

# HERBAL MEDICINES IN DENTISTRY: HISTORY, OBTAINMENT METHODS, AND PROPERTIES OF *COPAIFERA MULTIJUGA HAYNE* AND *BACCHARIS DRACUNCULIFOLIA DC*

## ABSTRACT

The aim of this study was to do a literature review on herbal medicines used in dentistry. For that purpose, an electronic search of papers in Portuguese, Spanish, and English was performed in the following databases: PubMed, MEDLINE, SciELO, Science Direct, LILACS, and BBO, supplemented by hand search in books, theses, and journals. For the search, the following keywords were used: phytotherapy, *Copaifera*, and *Baccharis dracunculifolia*. Medicinal plants have been used since ancient times and some of them such as the *Copaifera multijuga Hayne* and *Baccharis dracunculifolia DC* have shown medicinal properties. Different ways to obtain extracts from those plants have been described, as well as their many important properties, such as antimicrobial, anti-inflammatory, and antiseptic effects. However, studies on their medicinal properties are still scarce, which indicates the need for further studies to unravel their effects and possible side effects, as well as implications of improper use of these plants.

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## KEYWORDS

Herbal medicine. Phytotherapy. Baccharis.

## INTRODUCTION

Herbal medicine can be defined as a science that studies the use of plant products for therapeutic purposes, i.e., to prevent, mitigate, and cure diseases. In addition, herbal medicines are available to the population and public health services at more affordable costs as compared to medicines obtained through chemical synthesis, which are usually more expensive due to patent costs.<sup>1</sup>

Knowledge about medicinal plants for healing purposes is as old as the history of mankind. Initially empirical, the use of medicinal plants has become a therapeutic source for physicians and philosophers. In the twentieth century, most of the drugs marketed by the pharmaceutical industry contained vegetal raw materials.<sup>2</sup>

The World Health Organization (WHO) approved plant-based drugs for therapeutic purposes in 1978. In Brazil, the use of these drugs was only regulated after the creation of a medicinal plant policy for the use in the public service through Ordinance No. 971 and Decree No. 5813, as of May 3, 2006. Such policy ensured medical treatment by using herbal medicines and medicinal plants, thus enabling the emergence of new markets and overcoming barriers already established.<sup>3</sup> However, it was only in 2008 that the Federal Council of Dentistry (*Conselho Federal de Odontologia - CFO*) approved the use of medicinal plants for oral health care

(Resolution CFO-82/2008).

Tropical forests have a high biodiversity and are located in developing economies, such as Brazil. The Brazilian flora has shown to be important since its inventory in 1886, describing the diversity in fruits, oils, resins, flavors, gums, and medicinal potential.<sup>4</sup>

There is scientific knowledge of only a very small number of medicinal plants in the country. Brazil's industries have the ability to create technological processes; however, they do not have a body of research and development capable of creating innovations in phytomedicines in a continuous way.<sup>4</sup>

Phytomedicines may be used in dentistry for different purposes. For example, *Syzygium aromaticum L.* (Indian clove), from which eugenol is extracted, has antiseptic properties; *Malva sylvestris* (mallow) and *Salvia officinalis* have antibacterial and anti-inflammatory properties; *Aloe Vera (L) N.L. Burm* (aloe) can be used as a wound healing and anti-inflammatory medication; and *Melissa officinalis* (lemon balm) has anxiolytic and sedative properties. Moreover, some studies have found that essential oils and medicinal plant extracts may show effective properties for different purposes.<sup>5</sup>

Knowledge of medicinal plants in dentistry is of great importance because plants with physicochemical properties unknown to the dentist may be used inappropriately. In

addition, the inappropriate use of medications may lead to increased bacterial resistance and greater use of antibiotics. Inappropriate use of herbal medicines without botanical identification can do serious harm to health. Identifying efficient plants with reduced side effects to be safely used in dentistry is of vital importance.<sup>6</sup>

Moreover, further scientific studies are needed to confirm the efficacy and safety of medicinal plants, given that so far most herbal medicines are used based solely on popular knowledge.<sup>6</sup>

Based on the above reasoning, the aim of this paper was to conduct a review of the literature on herbal medicine in dentistry. In addition, we intended to improve the knowledge of health professionals about *Copaifera multijuga* Hayne and *Baccharis drancunculifolia* DC, describe ways of obtaining them, identify their properties, and pique the interest of dentists in the development of new materials.

## LITERATURE REVIEW

### PHYTOTHERAPY: HISTORICAL ASPECTS

Since ancient times, there are records confirming man's knowledge on the use of medicinal plants. Early civilizations such as the Babylonians stored manuscripts on roots, flowers, leaves, and fruits, e.g., garlic (*Allium sativum* L.).<sup>2</sup>

In the *Materia Medica* book, the author listed about 600 plants used for healing purposes, and discovered that chamomile tea (*Matricaria chamomilla* L.) promoted a menstrual flow increase (which was scientifically proven about 2,000 years later).<sup>7</sup>

The use of natural plants certainly precedes men of the modern period. Some excavations in Paleolithic sites show that medicinal plants have been known for about 60,000 years.<sup>2</sup>

Furthermore, Theophrastus, called the Father of Botany, wrote about medicinal properties of herbs. His first work, *Historia Plantarum* (enquiry into plants), was largely descriptive and showed how to collect and prepare perfumes, plants and condiments, which was used as a reference for years.<sup>2</sup>

Reports from ancient manuscripts were valuable for the preparation of the first pharmacopoeia that served for the preparations prescribed by physicians from the fourteenth to the sixteenth century.<sup>8</sup>

Between 1800 and 1900, several drugs were discovered such as emetine, morphine, quinine, and salicin. The period from 1901 to 1980 saw the discovery of antimicrobial agents from fungi and bacteria, the antibiotics, and from 1970 until today, there has been a great demand for vegetable medicines. The important discovery of herbal medicines, such as artemisinin and paclitaxel, was made during this period as well.<sup>9</sup>

Currently, we have our own pharmacopoeia. In the late twentieth century, people began to realize the benefits of herbal therapy, a practice that has grown considerably in recent years. According to the WHO, about 80% of the world's population uses medicinal plants or some herb extracts to relieve pain and other undesirable symptoms, but most of these products have no in-depth study of their chemical and biological properties. Even those plants that have been investigated still need further clinical trials.<sup>8</sup>

The media has played an important role in the consumption of natural products. It relies on herbalists who claim herbal products have the power to provide a long, healthy life, based on their age-old use. The pharmaceutical industry saw an opportunity to profit in that environment and is seeking new raw materials to match their products, thus reducing costs because natural products are financially more viable than synthetic products.<sup>9</sup>

In Brazil, scientific information about medicinal properties of native plants is scarce or even nonexistent. Yet, many of them are widely used in different ways and for distinct purposes. Herbal medicines are considered to have no toxicity as compared to traditional drugs, but this is not true. Herbal medicines do have toxicity levels and synergistic action, which is the drug's ability to combine and interact with other drugs.<sup>10</sup>

In Brazil, there is little assessment of safety and efficacy of medicinal plants and herbal medicines, as well as of its commercialization in natural food shops, public markets, and fairs. Thus, quality control of these products should be intensified, given that they are often subject to adulteration and forgery. Laboratory physico-chemical analysis of these products is of paramount importance for quality control, even though not every herbal medicine has analytical parameters and reference standard to be used for comparison.<sup>6</sup>

The WHO states that herbal medicines are plants, either growing wild or cultivated, which are used to alleviate, prevent, cure, or modify a pathological or physiological condition, and any plant employed as a source of drugs or their precursors.<sup>11</sup>

Therefore, herbal medicines are plants that have components capable of being used as therapeutic agents, or are precursors of other substances for such purpose, which are used on a large scale by the so-called alternative medicine.<sup>12</sup>

Herbal medicines are finished, labeled medicinal products, which have active substances composed of underground or aerial parts of plants or other plant material, and may be in crude form or vegetal preparation.<sup>13</sup>

In Brazil, herbal medicines are defined as plant products that are obtained or produced for healing, prophylactic, diagnostic, or palliative purposes.<sup>14</sup>

### PHYTOTHERAPY IN DENTISTRY

It is known that Brazil has about 55,000 species of plants that have been cataloged; of these, only 8% were analyzed to identify the bioactive components, and 4,000 medicinal plants are recognized.<sup>4</sup>

A study conducted in 2005 listed 71 species of native medicinal plants that showed anti-inflammatory activity. However, both the active ingredients and the effectiveness of plants are still unknown. Brazil has a large potential to develop herbal medicines, as it has high plant diversity, which is superior to that of most countries.<sup>15</sup>

Brazil has 20% of the 250,000 medicinal plants recognized by the United Nations, which shows great potential for therapeutic development.<sup>16</sup>

However, natural plants remain underused in dentistry in Brazil, and the most popular dental materials with natural compounds come from foreign plants. There are many doubts about the effectiveness of medicinal plants, especially when indicated for oral problems. Additionally, there is an indiscriminate use of them, as it is believed that even if natural drugs are not effective, they will not cause harm.<sup>17, 5</sup>

Research on medicinal plants for dentistry is very important for the following reasons: misuse of plants unknown to dental professionals; high consumption of antibiotics; easy access to synthetic drugs; treatment with

plants that do not have proper identification; high bacterial resistance, and the need to identify medicinal medicines that are effective and have fewer side effects as compared to synthetic drugs.<sup>6</sup>

The use of medicinal plants in the treatment of oral ailments is common in the population, but a very small number of these plants are scientifically tested with respect to their biological properties.<sup>6</sup>

### *COPAIFERA MULTIJUGA HAYNE*

Copaifera species are popularly known as *Copaíba* and *pau-d'óleo*. Since the sixteenth century, copaiba oil was used by the Indians in northern and northeastern Brazil for the treatment of various diseases. The extensive use has led to intense marketing of copaiba oil or capsules.<sup>18</sup>

Copaiba trees are commonly found in Latin America and West Africa. In Brazil, they are mostly found in the southeastern, midwestern and Amazon regions. They have an average lifespan of approximately 400 years and can grow up to 40 meters tall. Furthermore, the diameter of the trunk can range from 0.4 to 4 meters, and they have dense foliage, small flowers, aromatic bark, and dry fruits. The seeds are black and oval-shaped, being rich in lipids.<sup>10</sup>

The effects attributed to copaiba oil in folk medicine include anti-inflammatory, anti-tumor, and urinary antiseptic activities. It has

been used to treat skin diseases, ulcers, and wound healing. A study of copaiba oil has shown anti-inflammatory, antioxidant, and antimicrobial properties. In addition, it has also been used as an insect repellent and cosmetic ingredient for the manufacturing of hair care products.<sup>19</sup>

Copaiba oil is produced by exudation from the bark of trees belonging to the genus *Copaifera*. The exudate material is a transparent, yellow to light-brown liquid.<sup>10</sup>

Oil extraction needs to be carefully done to avoid harm to the trees, as they are few in number in the forest. Some people often chop down or cut the tree's bark with an axe to get a larger amount of oil. However, this is not a sustainable method. Cuts through a tree's bark can cause harm and facilitate contamination by fungi and termites, thus reducing the tree's lifespan.<sup>20</sup>

Currently, copaiba oil is one of the most traded products, with exports to the United States, France, Germany, and England.<sup>10</sup>

#### *BACCHARIS DRANCUNCULIFOLIA DC*

The *Baccharis* genus has more than 500 species and is known as "alecrim-do-campo", "vassourinha-do-campo" or "alecrim-de-vassoura" (field rosemary or broom). It is found in the southeastern and southern Brazil, ranging from 0.5-4.0 meters tall, and is a fast-growing plant. Because it adapts quickly to acid soils with few nutrients, it is considered

an invasive plant spreading into fields and pastures. It is a native plant from the Brazilian *cerrado* (savanna) and the botanical source of green *propolis*.<sup>21,22</sup>

Its composition has been studied by several researchers who found antifungal, antibacterial, insecticide, analgesic, sedative, antispasmodic and sedative properties.<sup>22</sup>

The different species of *Baccharis* genus have a great field of study for active compounds from volatile oils and their interactions with the environment.<sup>21,22</sup>

## DISCUSSION

Copaiba oil, also known as *scopahu* by the Indians, was widely used by them at the time when the first Portuguese settlers came to Brazil. Apparently, the use of copaiba oil began after observing the behavior of some animals that, once injured, ran to rub against the copaiba shrubs. Indian tribes used the plant for wound healing and they sought to avoid the emergence of the *mal-dos-sete-dias* (seven-day evil) in newborn babies. Furthermore, when returning from combats, they covered the body with oil and positioned themselves on suspended, hot mats for the wound healing.<sup>23</sup>

*Copaifera multijuga Hayne* is part of the *Fabaceae* family and *Caesalpinioideae* subfamily. According to the National Institute for Amazonian Research, there is a plantation of this native species. The tree is rather large, and is reported to attain a height of about 36

meters, with a trunk diameter of 80 cm. Most studies of this species are related to oleo resin extracted from the trunk of these trees. Oleoresin is resulting from tree detoxification and serves as a defense mechanism against predators. Copaifera trees with the highest oil production rate are located in tropical South America, the vast majority in Brazil, mainly distributed throughout the Amazon region.<sup>10</sup>

Oleoresin is extracted by drilling holes in the tree trunk. Since the start of operation, many types of extraction seriously damaged copaiba trees or even killed them.<sup>10,20,19</sup> Today, a less aggressive extraction method is used. Two 2-cm-diameter holes are drilled in the trunk by using an auger. The first hole is drilled 1 meter above the ground and the second 1 to 1.5 meters above the first hole<sup>10,19,20</sup>. Then, PVC pipes are placed approximately 1.9-cm deep into the perforations through which the oil will drain out and then stored. After the collection is completed, the holes must be sealed with clay or plastic cap to protect the copaiba trees from fungi and termites.<sup>20</sup>

Traditional medicine recognizes the copaiba oil as having useful properties, which should be further investigated to confirm the beneficial effects. The Food and Drug Administration (FDA) approved oleoresin extracted from the copaiba trees after sensitivity and irritation testing in a sample of 25 subjects with negative results in both

tests<sup>10</sup>.

The most important medicinal properties include anti-inflammatory, healing, antiseptic, antitumor, antibacterial, germicide, expectorant, diuretic and analgesic effects.<sup>19</sup>

Oleoresin exhibited almost magical properties, and Europeans were astonished when they saw this aromatic oil spouting out from the trees.<sup>24</sup>

Furthermore, oleoresin is prescribed for diarrhea and in the treatment of cystitis, pneumonia, bronchitis, sinusitis, dermal and mucosal infections, psoriasis, dermatitis, uterus wounds, snake bites, and headaches. It also has expectorant, anti-asthmatic, anti-herpes, and anti-rheumatic effects.<sup>25</sup>

*Baccharis dracunculifolia* is found in southeastern and southern Brazil, as well as in Argentina, Bolivia, Uruguay, and Paraguay. It can be found growing in the *cerrado* and pastures. It blooms when the rainy season is over. *Baccharis dracunculifolia* is an herbaceous plant, reaching up to 4 meters in height, and is relatively resistant to human actions. It is commonly found in degraded and disturbed habitats, usually near highways and pastures. It is considered an invasive, pioneer species, growing in abandoned fields.<sup>26</sup>

Because these species retain their foliage and bloom throughout the year, they host pollinators and insects. In addition, they are investigated for their pharmacological

properties. In southeastern Brazil, essential oils from *Baccharis dracunculifolia* are used for fragrances.<sup>26</sup>

Tea made from the leaves of *Baccharis* is used for the treatment and prevention of inflammation, liver and prostate disorders, anemia, and diabetes. Studies carried out on the biological activity of *Baccharis* have also demonstrated antimicrobial, anti-inflammatory, and cytotoxic effects.<sup>26</sup>

*Baccharis dracunculifolia* DC is the main botanical source used by honeybees to produce green propolis, which has several pharmacological properties. Seeds of *Baccharis dracunculifolia* DC germinate more easily in well-lit environments, which indicates that sunlight is important.<sup>26</sup>

Propolis produced from *Baccharis* is collected by honeybees and has a resinous consistency. It can display a wide range of colors: green, light brown, dark brown, cream, and yellow. Bees use propolis to seal and protect the beehive from intruders. It keeps the beehive aseptic and contributes to maintain the temperature around 35°C. The antiseptic property of propolis is known from the time of Aristotle, who recommended it for treating wounds and abscesses. Roman soldiers used propolis to treat war wounds.<sup>27</sup>

Furthermore, propolis can be used as food and in the prevention of caries.<sup>26,27</sup>

Herbal medicines have been used since ancient times and have various functions.

Some studies were carried out to determine the best method to extract the natural products from plants, without causing damage to them. Medicinal properties have been ascribed to *Copaifera multijuga* Hayne and *Baccharis dracunculifolia* DC along the years. However, further research is needed to test the described properties such as antimicrobial and anti-inflammatory effects. Furthermore, the lack of in-depth knowledge concerning the side effects in the human body from the inadequate use of these plants emphasizes the need for further studies.

## CONCLUSION

Copaiba trees, used by the Indians since the sixteenth century, are found in southeastern and midwestern Brazil, as well as in the Amazon region. They have an average lifespan of approximately 400 years and can grow up to 40 meters tall. They have dense foliage, small flowers, aromatic bark and dry fruits as biological characteristics. *Baccharis dracunculifolia* DC plants are located in the southeastern and southern Brazil and typically grow in the *cerrado* and pastures. They are very resistant and may reach from 0.5 to 4 meters in height. They easily adapt to acid soils, poor in mineral elements and organic matter.

There are various methods for obtaining oleoresin, but a safe and effective method is through holes in the tree trunk using a specific

size auger and a PVC pipe to drain the oil. This method reduces the risk of infections caused by invaders and does not endanger the survival of the trees. In the case of *alecrim-do-campo* (field rosemary), the best method is to harvest and process fresh leaves. Green propolis must be collected from the beehives.

Both *Copaifera multijuga* Hayne as *Baccharis dracunculifolia* DC have numerous medicinal properties, among which anti-inflammatory, antimicrobial, antiseptic, germicide, and analgesic effects can ascribed to the former, and antibacterial, analgesic, relaxing, and sedative effects can be ascribed to the latter, in addition to preventing dental caries. These properties demonstrate the possibility of creating new dental materials, provided that further studies are carried out to evaluate the safety of herbal medicines.

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