awareness of potential adverse drug reactions<sup>13</sup>. Other studies have evaluated dental practitioners' knowledge and practice in complementary and alternative medicine (CAM)<sup>14,17</sup>, but not specifically in phytotherapy. In southern India, a country with ancient tradition in herbal medicine, 30% of dentists reported practicing alternative medicine in dentistry, including

phytotherapy<sup>14</sup>. In Germany, where naturopathy and herbal industry are strong areas, medicinal plants were the first four CAM procedures cited by clinical dentists, reaching up to 64% of recommendations<sup>17</sup>. Among the assessed variables, personal use of herbal medicine was the main factor associated with dental prescription of phytotherapy. A preceding study also reported the dominant influence of personal beliefs and practices on the teaching of herbal medicine by full-time faculty of health sciences, including dentistry<sup>16</sup>. In the present sample, almost 40% reported personal use of phytotherapy for common but specific health problems such as insomnia, anxiety, gastritis, colds and low immunity. Likewise, dentists reported prescribing herbal medicine for their patients occasionally, mainly for behavioral and symptomatic reasons. The most frequently cited medicinal plants for dental prescription were chamomile, passionfruit, mallow and lemongrass, which are widely used as traditional medicine by the general public as well<sup>18</sup>. Other traditional medicinal plants recommended by German dentists were *Arnica montana*, clove, *Salvia officinalis*, tea tree and *Aloe vera*<sup>17</sup>.

Having a post-graduate degree was another positive factor associated with dental prescription of phytotherapy. Time from dental graduation and formal education in phytotherapy were not significant factors. One possible explanation is that dentists with advanced dental education may be more open to adopting phytotherapy, which has not been regularly taught in academic healthcare courses<sup>15,18</sup> despite the increasing educational efforts in many countries<sup>1</sup>. Few dentists had received formal education in phytotherapy during their academic courses or continuing education, or from

self-learning for general or oral health purposes. On the contrary, informal knowledge on herbal medicine and medicinal plants (from family, friends, colleagues) was the most frequent source. This can be an additional explanation for the fact that most prescribed medicinal plants for dental patients were also commonly used as traditional medicine in the community<sup>18</sup>.

Limited specific knowledge on herbal medicine in dentistry was evident from the findings of the present study. This may act as a barrier for the rational use of phytotherapy in clinical practice. Most dentists did not know or did not respond whether they considered herbal medicine to be better than synthetic drugs in relation to cost, ease of procurement, safety, efficacy, or speed or duration of effect. In addition, about 36% of participants did not know that there is a potential risk of using herbal medicine or medicinal plant concurrently with a synthetic drug. This figure is similar to the number of Indian dentists who were not aware of potential adverse reactions to herbal medicines<sup>13</sup>, which can be a serious medical problem<sup>3,4</sup> and affect surgical procedures<sup>11,12</sup>. In Brazil, dentists working in the public primary healthcare sector also reported that they were not confident in prescribing phytotherapy because they lacked specific information or training<sup>15,18,19</sup>.

In the qualitative part of this study, the respondents offered insight into the problems, needs and solutions involved in improving the rational use of phytotherapy in dentistry. The three themes identified from dentists' opinions reflect a triad of joint, concurrent actions needed: 'Evidence on effectiveness, benefits and risks', 'Specific knowledge education in graduate and post-graduate courses', and 'Improved communication to dental practitioners'. Ideally, reliable content on phytotherapy should be learned during academic education and widely disseminated to professionals. However, there is a translational gap between the production of scientific knowledge and its effective use in clinical practice.

Firstly, most dental schools do not include phytotherapy content systematically in their syllabus. Formal education during academic courses is essential to build the professional foundations of clinical practice, but scientific findings are continuously evolving and changing clinical protocols over time. Therefore, over their

careers, clinicians should update their knowledge with evidence-based information from reliable sources. However, regarding the way they seek information, most dental practitioners prefer to fill a gap in their knowledge by resorting to informal sources, mainly consulting a colleague or using a general internet search<sup>22,23</sup>. The indexed literature has provided summarized scientific evidence on the use of herbal medicine in dentistry<sup>8,9</sup>, but clinicians may not search for and apply this information in practice. Indeed, most dental practitioners have reported lack of time to keep updated with the latest scientific articles, and low confidence level for using evidence-based search<sup>22,23</sup>. This situation can be more problematic for professionals who do not have access to subscription scholarly journals or are not proficient in the language of the publications.

To bridge the scientific translational gap on a large scale, the third theme 'Improved communication to dental practitioners' focused on dissemination of practical knowledge should be taken up by dental professional organizations, as mentioned by one participant. Official channels of communication can help disseminate evidence-based content to be used directly in dental practice, such as updated news and clinical practice guidelines with rigorous methodology<sup>24</sup>. Dissemination and implementation of research is a top priority in behavioral and social oral health sciences to tackle the evidence-to-practice gap and improve oral health education, promotion and care, as well as continuous professional training<sup>25,26</sup>. It is noteworthy that this sample consisted of dentists who were seeking professional development in clinical courses to treat adult patients with complex oral rehabilitation needs. However, many patients may not disclose the use of over-the-counter medications, herbal medicine, or dietary supplements in medical and dental visits<sup>27</sup>, while healthcare professionals may not be aware of the importance of this subject. In fact, 94% of the respondents did not ask their patients whether they used any medicinal plant. To help practitioners improve their routine procedures in dental patient anamnesis, four specific questions on medicinal plants and herbal medicines have been suggested, based on the study findings, scientific literature, and researchers' experience (Table 6). The aims of these questions are to enquire about patients' use of such products, and to raise awareness on the importance of reporting it before and during dental treatment.



**Table 6. Clinical practice recommendation of specific questions on use of medicinal plants and herbal medicines for dental patient's anamnesis.**

PROPOSED QUESTION	RATIONALE
<i>Do you use any natural product, herbal medicine, medicinal plant (such as leaves, roots, and flowers) or dietary supplement? It can be in any form, such as tea or infusion, extract, oil, pills, etc.</i>	It is important to be specific in asking patients about any form of internal or external use. Some people may not remember during dental anamnesis that they use some traditional medicine.
<i>If YES, please explain WHY, HOW and WHEN you use it.</i>	Indication and posology are important to assess potential risks for dental treatment and further research, if appropriate.
<i>If YES, did you receive a prescription or recommendation from someone or learn by yourself?</i>	To ascertain whether there is a professional prescription, traditional practice of other source of information.
<i>Are you aware that any medication, including herbal medicine and dietary supplements, can have adverse effects or interfere with your dental treatment?</i>	To alert patients about the potential health risks of any medication or traditional product used, as well as the need to report their use to the dentist.

A limitation of this preliminary study is the small number of respondents from a single location, which does not allow the findings to be generalized to the entire population of clinical dentists. However, this sample consisted of real-world dental practitioners and should be more homogeneous than samples obtained in online surveys. Moreover, as far as we know, this was the first study that collected quantitative and qualitative research data on dentists' knowledge, attitudes and practices regarding phytotherapy. This comprehensive information was analyzed by the research team, which consisted of three members specializing in complementary and integrative medicine (clinical phytotherapy and acupuncture), and two experts in health social sciences.

The outcomes of this exploratory study will contribute to refine the research model and instrument for large-scale application among dental practitioners and clinical staff. A further step is to design a participatory research project to allow front-line dental clinicians engage with scientific knowledge production and use in practice. In addition, it would be useful to conduct a prospective

study with implementation of education activities on phytotherapy in dentistry using digital technologies. To gain capillarity and reach the end-user clinicians, it will be necessary to build sustained collaboration with dental associations and professional councils to broadly disseminate evidence-based information and good practices on the rational use of phytotherapy in oral healthcare.

## CONCLUSION

In summary, the results suggest that dentists with post-graduate degrees and who use herbal medicine for their own health issues also prescribe phytotherapy for dental patients. Most dentists perceive a lack of specific information about herbal medicine during their academic training and from professional sources in dentistry. Therefore, professional behavior and the practice of phytotherapy in dental clinics seem to reflect personal experience with general health rather than formal education and scientific knowledge on the subject. The implementation of scientific initiatives can help solve the evidence-to-practice gap.

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## CONFLICT OF INTEREST

The authors declare no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

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