

## HERBAL THERAPY USED IN AFRO-INDIGENOUS COMMUNITIES FOR ANIMALS AND PEOPLE

### FITOTERAPIA UTILIZADA EM COMUNIDADES AFRO-INDÍGENAS PARA ANIMAIS E PESSOAS

Daniel de Azevedo Silva Costa<sup>I</sup>, Sérgio Ricardo de Andrade Virgínio<sup>II</sup>, João Vinicius Barbosa Roberto<sup>III</sup>,  
Maria das Graças Nogueira Ferreira<sup>IV\*</sup>, Alisson Fernando Soares Batista<sup>V</sup>, Maiza Araújo Cordão<sup>VI</sup>

**Abstract.** Ethnobotany is the ethnographic study of plants and herbs passed down through the oral tradition of a particular ethnic group. The African-Brazilian religion, Candomblé, keeps and transmits medicinal knowledge in its practices, such as the use of herbs and plants, which, in their biochemical context, are effective against various clinical pathologies. With the growth of the pharmaceutical industry, science is also expanding its research into new drugs and options for medicinal treatment, thus giving rise to herbal medicine. In addition to reducing economic costs, as it is an abundant raw material, i.e., widely present even in people's backyards, herbal medicine provides a variety of effective therapeutic options for treating pathologies. The aim of this study was to identify the medicinal herbal knowledge used in some African-Brazilian communities in João Pessoa-PB. Interviews were carried out, using a questionnaire, with babalorixás and yalorixás from the municipality. The information collected from the religious leaders revealed a wide range of knowledge, such as the use of *O. basilicum* (basil) to treat colic in newborn children, respiratory and stomach problems. The herbal knowledge of the African community's religious leaders is wide-ranging and applicable to the treatment of various pathologies. 100% of the priests claimed to have used herbs and plants to treat children of the house, and 80% of the priests to treat non-human animals. Some of the herbs and plants mentioned were: thorny pigweed, wild sage, skunkweed, American wormseed, Brazilian peppertree, cow-foot leaf, aloe vera, peppermint, myrrh, boldo, rosemary, and basil. The infectious diseases treated were gastrointestinal, pain, wounds, and even more complex infections such as pneumonia. It was observed that the religious leaders use various medicinal plants and herbs for several symptoms, from topical to oral uses, both in humans and in animals, which gives us the possibility of using this knowledge in one health medicine.

**Keywords:** Candomblé; Ethnobotany; Phytotherapy; African origin; Popular knowledge.

**Resumo.** A etnobotânica é o estudo etnográfico das plantas e ervas transmitido pela oratória de um determinado grupo étnico. A religião de matriz africana, o candomblé, guarda e transmite conhecimentos medicinais em suas práticas tais como uso de ervas e plantas que, em seu contexto bioquímico, têm eficácia contra diversas patologias clínicas. Com a indústria farmacêutica em crescimento, também é ampliado na ciência o contexto de pesquisa de novos fármacos e opções para o tratamento medicinal, surgindo assim a medicina fitoterápica. Além da redução do custo econômico, por se tratar de uma matéria-prima abundante, ou seja, muito presente até mesmo nos quintais de suas casas, a fitoterapia fornece uma variedade de opções terapêuticas eficientes para tratar patologias. O objetivo do trabalho foi identificar os conhecimentos medicinais fitoterápicos utilizados em algumas comunidades de matriz africana no município de João Pessoa-PB. Foram realizadas entrevistas, através de um questionário, com babalorixás e yalorixás do município. As informações coletadas dos sacerdotes trouxeram diversos conhecimentos como o uso do *O. basilicum* (manjeriço) no tratamento de cólica em crianças recém-nascidas, problemas respiratórios e estomacais. Os conhecimentos fitoterápicos por sacerdotes em comunidades afro são amplos e aplicáveis no tratamento para várias patologias. 100% dos sacerdotes alegaram já terem usado ervas e plantas para tratar filhos da casa e 80% dos sacerdotes para tratar animais-não-humanos. Dentre as ervas e plantas citadas, algumas são: espinho-de-porco, são gonçalinho, tipi, mastruz, aroeira, caepeba, babosa, hortelã-pimenta, mirra, boldo, alecrim, manjeriço. Já as doenças infecciosas tratadas foram as gastrointestinais, dores, feridas, até mesmo infecções mais complexas como a pneumonia. Observou-se que os sacerdotes utilizam diversas plantas e ervas medicinais para várias sintomatologias, desde usos tópicos a usos orais, tanto em humanos quanto em animais, o que nos traz a possibilidade do uso desses conhecimentos na medicina de saúde única.

**Palavras-chave:** Candomblé; Etnobotânica; Fitoterapia; Matriz africana; Saber popular.

<sup>I</sup>Bacharel em Medicina veterinária  
e-mail: danielcostavetclin@gmail.com  
CEP: 58067-695  
ORCID: 0009-0006-4990-2867

<sup>II</sup>Mestre em Filosofia  
CEP: 58067-695, João Pessoa-PB, Brasil  
ORCID: 0009-0008-0496-3468

<sup>III</sup>Doutor em Medicina Veterinária  
CEP 58051840  
ORCID: 00000-0002-8101-998X

<sup>\*IV</sup>Enfermeira, mestre em Saúde da Família  
e-mail: gau.ferreira@hotmail.com  
CEP: 58068-050  
ORCID: 0000-0002-8041-374X

<sup>V</sup>Graduando em Medicina veterinária  
CEP: 58031-010  
ORCID:0009-0000-0233-2023

<sup>VI</sup>Doutora em Medicina veterinária  
CEP: 58067-695  
ORCID: 0000-0002-5645-1869

## INTRODUCTION

Ethnography is a specific and ideographic investigation mode. It differs from history and archaeology in that it uses direct observation of present-day peoples rather than written records or material remains attesting to the activities of peoples in Ancient history. In other words, ethnography aims to describe people's lifestyles through detailed observation and by living intimately within these peoples, being told in detail to those willing to experience it<sup>1</sup>.

Historically, using plants has accompanied human evolution in terms of food, building shelter, making clothes, and, especially, treating diseases in people and animals. Thus, since the dawn of evolution, mankind has used plants to solve countless problems. According to the World Health Organization (WHO), the use of medicinal plants is reinvented every day in the culture of our population. Approximately 80% of the world's population relies on herbal products to treat their illnesses in Primary Health Care (PHC), especially in developing countries<sup>2</sup>.

In Brazil, medicinal plants are part of the healthcare practice. This is known as popular 'medicine,' which comprises the rich ethnic and cultural diversity in the know-how of families in intergenerational transversality. The sensitive approach to this diversity motivated the drafting the National Policy for Integrative and Complementary Practices (PNPIC) in the Unified Health System (SUS). This policy outlines the guidelines and priority lines for guaranteeing safe access and the rational use of medicinal plants and herbal medicines<sup>3</sup>.

Many farmers and ranchers use popular practices and knowledge to prevent or treat illnesses in livestock or pets. The use of this popular knowledge and beliefs regarding animal health is called ethnoveterinary, which can be defined as a systematic theoretical investigation and practical application of popular veterinary knowledge<sup>4</sup>.

This research aimed to identify the medicinal herbal knowledge used in some African-Brazilian communities in João Pessoa-PB for treating animals and people.

## MATERIAL AND METHODS

The study was carried out with babalorixás/yalorixás (priest/priestess of the candomblé cult) who have active religious temples in João Pessoa - PB. The research period covered the months of February to April 2023. It was an observational study with convenience sampling to collect data from an available population.

The survey was carried out either in the afternoon or in the evening, depending on the availability of the location and the interviewees, noting that each temple received a single visit for the interview and data collection. The research was carried out in around five locations and was structured on an interview basis. In other words, the priests answered questions from the questionnaire, which supported the aim of the research, about their knowledge of herbal medicine. The questions focused on herbal medicine practices and the use of herbs in their healing context.

Data collection was structured so that participants could respond according to their knowledge and popular knowledge learned within the axé house. The data was stored in spreadsheets so that no information was leaked. The analysis was descriptive, with a statistical profile that allowed tables and graphs to be drawn up.

The research was carried out following the provisions of Resolution 466/2012 of the National Health Council, which deals with research involving human beings (BRASIL, 2012), and following the Veterinarian's Code of Ethics (CFMV Resolution No. 1138). The project was initially submitted to FACENE's Research Ethics Committee (CEP). After its approval under protocol No. 05/2023 and CAAE number: 66832023.5.0000.5179, the research began with the priests and priestesses of the Ilê Asê houses. To answer the questionnaire, those involved were asked quick questions and signed the Informed Consent Form (ICF).

According to Resolution 466/2012, the confidentiality of the participant's identification must be respected, which is why the questionnaire was individual. Each questionnaire had an Informed Consent Form (ICF) and the option to agree or disagree with the answers. It should be noted that access to the questions was only possible after they had consented, leaving them free not to answer anything outside their competence and will. The entire information-gathering process followed the provisions of Article 4 of CNS Resolution 510 of 2016<sup>19</sup>.

After the data was collected, it was tabulated, and tables and graphs were drawn up to better visualize and discuss the numbers observed in the use of plants on animals and people.

## RESULTS AND DISCUSSION

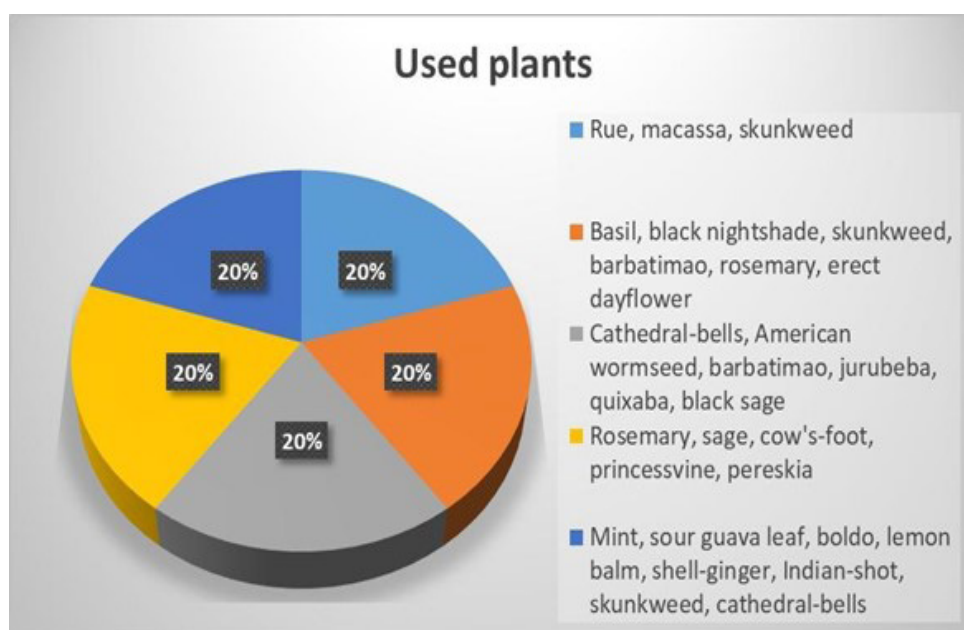
According to the data obtained regarding the initiation into the religion, the priests' ages varied. All the interviewees learned about the use of herbal medicine within the religion and had already used their knowledge of herbs on others. It was observed that the priests were between 26 and 50 years old and had always been taught how to use medicinal plants to treat people and animals.

The use of herbal medicines is welcomed within the Candomblé religion since everyone uses the most varied plants. Basically, in the entire belief system of the African-based religions that developed in Brazil, plants play a mediating role between the two planes of existence: the *aiê* - the natural world - and the *orún* - the supernatural world. Through plants, connections between men and the *orishas* and ancestor spirits are built, and vice versa. In Yoruba custom, for example, plants are sacred because they concentrate the vital forces of the *orishas*. Thus, the link built between plants and the sacred rites practiced in Afro-Brazilian religions is of great importance<sup>5</sup>.

It was noticed that the most used plant within the religion is connected with its natural habitat, such as basil. Basil, the popular name for the genus *Ocimum*, belongs to the Lamiaceae family and is an aromatic herb that produces essential oil for medicinal use. In addition to its economic importance due to essential oil production, it is also widely consumed fresh or as a raw material in industry. It is well known for its use in cooking, which is sold at fairs and supermarkets<sup>6</sup>, as well as for seasoning food and drinks, and is widely used in the cosmetics and perfumery industry<sup>6</sup>. Basil tea (*O. basilicum*) is widely used to treat colic in newborn children, respiratory and stomach problems.

According to Cunha et al. (2012), an *in vitro* study, a significant effect of basil essential oil (*Ocimum basilicum* L.) was observed during the research on the bovine tick *Rhipicephalus (Boophilus)*<sup>7</sup>. During the research, it was observed that the priests of candomblé houses use various plants as herbal medicine (Graph 1).

**Graph 1:** Most used plants by priests as herbal medicines



Among the data collected, there were plants in common. Several species with claims of popular use, such as skunkweed (*Petiveria alliacea* L.), belonging to the Phytolaccaceae family, popularly known as tipi, mucuracaá, guiné, is used in traditional medicine as an antirheumatic, antispasmodic, diuretic and with emphasis on its antifungal action, although addressed in few studies<sup>8</sup>.

Cathedral-bells (*Kalanchoe cf. brasiliensis*), which belongs to the Crassulaceae family, was also commonly observed. This species is characterized by being rich in alkaloids, triterpenes, glycosides, flavonoids, steroids, and lipids and having emollient, mucilaginous, tonic, and anti-inflammatory properties.<sup>9</sup> In addition to these properties, other species with a similar chemical composition have shown moisturizing, protective, and restructuring effects on the skin's barrier function<sup>10,11</sup>.

Most of the plants used by the priests are therapeutic and anti-inflammatory, such as for toothaches and joint pain. It can be seen that they are used for various purposes, such as inflammation, infections, pain, etc (Table 1).

**TABLE 1:** Diseases treated by the priests, the part of the plants used, and the ways in which the priests use herbal plants in their home children.

Variable	N	%
<b>What kind of illness did you treat?</b>		
earache, toothache, rheumatism, sore throat	1	20
Skin and wounds, gastrointestinal, colds and flu, headaches, eye infections	1	20
Skin and wounds, gastrointestinal, colds and flu, headaches	1	20
Skin and wounds, Gastrointestinal, Colds and flu, Headaches, Diabetes, High blood pressure, Asthma, Pneumonia	1	20
Skin and wounds, gastrointestinal, colds and flu, headaches, diarrhea	1	20
<b>Total</b>	<b>5</b>	<b>100</b>
<b>Which part of the plant did you use?</b>		
Roots, leaves	2	40
Leaves, bark	1	20
Roots, leaves, bark	1	20
Leaves	1	20
<b>Total</b>	<b>5</b>	<b>100</b>
<b>How did you use it?</b>		
Tea, macerated in water	2	40
Infusion, macerated into paste	1	20
Teas, oil tinctures	1	20
Tea, paste, macerated in water, oil	1	20
<b>Total</b>	<b>5</b>	<b>100</b>

All the priests claimed to have taken care of their children in the candomblé house using plants. The data show that a variety of ailments have been treated, the most commonly cited being skin and wound treatment, inflammation, and infectious processes, from the simplest such as tonsillitis to more complex infectious processes, such as pneumonia. American wormseed (*Chenopodium ambrosioides* L.) was one of the plants cited for treating pneumonia and infections. *Chenopodium ambrosioides* is a plant from the *Chenopodiaceae* family that is widely distributed worldwide and is one of the most widely used species in popular medicine. It is popularly known in Brazilian Portuguese as “erva de Santa Maria,” “mastruz” or “mastruço” and is widely indicated for treating wounds, skin inflammations, bruises, and fractures<sup>12</sup>.

Regarding the part of the plant, it was observed that the leaves are the most commonly used, cited by 80% of the priests. An ethnobotanical study was conducted in the village of Manejo, located in Lima Duarte (MG), to identify how medicinal plants are handled. Through questionnaires and visits to residents' homes, it was found that the leaves are the most commonly used, and the most common form of preparation of the plants is teas by infusion<sup>13</sup>.

As for how the herbs and plants are used, it was observed that oral consumption of teas is very common. The practice of macerating the leaves in water for topical use was also mentioned. The priests claimed to bathe with the herb, using extracts that they themselves prepared from the macerated herbs, infusions, and oils. Out of 80% of those interviewed, only 1 claimed never to have treated non-human animals with medicinal plants and herbs. The other priests claimed to have used medicinal plants and herbs on animals.

*Euphorbia hirta* (Dayflower) has become known for its therapeutic activity, being used to treat gastrointestinal disorders, bronchial and other respiratory diseases, conjunctivitis, eye infections, and other diseases affecting women<sup>14,15</sup>. *Euphorbia hirta* can be used to combat intestinal parasites, diarrhea, peptic ulcers, heartburn, vomiting, amoebic dysentery, asthma, bronchitis, hay fever, laryngeal spasms, emphysema, coughs, colds, kidney stones, menstrual problems, sterility, STDs, diseases of the skin and mucous membranes (including warts, scabies, ringworm, canker sores, fungal afflictions, measles), as an antiseptic to treat wounds, and conjunctivitis. The plant is known as an analgesic and is indicated for curing severe headaches, toothache, rheumatism, colic, and pain during pregnancy. It can also be used as an antidote and pain reliever for scorpion stings and snake bites<sup>16</sup>.

When treating animals with these plants, 80% of the priests have used herbs for therapeutic purposes. The use of medicinal plants in veterinary medicine is already very evident. It is already possible to find medicinal plants in the routine treatment or prevention of illnesses in animal husbandry as an activity passed down through generations. Rural people are responsible for this continuous use, and many factors have contributed to the increase in the use of this resource. Some of them are the high cost of industrialized medicines, the difficult access to medical care by the population, as well as the tendency to use products of natural origin<sup>17</sup>.

In a descriptive and qualitative literature review, articles, theses, and dissertations from up to 10 years earlier were analyzed. The survey was carried out from July to September 2014. The aim was to investigate innovative studies focusing on experimental research and sociocultural rescue that accredit and promote the formulation of new veterinary herbal medicines. The following phytotherapeutic species were registered in the therapy of farm animals: *Allium sativum* L. (Garlic), *Aloe vera* L. (Aloe vera), *Anacardium occidentale* (Cashew), *Aspidosperma pirifolium* (Pear), *Azadirachta indica* (Neem), *Chenopodium ambrosioides* (Wormseed), *Citrus limon* (Lemon), *Curcubita pepo* (Gourd), *Cymbopogon nardus* L. (Citronella), *Mentha piperita* (Mint), *Momordica charantia* (Bitter melon), *Myracrodruon urundeuva* (Brazilian peppertree), *Operculina hamiltoni* (Batata de purga, in Brazilian Portuguese), *Peumus boldus* (Boldo), *Psidium guayava* (Guava), *Zingiber officinale* (Ginger) and *Zizyphus joazeiro* (Jua). The most commonly reported therapeutic indications were antiparasitic (ectoparasites and endoparasites), wound healing, antimicrobial, repellent, antipyretic, anti-inflammatory, antidiarrheal, antiemetic, antispasmodic, colds, and retained placenta<sup>18</sup>.

It was observed that the priests had used blood amaranth, thorny pigweed, wild sage, aloe vera, and myrrh, among other herbs and plants, to treat their animals (Table 2).

**TABLE 2:** Herbs and plants used to treat animals and parts of plants most commonly used by priests in candomblé.

Variable	n	%
<b>If so, which herbs did you use?</b>		
Blood amaranth, thorny pigweed, wild sage, skunkweed	1	25

American wormseed, bellyache-bush, Brazilian Peppertree	1	25
Dayflower, cow-foot leaf, bitter melon, shell-ginger, aloe vera, peppermint	1	25
Bellyache-bush, myrrh, boldo	1	25
<b>Total</b>	<b>4</b>	<b>100</b>
<b>Which part of the plant did you use?</b>		
leaves, stems	1	25
leaves, bark	1	25
Leaves	2	50
<b>Total</b>	<b>4</b>	<b>100</b>
<b>How did you use it?</b>		
Fresh	3	75
Fresh, dried	1	25
<b>Total</b>	<b>4</b>	<b>100</b>
<b>How did you use it?</b>		
macerated into a paste	1	25
Topical ointments and plant extracts	1	25
Tea, macerated in water	1	25
Tea, leaf juice	1	25
<b>Total</b>	<b>4</b>	<b>100</b>

According to the data, the most commonly used parts of the plants to treat non-human animals were the leaves in natura through oral teas and various topical uses such as extracts and maceration in water.

As the name suggests, ethnobotany studies the botanical knowledge passed down by ethnic groups. Within candomblé houses, it is tradition to receive knowledge from the elders so that they can pass it on to the next generations. It was observed that the priests learned to use herbs from other priests and learned the importance of this use.

The priests learned how to handle herbs and leaves from their birth mothers, who were also priestesses, which leads us to understand that most of the priests learned their medicinal practices from their biological and religious lineage. They all believe that it is important to restore and study their customs for society, as well as the importance of ethnobotany in veterinary and human medicine, which makes us realize that this knowledge can be used in One health medicine.

Valuing Ethnobotany and Ethnopharmacology means protecting Brazil's biodiversity and genetic heritage. As stated in Bill 13.123/2015: "(...) Access to genetic heritage or associated traditional knowledge will be carried out without prejudice to material or immaterial property rights that affect the genetic heritage or associated traditional knowledge accessed or the place of its occurrence"<sup>19</sup>.

According to Camargo<sup>20</sup>, functional treatment is defined as "based on the intrinsic value that plants contain, considering the chemical components responsible for their biological activities, which can be empirically verified." (...) Empirically verifiable thinking prevails since plants contain active principles, which vary according to their chemical composition and, consequently, their biological activity. This, however, does not stem from a single chemical element present but from the synergistic action of all the components present in the whole plant, although they may be more concentrated in one or more parts of it, such as the root, the stem, the bark, the leaf, the flower, the fruit, and the seed, also considering how plants are consumed [...] <sup>19</sup>.

According to the work carried out by Alvez<sup>21</sup>, with the aim of understanding and analyzing ethnobotany in the Umbanda and Candomblé religions for medicinal purposes practiced in Ituiutaba, Minas Gerais, visits were made to collect data to prepare a catalog with the following items: scientific name, botanical family, popular name, religious and therapeutic use.

The study found that of the 53 species collected, only 12 were cited more than once: barbatimao and mint, cited twice; dumbcane and Saint George's sword, three times; boundary tree, lemongrass, and dracaena, four times; Guinea-hen-weed, five times; arnica, six times; basil, eight times: rue and boldo with the highest number of citations, thirteen times.

According to Araújo<sup>22</sup>, who studied the plants used in religious rites of African origin in the community of Campina Grande, PB, teas were the majority, followed by baths. Therefore, it is possible to suggest that using plants for baths in axé houses is quite common. The justification for baths being cited more often is due to their ease of handling and rapid therapeutic action, which is the technique that priests most often recommend to practitioners to obtain the actions of plants.

The expected effect cannot always be guaranteed. The following table shows the priests' responses concerning side effects or allergies from the indiscriminate use of herbs and plants. There has never been a case of poisoning or allergies when using herbs and medicinal plants.

The data show that 100% of the priests interviewed have never suffered or caused any kind of intoxication due to the inappropriate use of plants and herbs, nor has there been any allergic process in the use of herbs and plants, which makes us realize that there is a rational logic in the use and caution in the transmission of ethnobotanical knowledge in order to avoid complications or side effects. The use of herbs and plants is precise and has the necessary accuracy to the point where the priests choose the correct herb and dose to avoid cases of intoxication or allergies. According to the priests, the plants and herbs are most commonly used through oral teas and herbal baths. According to them, taking a bath has calming properties.

According to the priests, treating an individual's emotions using herbs or plants is possible. Among the plants and herbs mentioned, Mulungu (*Erythrina verna*) from the Fabaceae family was the most common. The name "Mulungu" is of African origin. Many trees of the *Erythrina* genus were already known and used by Bantu peoples, such as *E. abyssinica* (DC.) Lam., *E. caffra* Thumb., *E. tomentosa* (A. Rich.) R. Br., *E. senegalensis* Chevalier. They were known as "mulungo", "murungu" or "mungu"<sup>23</sup>.

The use of medicinal plants as a therapeutic resource in the treatment of anxiety and depression has proved to be a viable option compared to drug treatments, given that some patients cannot tolerate the adverse effects or do not respond to traditional pharmacological treatments<sup>24</sup>.

The species *Erythrina mulungu* (*E. mulungu*) has a sedative, anxiolytic, and anticonvulsant effect and is often used in mild cases of anxiety. Parts of the stem, bark, and flowers are used in decoctions, and in the herbal medicine sector, it is used in tandem with other components such as chamomile, passionflower and valerian to provide a more powerful effect<sup>25</sup>.

Regarding the self-use of medicinal herbs, it was observed that the priests use them for various purposes (Table 3).

Table 3: Self-treatment with herbs and plants by candomblé priests.

Variable	n	%
<b>Have you ever treated yourself with herbs and medicinal plants?</b>		
Yes	5	100
No		0
<b>Total</b>	<b>5</b>	<b>100</b>
<b>If so, which disease was treated?</b>		
Throat infection	1	20
Arthritis	2	40
Diabetes, seizures	1	20
Headache, fever, body aches	1	20
<b>Total</b>	<b>5</b>	<b>100</b>
<b>If so, which herb did you use?</b>		
Rosemary, skunkweed	1	20

Blolly	1	20
Sucupira, turmeric, black sage, arnica	1	20
Cow's-foot, mother of thousands	1	20
Bellyache-bush, shell-ginger, freshcut	1	20
<b>Total</b>	<b>5</b>	<b>100</b>

According to the data, 100% of the priests claimed to have used herbs and plants to treat themselves. The most common ailments are infections such as tonsillitis, muscle pain, among other more complex ailments such as using the "insulin" plant, princessvine, (*Cissus sicyoides*) and Cow's-foot (*Bauhinia forficata*) to treat diabetes.

This use has been widely reported in the literature, according to the work of Trojan<sup>26</sup>, who, through an analysis of ethnobotanical studies, observed that *B. forficata* stood out among the plants popularly mentioned to treat diabetes mellitus in the state of Rio Grande do Sul, which proves the medicinal herbal use claimed by the priests.

Many plants and herbs can be found on the streets and sidewalks, most of which have medicinal uses. The following data show the priests' knowledge of herbs and plants found on sidewalks, streets, and backyards.

According to the information obtained, among the herbs and plants mentioned that can very easily be found on sidewalks, the stonebreaker (*Phyllanthus niruri* L.) stood out, as 80% of those interviewed mentioned that it was easy to find on streets, sidewalks, and backyards. Use in the form of tea obtained by infusion of fresh or dried *Phyllanthus niruri* L. material from the leaves, aerial parts, or the whole plant is recommended as an alternative medicine for treating kidney lithiasis, which proves the popular use said by the priests<sup>27</sup>.

According to Bonaterra<sup>28</sup>, St. John's wort (*Hypericum perforatum*) from the Hypericaceae family has cytoprotective, neutrophilic, and anti-inflammatory properties. In the pharmaceutical field, when analyzing studies of various herbal medicines, the author identified the use of *Hypericum perforatum* as an antidepressant treatment, making it effective, acting as a selective inhibitor of serotonin, noradrenaline, and dopamine, through hypericin and hyperforin, which have an effect on mood regulation<sup>29</sup>.

The plant *Pilea microphylla* of the Urticaceae family, commonly known as artillery plant, angelweed, or joypowder plant and popularly known in Brazil as "Língua-de-sapo, brilhantina, mil homens," is native to Mexico and tropical South America. It is mainly used in gardens and landscapes as a foliage or ornamental ground cover plant, but also for many ethnobotanical uses. Presently, it is considered a problematic weed affecting tropical and subtropical regions worldwide. Studies show that *Pilea microphylla* has antioxidant, antidiabetic, radioprotective, antimicrobial, cryoprotective, antigenotoxic, and antidepressant properties.

## CONCLUSION

It was observed that the priests use medicinal plants and herbs for various symptoms, from topical to oral uses, on humans and animals. This brings us to the possibility of using this knowledge in One Health medicine.

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