

Brazilian scientific production on herbal medicines used in dentistry**CASTRO, R.D.¹, OLIVEIRA, J.A.², VASCONCELOS, L.C.², MACIEL, P.P.², BRASIL, V.L.M.²**

¹ Professor Doutor do Programa de Pós-graduação em Odontologia da UFPB, Universidade Federal da Paraíba, Campus I, Cidade universitária, 58051-900, João Pessoa, PB, Brasil; ² Programa de Pós-graduação em Odontologia da UFPB, Universidade Federal da Paraíba, Campus I, Cidade universitária, 58051-900, João Pessoa, PB, Brasil. * Autor correspondente: ricardodiasdecastro@yahoo.com.br.

ABSTRACT: The objective of this study was to critically analyze the scientific production published in specialized Brazilian journals concerning the use of medicinal plants in dentistry. A literature review was carried out using an indirect documentation technique by means of a bibliographical study. Four examiners performed independent searches in Brazilian journals of medicinal plants indexed in the database SciELO (Brazilian Journal of Pharmacognosy; Brazilian Journal of Medicinal Plants; Brazilian Journal of Pharmaceutical Sciences; and Acta Botanica Brasílica) using the descriptors “herbal medicine/phytotherapy” or “medicinal plants” and “dentistry”. The articles published from 2002 to 2012 addressing the use of medicinal plants in dentistry were included and analyzed. The searches based on the descriptors and reading of abstracts, resulted in 155 articles. Of these, 44 were read in full and a total of 16 publications met the eligibility criteria and were selected. Laboratory studies predominated (10) and were limited to the evaluation of antimicrobial properties by means of tests for determining inhibitory, fungicidal and bactericidal concentrations. Three literature reviews and only one clinical trial with no blinding and randomization were found. It is highlighted the need for better methodological designs in the researches and greater production of clinical or *in vivo* studies.

Key words: Dentistry, Ethnobotany, Medicinal Plants, Phytotherapy, Plant Extracts.

RESUMO: Produção científica brasileira sobre o uso de plantas medicinais na odontologia.

O objetivo deste estudo foi analisar criticamente a produção científica acerca do uso de plantas medicinais em Odontologia nos periódicos brasileiros especializados. Realizou-se uma revisão da literatura, utilizando técnica de documentação indireta a partir de um estudo bibliográfico. Quatro pesquisadores procederam, de forma independente, uma busca nas revistas brasileiras de plantas medicinais indexadas na base de dados Scielo (Revista brasileira de farmacognosia; Revista brasileira de plantas medicinais; Brazilian journal of pharmaceutical sciences; Acta botânica. brasílica) utilizando como descritores “fitoterapia” ou “plantas medicinais” e “Odontologia”. Os artigos publicados de 2002 a 2012 que envolveram o uso de plantas medicinais em Odontologia foram incluídos e analisados. A busca por descritores e leitura de resumos gerou 155 artigos, dos quais 44 foram lidos na íntegra, sendo selecionadas 16 publicações que se enquadraram aos critérios requeridos. Estudos laboratoriais foram majoritários (10), e limitaram-se em avaliar propriedades antimicrobianas através das concentrações inibitórias, fungicidas e bactericidas. Três foram revisões da literatura e apenas um ensaio clínico esteve presente, sendo o cegamento e a randomização ausentes. Evidenciou-se a necessidade de um melhor delineamento metodológico das pesquisas e de uma maior produção de estudos clínicos ou *in vivo*.

Palavras-chave: extratos vegetais, etnobotânica, fitoterapia, odontologia, plantas medicinais.

INTRODUCTION

Plants have been used worldwide with medicinal purposes. In this perspective, Brazil has a great potential for the development of herbal medicine, since it holds the largest plant diversity

in the world and also encompasses a wide social diversity (Martins, 2000; Albuquerque & Hanazaki, 2006). This might explain the resurgence of natural medicine in Brazil in recent years, with emphasis

on the use of medicinal plants for health recovery (Yunes et al., 2001; Borba & Macedo, 2006). Plant extracts are not only raw materials for industrial production of pure chemical derivatives, but they are also components of herbal formulations used in the treatment of several diseases (Lima Júnior & Souza, 2005).

The use of herbal medicines has been an alternative therapeutic option for health professionals in the search for greater pharmacological activity, higher biocompatibility, low toxicity and a more affordable treatment to the population (Castilho et al., 2007). In addition, it may be provided equivalent registered drugs with proven efficacy for the same or other clinical indications (Rates, 2001).

The increasing use of herbal medicine, commonly in a judicious and indiscriminate way, together with the scarcity of high quality studies in this field and limited access to the literature on this topic, have raised many issues about the effectiveness and safety of herbal medicines. The empirical knowledge accumulated over the years based on cultural tradition, coupled with scientific findings has shown that medicinal plants and herbal medicines bring benefits to the body, as well as can cause adverse effects and toxicity and be contraindicated (Alexander Garcia & Simões, 2005) just as any other substance with pharmacological effects.

Although with many gaps in scientific research (Oliveira, 2010), there was an official recognition of the practicability of using herbal medicines in the Brazilian public health system (Bettega et al., 2011). In 2008, the 2.960/2008 inter-ministry ordinance implemented the National Program of Medicinal Plants and Herbal Medicines in the Unified Health System (UHS). The role of dentists in this field has gained more strength with the Resolution 082/2008 of the Federal Council of Dentistry (FCO), through which herbal medicine was

recognized as an integrative and complementary practice in oral health (Assis, 2009).

Even though a number of public policies have been created with the purpose of encouraging the study and clinical use of medicinal plants, herbal medicine takes place in a modest way by dental practitioners mainly due to the lack of scientific support – specifically for plant species indicated to prevent/treat oral diseases (Oliveira, 2010). According to Bettega et al. (2011), this resistance can be attributed to the lack of standardization and knowledge about prescription as well as skepticism and conviction that manufactured drugs have more guaranteed effectiveness. Nevertheless, there has been a growing interest in this subject in recent years, demonstrated by the increased number of studies with natural products in dentistry (Castilho et al., 2007). These studies point out that medicinal plants can be used therapeutically against oral diseases (Oliveira, 2010), displaying anti-inflammatory, analgesic and anti-hemorrhagic properties for the treatment of odontalgias and other oral disorders (Lima Júnior et al., 2005).

Thus, given the need for further research addressing the use of medicinal plants for the prevention and treatment of oral diseases, this study aimed to critically analyze the scientific production on medicinal plants published in Brazilian specialized journals over the last ten years.

MATERIALS AND METHODS

Search strategy

This is a bibliographical study using the indirect documentation technique. A critical review of scientific studies about the use of herbal medicines in dentistry was carried out following the guidelines of the Brazilian Cochrane Collaboration. Searches were conducted in Brazilian specialized journals of

Table 1. Identification of inclusion and exclusion criteria defined for this study.

Inclusion criteria	Exclusion criteria
Period and language of publishing: Studies published between January 2002 and December 2012 in Portuguese and English	Studies published before 2002
Study design: Clinical trials and laboratory assays (<i>in vivo</i> , <i>in situ</i> and <i>in vitro</i>)	All studies that did not match the search strategy
Experimental product: Naturally-occurring agents	Studies evaluating synthetic products
Primary interest: Use against oral diseases (dental caries, periodontal diseases, mycoses)	Studies whose design did not characterize the clinical context of interest

medicinal plants indexed in the database SciELO (Brazilian Journal of Pharmacognosy; Brazilian Journal of Medicinal Plants; Brazilian Journal of Pharmaceutical Sciences; Acta Botanica Brasílica). The articles discussing the use of herbal medicines to prevent and treat oral diseases, published between January 2002 and December 2012, were selected. Articles were included only from these journals in order to assess the national production through the publication of results approved by expert reviewers in the subject (Table 1).

The selection of descriptors was done based on DecS (subject descriptors in health sciences, BIREME <http://www.bireme.br>) in Portuguese and English. At first, it was used “herbal medicine” OR “medicinal plants” AND “Dentistry” in the SciELO database. Subsequently, more detailed searches were performed directly on each national specialized journal, using only the descriptor “dentistry,” in order to avoid losses of articles that met the inclusion criteria proposed for the study. The abstracts that met the inclusion criteria regardless of the language in which they had been published were pre-selected. Then an analysis of the methodological quality of full texts was performed by four independent trained examiners.

Analysis of studies

The variables analyzed were: study nature (quantitative or qualitative), study type (descriptive or experimental), search strategy (laboratory or field research), research subjects (cell culture, animals or humans), statistical analysis, language and year of publication. Botanical data were gathered to evaluate: species and part of the plant used in the study, pharmaceutical form, phytochemical analysis and botanical identification. It was also considered the disease against which the herbal medicine was used and its therapeutic purpose. For clinical studies, it was considered: the type of subject allocation (randomization or convenience), sampling (probabilistic or non-probabilistic), masking of products, use of placebo or control, intra and inter-examiner calibration, and pilot study.

In order to assess the methodological consistency of each article, an assessment of quality, internal and external validity was carried out independently for each study by four examiners. Clinical studies were classified according to Jadad's scale (Jadad 1996), which assigns a score from 0 to 5 to the studies. Jadad's scale checks the validity of the evidence on interventions and evaluates three conditions: randomization, blinding and loss of follow up. Based on these criteria, it is assigned a score to the study ranging from 0 to 5. Articles that did not meet the inclusion criteria (addressing the use of herbal medicines in dentistry) were classified as “discarded”.

RESULTS

The search strategy in the databases resulted in 155 studies (Table 2).

After abstracts were examined, 44 studies were selected to be read in full, from which 16 met the methodological criteria required (Table 3 and 4). Of these 16 articles, 10 were *in vitro* laboratory studies; 02 were ethnobotanical field studies based on interviews with healers or community; 03 were literature reviews; and only 01 was a phase 2 clinical trial.

DISCUSSION

The Brazilian territory is home to around 20 % of global biodiversity including plants, which serve as raw material for the production of herbal and other medicines. Together with this is the vast cultural and ethnic diversity of Brazil, responsible for the knowledge on the management and use of medicinal plants passed down over generations (Brazil, 2006). Hence, national journals falling into this scope are expected to provide a large contribution with several high quality publications from different areas of health, including dentistry. Nevertheless, the results found in this study are in disagreement with this expectation.

The study types found were: *in vitro* (majority), ethnobotanical studies, literature review and clinical trial. Despite the remarkable importance of *in vitro* studies, they take place on the base of the pyramid regarding levels of scientific evidence (Cook et al., 1995). However, considering the great potential of Brazil in this area, researches with scientific evidence such as *in vivo* studies, clinical trials or systematic reviews were considered scarce in the field of dentistry. Although there was a large number of *in vitro* studies, which could lead a variety of methodological approaches, the investigations were basically limited to MIC and MBC/MFC tests of extracts against microorganisms causing dental caries (Vasconcelos et al., 2008; Silva et al., 2008; Pereira et al., 2006; Melo et al., 2006; Macedo-Costa et al., 2009; Carvalho et al., 2009) and oral candidiasis (Lubian et al., 2010; Castro & Lima, 2011; Alves et al., 2006).

Besides the antifungal and antibacterial potential of medicinal plants against dental infections, it is important to study and evaluate other properties such as anesthetic, analgesic (Soares et al., 2009), antiviral (Kazyiama et al., 2012), antimutagenic and antitumor (Maciel et al., 2002) activities. Toxicological studies addressing possible adverse effects of medicinal plants (Cowan, 1999; Veiga Júnior et al., 2005) are also scarce, given their importance for the evolution and progression of researches in this field. In this respect, it was observed that the scientific

Table 2. Selection of studies according to the descriptors and reading of abstracts and full texts.

Identification of potentially relevant studies based on their titles and abstracts	Brazilian Journal of Pharmacognosy	107
	Brazilian Journal of Medicinal Plants	13
	Brazilian Journal of Pharmaceutical Sciences	33
	Acta Botanica Brasilica	2
	Total	155
Collection and reading of selected studies	Brazilian Journal of Pharmacognosy	32
	Brazilian Journal of Medicinal Plants	10
	Brazilian Journal of Pharmaceutical Sciences	5
	Acta Botanica Brasilica	1
	Total	44
Included studies	Brazilian Journal of Pharmacognosy	9
	Brazilian Journal of Medicinal Plants	6
	Brazilian Journal of Pharmaceutical Sciences	0
	Acta Botanica Brasilica	1
	Total	16
Excluded studies	Brazilian Journal of Pharmacognosy	23
	Brazilian Journal of Medicinal Plants	4
	Brazilian Journal of Pharmaceutical Sciences	5
	Acta Botanica Brasilica	0
	Total	28

Table 3. Main author, language, year of publication, article title, national journal and study design of selected studies.

Main Author	Language	Year of publication	Article title	Journal	Study Design	JADAD Scale
ALVES, P. M.	Portuguese	2006	Antifungal activity of the extract of <i>Psidium guajava</i> Linn. ("goiabeira") upon <i>Candida</i> yeasts of the oral cavity: an <i>in vitro</i> evaluation	Brazilian Journal of Pharmacognosy	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable
BORBA, A. M.	Portuguese	2006	Medicinal plants used for oral health in the Santa Cruz neighborhood, Chapada dos Guimarães, Mato Grosso State, Brazil	Acta botanica Brasilica	Qualitative Descriptive Field research	Not applicable
MELO, A. F. M.	Portuguese	2006	<i>In vitro</i> antimicrobial activity of an extract of <i>Anacardium occidentale</i> L. against <i>Streptococcus</i> species	Brazilian Journal of Pharmacognosy	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable
PEREIRA, J. V.	Portuguese	2006	<i>In vitro</i> antibacterial and anti-adherent effect of the extract of <i>Punica granatum</i> Linn. upon dental biofilm microorganisms	Brazilian Journal of Pharmacognosy	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable
OLIVEIRA, F. Q.	Portuguese	2007	Plants species indicated in odontology	Brazilian Journal of Pharmacognosy	Qualitative Descriptive	Not applicable

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Table 3. Main author, language, year of publication, article title, national journal and study design of selected studies.

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SILVA, M.S.A	Portuguese	2008	<i>In vitro</i> antimicrobial activity and anti-adherence of <i>Rosmarinus officinalis</i> Linn. against oral planktonic bacteria	Brazilian Journal of Pharmacognosy	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable
VASCONCELOS, K. R. F.	Portuguese	2008	<i>In vitro</i> assessment of antibacterial activity of a dental cement constituted of <i>Copaifera multijuga</i> Hayne oil-resin	Brazilian Journal of Pharmacognosy	Quantitative Clinical trial <i>in-vivo</i> Controlled	Not applicable
SANTOS, E. B.	Portuguese	2009	Etnobotanical studies of medicinal plants for oral conditions in the municipality of João Pessoa, Brazil	Brazilian Journal of Pharmacognosy	Quantitative Qualitative Descriptive Field research	Not applicable
CARVALHO, C. M.	Portuguese	2009	<i>In vitro</i> antimicrobial effect of jabuticaba (<i>Myrciaria cauliflora</i> (Mart.) O. Berg) extract on <i>Streptococcus</i> from the oral cavity	Brazilian Journal of Medicinal Plants	Quantitative Experimental <i>in-vitro</i> Uncontrolled	Not applicable
M A C E D O - COSTA, M. R.	Portuguese	2009	Effectiveness of the <i>Myrciaria cauliflora</i> (Mart.) O. Berg. extract on oral bacteria	Brazilian Journal of Pharmacognosy	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable
LUBIAN, C.T	Portuguese	2010	Antifungal activity of the aqueous extract from <i>Arctium minus</i> (Hill) Bernh. (Asteraceae) on oral <i>Candida</i> species	Brazilian Journal of Medicinal Plants	Quantitative Experimental <i>in-vitro</i> Uncontrolled	Not applicable
CASTRO, R. D.	Portuguese	2011	Antifungal activity of Brazilian sassafras (<i>Ocotea odorifera</i> Vell.) and rosemary (<i>Rosmarinus officinalis</i> L.) essential oils against the genus <i>Candida</i>	Brazilian Journal of Medicinal Plants	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable
OLIVEIRA, A. C. M.	Portuguese	2011	Use of <i>Melaleuca alternifolia</i> Cheel (Myrtaceae) oil in dentistry: perspectives on its use as alternative antimicrobial to infectious diseases of oral origin	Brazilian Journal of Medicinal Plants	Qualitative Descriptive	Not applicable
PAIVA, L. C. A.	Portuguese	2011	Clinical and laboratorial evaluation of <i>Uncaria tomentosa</i> (Cat's Claw) gel on oral candidiasis	Brazilian Journal of Pharmacognosy	Quantitative Clinical trial <i>in-vivo</i> Controlled	1
FREIRES, I.A.	English	2012	Clinical applicability of natural product(s)-containing mouthwashes as adjunctive treatment of biofilm-induced gingivitis: a systematic review	Brazilian Journal of Medicinal Plants	Qualitative Descriptive Systematic review	Not applicable
ALMEIDA, L.F.D.	English	2012	Antifungal activity of essential oils against clinical samples of <i>Candida albicans</i> isolated from HIV-positive patients	Brazilian Journal of Medicinal Plants	Quantitative Experimental <i>in-vitro</i> Controlled	Not applicable

Table 4. Main author and year, study subjects, plant and therapeutic purpose, methods, calibration of examiners, pilot study and statistical analysis of selected studies.

Main author/ Year	Study subjects	Pharmaceutical form/ part of the plant	Therapeutic purpose/ Pathology	Sample description	Methods	Calibration and pilot study	Statistical analysis
ALVES, P. M. (2006)	Fungal strains: <i>Candida albicans</i> , <i>C. tropicalis</i> , <i>C. stelatoidea</i> and <i>C. krusei</i>	Hydroalcoholic extract / Guava leaves (<i>Psidium guajava</i> Linn).	Treatment of mycosis	Strains of <i>C. albicans</i> (24), <i>C. tropicalis</i> (25), <i>C. stelatoidea</i> (23) and <i>C. krusei</i> (9)	McGinnis methods (1980): Solid diffusion method for determination of MIC. Tests were performed in duplicate.	Not applicable	Descriptive
BORBA, A. M. (2006)	Human beings	Not applicable	Not applicable	40 people with folk knowledge in medicinal plants.	Semi-structured interviews and observation on which medicinal plant had been popularly used in the region.	Not stated	Descriptive
MELO, A. F. M. (2006)	Bacterial strains: <i>S. mutans</i> , <i>S. mitis</i> and <i>S. sanguis</i>	Hydroalcoholic extract / Stem bark of <i>Anacardium occidentale</i> L.	Prevention of dental caries	Replication of three standard strains: <i>S. mitis</i> , <i>S. mutans</i> and <i>S. sanguis</i>	It was used the technique of wells by the agar diffusion method for determination of MIC. Tests were performed in duplicate.	Not applicable	Descriptive
PEREIRA, J. V. (2006)	Bacterial strains: <i>Streptococcus mitis</i> , <i>Streptococcus mutans</i> , <i>Streptococcus sanguis</i> , <i>Streptococcus sobrinus</i> , and <i>Lactobacillus casei</i>	Hydroalcoholic extract / stem bark of pomegranate (<i>Punica granatum</i> Linn.)	Prevention of dental caries	Standard strains of <i>Streptococcus mitis</i> (ATCC 9811), <i>Streptococcus mutans</i> (ATCC 25175), <i>Streptococcus sanguis</i> (ATCC 10557), <i>Streptococcus sobrinus</i> (ATCC 27609) <i>Lactobacillus casei</i> (ATCC 7469)	It was used the agar diffusion method for determination of MIC and the technique of inclined glass tubes for determination of the MICA (Minimum Inhibition Concentration of Adherence) in the presence of 5% sucrose.	Not applicable	Descriptive
OLIVEIRA, F. Q. (2007)	Books, scientific and popular articles and websites	Not applicable	Identification of species indicated for the treatment of dental diseases	Not applicable	For each species, the following information was gathered: scientific and popular name, family, pharmaceutical form and therapeutic purpose.	Not stated	Not stated
SILVA, M.S.A (2008)	Bacterial strains: <i>Streptococcus mitis</i> , <i>Streptococcus sanguinis</i> , <i>Streptococcus mutans</i> , <i>Streptococcus sobrinus</i> and <i>Lactobacillus casei</i>	Hydroalcoholic extract / leaves and stems of <i>Rosmarinus officinalis</i> Linn. (rosemary)	Prevention of dental caries	Standard strains of <i>Streptococcus mitis</i> (ATCC 98811) <i>Streptococcus sanguinis</i> (ATCC 10556), <i>Streptococcus mutans</i> (ATCC 25175), <i>Streptococcus sobrinus</i> (ATCC 27609) and <i>Lactobacillus casei</i> (ATCC 7469)	It was used the agar diffusion method for determination of MIC and technique of inclined tubes for determination of MICA in the presence of 5% sucrose.	Not applicable	Descriptive
VASCONCELOS, K. R. F. (2008)	Bacterial strains: <i>Streptococcus mutans</i> and <i>S. sanguinis</i> .	Oleo-resin / stem of <i>Copaifera multijuga</i> Hayne (copaiba)	Treatment of dental caries	Standard strains of <i>Streptococcus mutans</i> (ATCC 25175) and <i>S. sanguinis</i> (ATCC 15300)	Method of dilution in liquid culture medium by Andrews (2001), modified by Abinader (2005) for determination of MIC.	Not applicable	Descriptive

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Table 4. Main author and year, study subjects, plant and therapeutic purpose, methods, calibration of examiners, pilot study and statistical analysis of selected studies.

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SANTOS, E. B. (2009)	Human beings	Not applicable	Prevention and treatment of oral diseases	Not applicable	It was carried out a survey using a form. The sample consisted of healers ("raizeiros") (n=20) and users (n=200).	Not stated	Descriptive and inferential
CARVALHO, C. M. (2009)	Bacterial strains: <i>Streptococcus mutans</i> , <i>Streptococcus sobrinus</i> and <i>Streptococcus sanguis</i>	Hydroalcoholic extract / leaves of jabuticaba tree (<i>Myrciaria cauliflora</i>)	Prevention of dental caries	Standard strains of <i>Streptococcus mutans</i> (ATCC 25175), <i>Streptococcus sobrinus</i> (ATCC 27609) and <i>Streptococcus sanguis</i> (ATCC 10557)	Solid medium diffusion method for determination of MIC.	Not applicable	Descriptive
MACEDO-COSTA, M. R. (2009)	Bacterial strains: <i>Streptococcus mitis</i> , <i>Streptococcus mutans</i> , <i>Streptococcus sanguinis</i> , <i>Streptococcus oralis</i> , <i>Streptococcus salivarius</i> , and <i>Lactobacillus casei</i> .	Hydroalcoholic extract / leaves of jabuticaba tree (<i>Myrciaria cauliflora</i>)	Prevention of dental caries	<i>Streptococcus mitis</i> (ATCC 903), <i>Streptococcus mutans</i> (ATCC 25175), <i>Streptococcus sanguinis</i> (ATCC 15300), <i>Streptococcus oralis</i> (ATCC 10557), <i>Streptococcus salivarius</i> (ATCC 7073) and <i>Lactobacillus casei</i> (ATCC 9595).	Solid medium diffusion method for determination of MIC. Tests were performed in duplicate.	Not applicable	Descriptive and inferential
LUBIAN, C.T (2010)	Fungal strains: <i>Candida albicans</i> , <i>C. tropicalis</i> , <i>C. glabrata</i> , <i>C. stellatoidea</i> , <i>C. dubliniensis</i> and <i>C. krusei</i>	Aqueous extract / leaves of <i>Arctium minus</i> (Hill) Bernh (burdock)	Treatment of mycosis	Standard strains (ATCC 44858) and three different strains of clinical isolates of <i>C. albicans</i> , <i>C. tropicalis</i> and <i>C. krusei</i>	Antifungal tests were carried out using the broth microdilution technique.	Not applicable	Descriptive
CASTRO, R. D. (2011)	Fungal strains: <i>Candida albicans</i> and <i>C. tropicalis</i>	Essential oil / leaves of <i>Ocotea odorifera</i> Vell. (sassafras) and <i>Rosmarinus officinalis</i> L. (rosemary)	Treatment of mycosis	Strains of <i>C. albicans</i> (ATCC- 90028), <i>C. albicans</i> (ATCC-76615), <i>C. albicans</i> (ATCC-76645), <i>C. albicans</i> (ATCC-76485), <i>C. tropicalis</i> (ATCC-13803), <i>C. albicans</i> (LM-42V), <i>C. albicans</i> (18F), <i>C. albicans</i> (MD-37), <i>C. albicans</i> (LM-968), <i>C. albicans</i> (ICB-12), <i>C. tropicalis</i> (LM-708), <i>C. tropicalis</i> (LM-14), <i>C. tropicalis</i> (LM-028), <i>C. tropicalis</i> (LM-37), <i>C. tropicalis</i> (LM-13) and <i>C. tropicalis</i> (LM-759).	Microdilution technique was used for determination of MIC according to the Reference method for broth dilution antifungal susceptibility testing of yeasts.	Not applicable	Descriptive
OLIVEIRA, A. C. M. (2011)	Books, scientific articles and websites	Not applicable	Prevention and treatment of dental caries, periodontal disease and pulp injuries.	Not applicable	No search strategy was described	Not stated	Not stated

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Table 4. Main author and year, study subjects, plant and therapeutic purpose, methods, calibration of examiners, pilot study and statistical analysis of selected studies.

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PAIVA, L. C. A. (2011)	Human beings	Phytodrug in gel form contained in tubes with 10 g of <i>Uncaria tomentosa</i> (cat's claw)*	Treatment of mycosis	20 patients with clinical and laboratorial diagnosis of <i>Candida</i> infection.	Test group (10): gel 3x / day for 14 days. Control group (10): Miconazole/Daktarin Gel 3x / day for 14 days. Blinding was not reported.	Not stated	Descriptive and inferential
FREIRES, I.A (2012)	Systematic review in the databases Medline, SciELO, LILACS and Cochrane Library.	Not applicable	Prevention and treatment of biofilm-induced gingivitis using mouthwashes containing natural products.	Not applicable	Searches were carried out in the databases Medline, SciELO, LILACS and Cochrane Library using combination of the key-words "gingivitis/ natural products/ herbal medicines/ mouthwashes, in English, Portuguese and Spanish. The methodological design of studies was assessed according to Jadad's scale (Jadad et al., 1996).	Yes	Descriptive
ALMEIDA, L.F.D (2012)	Fungal strains of <i>Candida albicans</i> isolated from HIV+ patients (CA 01- CA 15) and a standard strain (ATCC 76845).	Essential oils / <i>Ocimum basilicum</i> L. (basil), <i>Cymbopogon martinii</i> L. (palmarosa), <i>Thymus vulgaris</i> L. (thyme) and <i>Cinnamomum cassia</i> Blume (Chinese cinnamon)*	Treatment of mycosis	Strains of <i>Candida albicans</i> (CA 01- CA 15) isolated from HIV+ patients and a standard strain (ATCC 76845)	Antifungal tests were carried out using the broth microdilution technique	Not applicable	Descriptive

*The plant part was not mentioned.

production on herbal medicine in dentistry needs to broaden thematic approaches and advance with regard to the level of evidence. This fact can be confirmed by the scarcity of phase 1 and 2 clinical trials, scientifically supported by previous laboratory studies.

Only one clinical trial was retrieved in the searches (Paiva et al., 2009), which was a phase 2 study investigating the effect of an herbal product on *Candida*-associated denture stomatitis. The authors did not report sample size calculation or any other scientific parameter to justify the number of participants recruited. Additionally, there was no description of blinding and sample randomization, but only of loss of follow-up of subjects, which led this study to reach a score 1 on Jadad's scale. This scale serves as a parameter for qualifying clinical trials, by which a study is considered biased when

it does not score a value greater than 3.

Another aspect to be considered is the fact that the selection of plants to be investigated commonly lacks satisfactory basis, as observed in the studies by Carvalho et al. (2009) and Costa-Macedo et al. (2009). These authors investigated the extract from *Myrciaria cauliflora* (Mart.) O. Berg. (jabuticaba tree) leaves even in the absence of justifiable evidence, being only supported by the information that it contained ascorbic acid, tannins and cyaniding, and peonidin glycosides (Reynertson et al., 2006) in its composition.

Although such studies require triplicate experiments, Carvalho et al. (2009) carried out their experiment in duplicate, leaving room for the unreliability of their findings.

Ethnobotanical studies have been developed as a way to guide experts on the botanical species

to be investigated. It allows for the identification of plants with their respective forms of use and folk medicine established over the time, according to Santos et al. (2009) and Borba & Macedo (2006). Given the importance of this type of study, it surprises the fact that only two ethnobotanical investigations were among the national publications. Moreover, in order to contribute to further researches of this nature as well as to ensure the reliability of the data collection instrument, the authors were expected to describe in detail the form (data collection instrument) used in their study, clarifying whether it was based on some other form previously used and validated in the literature. Attaching the form used to the published article would also favor its use by other studies, whose results could be discussed and compared.

The way how researches obtained the plants to be analyzed lacks standardization and raises questions about the safety of their origin conditions. While Pereira et al. (2006), Macedo-Costa et al. (2009), Carvalho et al. (2009) and Alves et al. (2006) found the plant material in street fairs, Silva et al. (2008) and Melo et al. (2006) collected their material in controlled environments, derived from plantation sites located in the university where their studies were undertaken. Lubian et al. (2010) also adopted a criterion for plant collection, as they reported it was held during the flowering period. In streets fairs or similar places, the lack of information about soil and growing environment conditions favors methodological biases. Freitas et al. (2004) pointed out that plants produce secondary metabolites as a function of an interaction with the environment, responding to chemical and biological factors. Thus, this lack of standardization can lead to biased researches as well as explain diverging results obtained in similar studies.

Some *in vitro* studies used percolation or leaching in continuous flow at room temperature as the extraction method (Alves et al., 2006; Pereira et al., 2006), while other authors have made use of an alcoholic or hydroalcoholic extraction solution to obtain their extracts (Silva et al., 2008; Carvalho et al., 2009; Macedo-Costa et al., 2009; Melo et al., 2009). Despite identifying the method used, its choice was not justified in the studies, which might lead to shortcomings in the methodological design. Alves et al. (2006) and Pereira et al. (2006) reported only the choice for room temperature for the leaching process because high temperatures might interfere with the ultimate stability of the substance. According to Cowan (1999), for studies to be more systematic, the methods of extraction of essential oils and also the methodological design of *in vitro* tests should be standardized. This would facilitate findings interpretation and comparison.

Interpretation of results and establishment of conclusions should be done avoiding inappropriate extrapolations. Oliveira et al. (2011) conducted a literature review and concluded improperly based on limited *in vitro* studies that TTO (tea tree oil) is an alternative agent to chlorhexidine against oral microorganisms. Indeed, conclusions and recommendations of this nature are reliable when supported by randomized controlled trials or systematic literature reviews. The latter bring together results of properly designed clinical trials, therefore assisting in clinical decisions (Cook et al., 1995).

Given the above, the present study indicates that the national production of scientific articles addressing medicinal plants or herbal medicine in dentistry is still scarce; most studies were laboratorial and investigated the antifungal and antibacterial properties of plant materials. It is important to emphasize the need for further publications in this area and also for advances in science by means of clinical trials, previously supported by *in vitro* findings.

The broadening of thematic approaches in relation to the national production available can bring interesting implications. Furthermore, it becomes critical to define systematic methodological standards in order to facilitate the comparison of results and avoid biases to scientific inferences.

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