


## Use of medicinal plants in the prevention and treatment of COVID-19 by the population of Carolina, Maranhão, Brazil

 <https://doi.org/10.56238/sevened2024.025-021>

Lúcia Silva Correia Menezes<sup>1</sup>, Vitória Silva Rolim<sup>2</sup>, Claudia Scareli-Santos<sup>3</sup>

### ABSTRACT

The objective of this research was to carry out the ethnobotanical study of the medicinal plants used by the population of Carolina, MA in the prevention and treatment therapies of COVID-19, their justifications and influencing sources. The study consisted of a qualitative-quantitative, exploratory research carried out along the lines of a case study, carried out in the city of Carolina, MA, where two questionnaires were applied to 120 residents of the city. The results showed 56.63% of the research participants stated that they used medicinal plants only for prevention, 12.05% used them only in treatment and 31.32% of the participants used it both in the prevention and treatment of COVID-19. The species with the highest percentages of citations, used in the prevention, treatment and in both cases of COVID-19, were *Peumus boldus* (boldo), *Citrus limon* (lemon), *Allium sativum* (garlic), *Curcuma longa* (turmeric). These results show that the population made use of several medicinal species with emphasis on *Lippia alba* and *Peumus boldus*, for different diseases, with emphasis on preventing and treating the symptoms of COVID-19. It is important to note that so far there are no studies that prove the therapeutic action of these plants against COVID-19, but the literature reports several properties regarding the symptoms caused by it.

**Keywords:** *Allium sativum*, Popular knowledge, *Lippia alba*, Maranhão.

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<sup>1</sup> Degree in Biology from the Federal University of Tocantins, Araguaína Campus, Tocantins, Brazil.

E-mail: [luciasilva1107@gmail.com](mailto:luciasilva1107@gmail.com)

LATTES: <http://lattes.cnpq.br/1332590123752052>

<sup>2</sup> Degree in Biology from the Federal University of Tocantins and Master in Science and Mathematics Teaching from the Federal University of Northern Tocantins, Araguaína Campus, Tocantins, Brazil.

E-mail: [vitória.rolim@ufnt.edu.br](mailto:vitória.rolim@ufnt.edu.br)

LATTES: <http://lattes.cnpq.br/5338679121609208>

<sup>3</sup> Bachelor and Degree in Biological Sciences, Master in Ecology and Natural Resources PhD in Sciences from the Federal University of São Carlos. Effective professor of the Biology Degree course and the Graduate Program in Science and Mathematics Teaching at the Federal University of Northern Tocantins, Araguaína Campus, Tocantins, Brazil.

E-mail: [claudia.santos@ufnt.edu.br](mailto:claudia.santos@ufnt.edu.br)

LATTES: <http://lattes.cnpq.br/3000305136161931>.



## INTRODUCTION

Brazil is considered the country with the greatest plant biodiversity, which allows the population to make use of its resources, especially for therapeutic purposes (NASCIMENTO, 2016). In addition to the vast biodiversity of flora, Brazil also stands out for having a rich cultural diversity, with different principles, opinions, knowledge, practices and techniques, resulting in a collection of traditional knowledge, habits and customs, passed down from generation to generation (ARNOUS; SAINTS; BEINNER, 2005). Historically, the Indians were the first to make use of medicinal plants, which used various herbs mainly in healing and worship rituals, this knowledge was associated with the information brought by Europeans and African slaves, thus allowing the construction of a comprehensive tradition throughout the country. (BRANDELLI et al., 2017).

The custom of using different plants for therapeutic purposes is quite strong, especially in the Northeast region of the country (SOUZA et al., 2019), which due to its vast territorial extension, remains rich in several traditions, with emphasis on the forms of knowledge and use and management of medicinal plants in the treatment and/or prevention of various diseases, the use and knowledge about medicinal species by the majority of the population of the northeast region, they originated in family tradition, becoming a very common practice in their daily lives (DINIZ et al., 2020).

The use of herbal practices began in an artisanal way, without much research and scientific support, however, based on popular knowledge and practices, it was possible to discover important medicines used in traditional medicine (ARNOUS; SAINTS; BEINNER, 2005). With the development of Science and technology, there has been a deepening of research on the subject, resulting in new knowledge about techniques and methods for a better use of medicinal species, in addition to the increase in their recommended use by health professionals (BRAGA, 2011).

Some factors contribute to the use of medicinal plants in alternative medicine, one of them is the need that exists in many communities, making it a more accessible option for the treatment and prevention of some diseases (CARNEIRO et al., 2014). The high cost of industrialized medicines, the population's difficult access to medical care and the growing use of natural products are some of these factors for the use of medicinal plants (BRASILEIRO et al., 2008).

With the pandemic of the new coronavirus and the uncertainties about the treatments to follow, many people have adhered to the use of medicinal plants. It is important to note that COVID-19 is an infectious disease, caused by the SARS-CoV-2 virus, which initially presents flu-like symptoms in people, but is characterized by an acute, potentially serious respiratory infection. It has a high degree of transmissibility, which caused and was quickly decreed in early 2020 as a pandemic (BRASIL, 2022).



Infected people manifest symptoms between the second and fourteenth day after exposure to the virus, and may have mild and moderate flu-like symptoms, treatment depends on the severity, in which case resting at home and taking medicine to reduce fever could often be enough. However, others developed a more serious condition and needed hospitalized care, intensive care, intravenous medications, oxygen and other support measures, with cases of respiratory failure and even death. The infected individual becomes contagious to others for up to two days before symptoms appear, remaining contagious for 10 to 20 days, depending on their immune system and the severity of the illness. People over the age of 65 or with a medical condition are at higher risk of severe disease (FRANÇA et al., 2021).

Knowing that a good immune system would be a primary factor in not contracting the virus, several people resorted to the use of medicinal plants, a habit already practiced in the daily lives of many Brazilians, as an attempt to get through the disease unscathed (DINIZ et al., 2020). Thus, research focused on the field of Ethnobotany makes it possible to identify and bring communities closer to the use of plants, in relation to the level of knowledge they have and what treatments are carried out with the use of these species (CAVALCANTE; SILVA, 2014; SILVA, 2020).

## OBJECTIVES

The general objective of the research was to carry out the ethnobotanical study of the medicinal plants used by the population of Carolina, MA in the prevention and treatment therapies of COVID-19; the specific objectives were: 1) To know the species of medicinal plants and their forms of preparation used in the prevention and treatment therapies of COVID-19; 2) To determine which factors interfere in the sampled population regarding the decision to use medicinal plants either in the prevention or treatment of COVID-19 and 3) To define and quantify the influencing agents in the interviewee's choice regarding the use of "home remedies" made with medicinal plants for the prevention and treatment of COVID-19 symptoms.

## MATERIAL AND METHODS

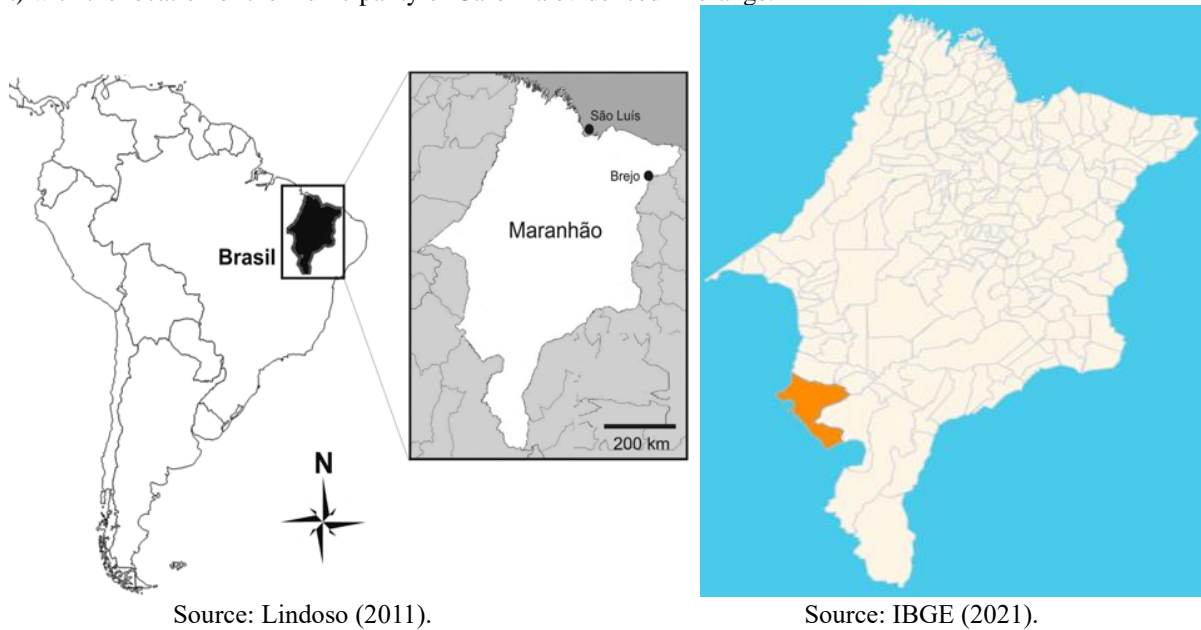
The work was carried out in the city of Carolina, located in the southern region of the State of Maranhão (Fig. 1); which is located on the right bank of the Tocantins River, with the following geographic coordinates: Latitude: 7° 20' 16" South and Longitude of 47° 28' 04" West (CIDADE BRASIL, 2022) and with a population of 23,959 inhabitants (IBGE, 2010). According to data from the last epidemiological bulletin on November 23, 2022, the municipality had 2565 confirmed cases of the Coronavirus and 47 deaths (CAROLINA, 2022).

The methodology used consisted of a qualitative-quantitative, exploratory research, carried out along the lines of a case study in which the study requires the deepening of the understanding of

a social group, more details about the type of research used is presented in the work of Godoy (1995).

The research project was approved by the Human Research Ethics Committee (CEP) of the Federal University of Tocantins, under code number 47603221.1.0000.5519, thus respecting the ethical and legal precepts required by the current Resolutions.

Figure 1. Map of Brazil (image on the left), with emphasis on the state of Maranhão. Detail of the state of Maranhão (right) with the location of the municipality of Carolina evidenced in orange.



The methodology used was based on Silva; Roriz and Scareli-Santos (2018), using the simple random sampling method, in which 30 streets in the city and four houses per street were drawn, totaling 120 residences, of which one resident of each house, aged 18 years or older, was invited to participate in the research. The research proposal and the consent form were read, then, without any doubt, the delivery for signature. The interviewees participated in the research by answering a questionnaire, whose elaboration was based on the publication of Mafra; Lasmar and Rivas (2020); it presented questions on the following aspects: A) Occurrence of COVID-19 symptoms; After obtaining the answer no, the other questions were directed to the use of medicinal plants in the prevention of the disease; B) Use of home remedies for prevention; C) Which plants were used in prevention; D) What are the forms of consumption in prevention (part of the plant, method of preparation and form of acquisition); E) Reasons that led them to use the plant in prevention; F) Indication of medicinal plants to prevent symptoms of COVID-19. The same questions were directed to respondents who reported having symptoms of COVID-19, who said they used the plants during the treatment of the disease; B) Use of home remedies for treatment; C) Which plants were used in the treatment; D) What are the forms of consumption in the treatment (part of the plant, method of



preparation and form of acquisition); E) Reasons that led them to use the plant in the treatment; F) Indication of medicinal plants to treat the symptoms of COVID-19.

Respondents who have used preventive use and were later diagnosed with COVID-19 were asked questions aimed at both prevention and treatment.

## RESULTS AND DISCUSSION

### USE OF MEDICINAL PLANTS IN THE PREVENTION AND TREATMENT OF COVID-19 BY THE POPULATION OF CAROLINA, MA

The results obtained showed that of the 120 interviewees in the city of Carolina, Maranhão, 36.67% stated that they had symptoms of COVID-19. This percentage was higher than that shown in Mafra's work; Lasmar and Rivas (2020) in the city of Manaus in Amazonas, in which 23% of the participants reported having presented symptoms of the disease, however it is low compared to those who stated that they did not have symptoms of COVID-19.

It was observed that 56.63% of the participants declared that they use medicinal plants only for the prevention of COVID-19, which is in line with the results of Scareli-Santos; Ferreira and Monteiro (2021), in which 51.56% of respondents stated that they use medicinal plants to prevent COVID-19. Similar to this result was also observed in the work of Mafra; Lasmar and Rivas (2020), where 64% of respondents, a little more, stated that they resorted to home remedies even though they did not have symptoms of COVID-19, that is, in prevention.

The interviewees mentioned 24 species of medicinal plants distributed in 16 botanical families in prevention. For the treatment, 19 species distributed in 15 botanical families were cited, and for both cases 26 species distributed in 18 botanical families (Table 1).

It is important to highlight that the consumption of home remedies grew during the COVID-19 pandemic, as verified by Braga and Silva (2021) who showed that during the pandemic 27.0% of people increased the consumption of medicinal plants, according to the authors, this increase may be related to the need to keep the immune system healthy, in order to avoid contamination by the virus. According to Mafra; Lasmar and Rivas (2020) found that medicinal plants, traditionally known for their curative properties used for respiratory problems, began to be sought after both for the prevention and treatment of suspected COVID-19, within the family environment, and even for the consequences of social isolation such as anxiety and depression.

Table 1. Medicinal species used in the prevention, treatment and both cases of COVID-19 by the population of Carolina, MA. Abbreviations used: Pr: prevention; Tr: treatment; Am: Both; Plant part: F: leaf; C: whole stem; Fr: fruit; CF: fruit peel; Fl: flower; S: seed; T: whole plant. Preparation: Ch: tea, infusion, decoction; S: juice; I: inhalation; G: garrafada; LB: licker; X: syrup; Ol: oil; SM: juice; ML: molasses. Acquisition: PC: planted at home; Q: Neighbors' or relatives' yard; CF: bought at fairs or market.

Botanical Family	Species Name	Popular name	Prevention, Treatment and Both	Part of the plant	Preparation	Method of acquisition
Amaranthaceae	<i>Chenopodium ambrosioides</i> L.	Mastruz	Pr, Tr, Am	F	Ch	Q
				F	SM	Q
				F	SM	PC
				F	Ch	PC
Amaranthaceae	<i>Alternanthera brasiliana</i> (L.) Kuntze	Meracillin	On the	F	Ch	PC
Amaranthaceae	<i>Gomphrena globosa</i> L.	Life	Pr	F	Ch	PC
Amaryllidaceae	<i>Allium sativum</i> L.	Garlic	Pr, Tr, Am	C	Ch	PC
				C	Ch	CF
				C	ML	CF
				C	X	PC
Amaryllidaceae	<i>Allium cepa</i> L.	Onion	Pr, Am	C	Ch	CF
Arecaceae	<i>Mauritia flexuosa</i> L. f.	Moriche palm	Tr, Am	Fri	Ol	CF
Arecaceae	<i>Cocos nucifera</i> L.	Coco	On the	Fri	S	CF
Asteraceae	<i>Matricaria chamomilla</i> L.	Camomile	Pr	Fl	Ch	CF
Bixaceae	<i>Bixa orellana</i> L.	Annatto	On the	S	Ch	PC
Caricaceae	<i>Carica papaya</i> L.	Papaya	Pr, Tr	F	Ch	PC
				F	Ch	Q
Botanical Family	Species Name	Popular name	Prevention, Treatment and Both	Part of the plant	Preparation	Method of acquisition
Clusiaceae	<i>Platonia insignis</i> Mart.	Bacuri	On the	Fri	Ol	CF
Cucurbitaceae	<i>Momordica charantia</i> L.	Melon of São Caetano	Pr, Tr, Am	F	Ch	PC
				T	SM	PC
Dioscoreaceae	<i>Dioscorea trifida</i> L. f.	Yam	On the	Fri	S	PC



Fabaceae	<i>Senna macranthera</i> (DC. ex Collad.) H. S. Irwin & Barneby	Fed	Pr	F	Ch	PC
Fabaceae	<i>Chenna Alexandrina</i> Mill.	Year	On the	F	Ch	Q
Fabaceae	<i>Pterodon pubescens</i> (Benth.) Benth.	Fava de Sucupira	Tr	S	Ch	Q
				S	Ch	PC
Lamiaceae	<i>Plectranthus barbatus</i> Andrews	Seven Pain	Pr	F	Ch	PC
Lamiaceae	<i>Rosmarinus officinalis</i> L.	Rosemary	Pr	F	Ch	PC
Lamiaceae	<i>Ocimum gratissimum</i> L.	Alfavaca	Tr, Am	F	Ch	PC
				F	Ch	Q
Lamiaceae	<i>Mentha spicata</i> L.	Mint	Pr, Tr	F	Ch	Q
				F	ML	Q
Lauraceae	<i>Licaria puchury-major</i> (Mart.) Kosterm	Pens	Tr	S	Ch	CF
Malvaceae	<i>Gossypium herbaceum</i> L.	Cotton	Pr, Am	F	SM	Q
				F	SM	PC
Malvaceae	<i>Malva sylvestris</i> L.	Mallows	Pr, Tr, Am	F	Ch	PC
				F	I	PC
				F	Ch	Q
Meliaceae	<i>Azadirachta indicata</i> A. Juss.	Before	Pr, Tr, Am	F	Ch	PC
				F	Ch	Q
Monimiaceae	<i>Peumus boldus</i> Molina	Boldo	Pr, Tr, Am	F	Ch	Q
				F	SM	Q
				F	Ch	PC
				F	G	PC
				F	SM	PC
				F	ML	PC
Phyllanthaceae	<i>Phyllanthus niruri</i> L.	Quebra Pedra	Pr, Tr	F	Ch	PC
<b>Botanical Family</b>	<b>Species Name</b>	<b>Popular name</b>	<b>Prevention, Treatment and Both</b>	<b>Part of the plant</b>	<b>Preparation</b>	<b>Method of acquisition</b>
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	Sweet Grass	On the	F	Ch	PC
Rosacea	<i>Pirus malus</i> L.	Apple	On the	Fri	S	CF
Rubiaceae	<i>Coffea sp</i> L.	Coffee	Tr	Dust	Ch	CF
Rubiaceae	<i>Cinchona</i> L.	What	Pr, Tr	F	Ch	Q
Rutaceae	<i>Citrus aurantium</i> L.	Orange	Pr, Tr, Am	F	Ch	PC
				Fri	Ch	CF
				Fri	X	CF

### Connections: Exploring Interdisciplinarity in Health

Use of medicinal plants in the prevention and treatment of COVID-19 by the population of Carolina, Maranhão, Brazil



Rutaceae	<i>Citrus aurantifolia</i> Swingle	File	On the	F	Ch	PC
Rutaceae	<i>Citrus limom</i> (L.) Osbeck	Lemon	Pr, Tr, Am	CF	X	CF
				CF	Ch	CF
				F	Ch	CF
				Fri	Ch	CF
				Fri	Ch	Q
				Fri	Ch	PC
				Fri	ML	CF
				Fri	S	Q
				Fri	S	PC
				Fri	X	CF
				Fri	ML	PC
Verbenaceae	<i>Lippia alba</i> (Mill.) N.E. Br. ex Britton & Wilson, P.	Lemon Balm	Pr, Am	F	Ch	PC
Verbenaceae	<i>Stachytarpheta</i> <i>cayennensis</i> (Rich.) Vahl	Gervão	Pr, Am	F	Ch	PC
Asphodelaceae	<i>Aloe</i> <i>barbadensis</i> Mill.	Slug	Pr, Am	F	Ch	PC
Zingiberaceae	<i>Curcuma longa</i> L.	Saffron	Pr, Tr, Am	C	X	Q
				C	Ch	Q
				C	Ch	PC
				C	ML	PC
				C	Ch	CF
				C	X	CF
				F	Ch	CF
Zingiberaceae	<i>Zingiber</i> <i>officinale</i> Roscoe	Ginger	Pr, Tr, Am	C	Ch	PC
				C	Ch	CF
				C	ML	CF

Source: Prepared by the author.

### SPECIES WITH THE HIGHEST CITATIONS, PART OF THE PLANT, METHOD OF PREPARATION AND FORM OF ACQUISITION OF THE SPECIES USED FOR THE PREVENTION AND/OR TREATMENT OF COVID-19

The species *Peumus boldus* (boldo), *Citrus limon* (lemon), *Allium sativum* (garlic) and *Curcuma longa* (turmeric) were the most cited by the interviewees, when asked about which medicinal plants they used for prevention, treatment or both cases of COVID-19, as shown in Table 2.



Table 2. Species with the highest percentages of citations by respondents, used in the prevention, treatment of COVID-19 and in both cases, in Carolina, MA.

		<b>Prevention</b>	<b>Treatment</b>	<b>Both</b>
<i>Peumus boldus</i>		25,23%	19,05%	26,14%
<i>Citrus limon</i>		23,42%	14,29%	15,90%
<i>Allium sativum</i>		21,62%	11,90%	12,50%
<i>Curcuma longa</i>		6,31%	9,52%	7,95%

Source: Prepared by the author.

*Peumus boldus* (boldo) was cited by respondents to combat the symptoms emitted by the virus. In addition, they mentioned using it for other purposes, such as anti-inflammatory, flu, malaise, anemia, fever, hangover, diabetes, pain in general and diseases of the digestive system. According to Ruiz et al. (2008), this species has antioxidant, anti-inflammatory, antibacterial and antifungal activities, suggesting that, even though the interviewees rely on popular knowledge, there are scientific bases that prove the efficacy of the home remedy. This species was also mentioned in the research carried out by Oliveira; Dias and Santos (2022), on medicinal plants used during the COVID-19 pandemic in the southern region of Pará, where according to the volunteers who responded to the questionnaire, boldo was the main medicinal plant used for the prevention or treatment of COVID-19. The authors point out that homemade tea can relieve mild symptoms of the disease, but does not have any therapeutic effect against the virus.

*Citrus limon* (lemon) was mentioned by participants for COVID-19, flu, shortness of breath, and digestion. Some of the proven properties of *Citrus limon* are anticancer, antioxidant, anti-inflammatory, antimicrobial, antiparasitic, antiallergic activity and effects on the digestive system (KLIMEK-SZCZYKUTOWICZ; SZOPA; EKIERT, 2020).

*Allium sativum* (garlic) has been described for COVID-19, influenza, lung clearance, colic, and diarrhea. According to Apolinário et al. (2008), this species may have healing activity, antioxidant effects, digestive activity, antiviral and antibacterial properties, in addition to stimulating the immune system. In addition, Oliveira et al. (2020), analyzing phytotherapeutic candidates to combat COVID-19 symptoms, demonstrated that *Allium sativum* had a possible effect against the virus, emphasizing that its extract can be seen as an option to enhance the immune response. Studies carried out by Thuy et al. (2020), state that the compounds in *Allium sativum* essential oil inhibit the ACE2 protein, causing the virus to lose the host receptor and attacking the PDB6LU7 protein, the main protease of SARS-CoV-2, while preventing the maturation of the virus protein from occurring. The authors point out that the use of garlic essential oil can help prevent the disease.

*Curcuma longa* (turmeric) has been prescribed for COVID-19, flu, sore throat, infection, back pain, anti-inflammatory, boosting immunity, and for fever. Some of its scientifically proven activities are anti-inflammatory, antioxidant, antiprotozoal, nematocidal, antibacterial and antiviral (ARAÚJO; LEON, 2001).

When asked about the part of the plant, mode of preparation and form of acquisition of plant species, a similarity was observed in the results when compared to the answers about the cases of prevention, treatment and both cases of COVID-19, as shown in Table 3.

Table 3. Percentage values referring to the part of the plant, form of acquisition and mode of preparation of the plant species mentioned by the interviewees in Carolina, MA for prevention, treatment and both.

<b>Part of the Plant</b>			<b>Prevention</b>	<b>Treatment</b>	<b>Both</b>
Leaf			55,56%	45,16%	54,76%
Stem			19,44%	25,81%	21,43%
Fruit			13,89%	19,35%	21,43%
Fruit Peel			5,56%	0,00%	0,00%
Flower			2,78%	0,00%	0,00%
The whole plant			2,78%	0,00%	0,00%
Seeds			0,00%	9,68%	2,38%
<b>Acquisition</b>					
Planted at Home			55,56%	35,48%	47,62%
Neighbors/Relatives' Backyard			19,44%	29,03%	19,05%
Bought at Fairs/Markets			25,00%	35,48%	33,33%
<b>Preparation</b>					
Tea			75,22%	70,97%	66,67%
Sumo			13,89%	6,45%	7,14%
Syrup			5,56%	9,68%	0,00%
Honey			5,56%	3,23%	11,90%
Juice			2,78%	3,23%	7,14%
Olive oil			0,00%	3,23%	4,76%
Inhalation			0,00%	3,23%	0,00%
Garrafada			0,00%	0,00%	2,38%

Source: Prepared by the author.

Leaves are the most used plant parts mentioned by the participants (Table 1), a fact also evidenced in other studies on ethnobotany, where leaves are the most used parts, such as in the work of Battisti et al. (2013) on the medicinal plants used in the municipality of Palmeira das Missões in Rio Grande do Sul, where the leaves obtained 52%. The authors also point out that the probable explanation for this is the fact that they are easy to collect and are available throughout the year. The work by Gonçalves et al. (2018) carried out in the city of Santa Luzia, Maranhão, also showed that the leaf was the most used vegetable part in the preparations of home remedies, with 35% of the citations, followed by sapwood with 20% and root with 13%. The study by Scareli-Santos; Ferreira and Monteiro (2021), also pointed out that the leaf comprised the part of the plant most used in COVID-19 phytotherapy by the population of Riachinho, in Tocantins (55.56%), followed by the stem (27.78%) and the fruit (16.67%).

Most of the medicinal plant species were acquired in their own backyards, in line with the research of Badke et al. (2012), about the knowledge and popular practices of health care with the use of medicinal plants, where the participants were asked about how they obtained the plants, all of them stated that they cultivated some of them in their own homes, They point out that the preferred



way to obtain vegetables is the one that comes from their own cultivation due to the importance of knowing the origin, because according to them, the conditions of planting, the form of harvesting and the way of storing them interfere with their medicinal properties.

The form of tea preparation was the most prevalent, corroborating the results of the work by Silva et al. (2021), who analyzed the importance of the use of medicinal plants in the pandemic scenario, concluded that the form of tea was predominant in relation to the other forms, comprising 92.2% of the citations. In Lira's study; Sousa and Lins the form of preparation obtained 78% for infusion and 28% decoction.

## MOTIVATIONS AND INFLUENCING SOURCES REGARDING THE USE OF MEDICINAL PLANTS IN THE PREVENTION AND TREATMENT OF COVID-19

When the participants were asked about the reasons that led them to use medicinal plants in the prevention of COVID-19, we obtained (40.37%) that they stated that it was a natural remedy, followed by internet advertising (18.35%), influence of friends (18.35%), recommendation of colleagues (11.01%), TV advertising (5.50%), low cost (3.67%) and medical indication with (2.75%). The reasons that led them to use medicinal plants in the treatment of the disease were because it is a natural remedy (46.81%), influence of friends (21.28%), advertising on the internet (12.77%), medical indication (6.38%), recommendation of colleagues (6.38%), advertising on TV (4.26%) and low cost (2.13%).

These results are in line with the data obtained by Braga and Silva (2021), who analyzed the consumption of medicinal plants and herbal medicines in Brazil in the face of the COVID-19 pandemic, concluded that the indication of the use of medicinal plants by friends and family also obtained a significant mention of 47.0%. The authors highlight that 14.6% were based on evidence and 12.6% used it by medical indication and 2.0% answered that they use it by internet indications, they point out that these data demonstrate that people are looking for proven information, in order to use it correctly and avoid fake news.

When asked about the sources that indicated home remedies with medicinal plants for the prevention of COVID-19, the interviewees mentioned family members (41.13%), friends (26.95%), internet advertising (16.31%), co-workers (4.96%), nurse referral (3.55%), TV advertisement (3.55%), doctor referral (2.13%), pharmacist referral (0.71%), pharmacy clerk referral (0.71%) and radio advertisement (0%). Regarding the sources that indicated home remedies with medicinal plants for the treatment of the disease, it was found that the interviewees stated that they had received indications from family members (41.54%), friends (29.23%), internet advertising (12.31%), nurse indication (6.15%), doctor indication (4.62%), co-workers (4.62%) and TV advertising (1.54%), the



categories radio advertising, indication of pharmacist and indication of pharmacy clerk were not mentioned by the research participants.

Similar results were found in the work of Scareli-Santos; Ferreira and Monteiro (2021), where the main source of indication for the use of medicinal plants was family members with (41.94%) for prevention and (50%) in the treatment of COVID-19, followed by friends with (35.48%) and (37.50%).

## INTERACTIONS BETWEEN SPECIES INDICATED FOR COVID-19 VERSUS SCIENTIFIC PROPERTIES DESCRIBED IN THE LITERATURE

The indications mentioned by the interviewees regarding the use of medicinal plants in the prevention and/or treatment of COVID-19 in Carolina, MA versus the therapeutic indications described in the scientific literature are presented in Table 4. It is important to note that there are still no studies that prove the therapeutic action of these plants, referring to the therapy of COVID-19. The effects of most medicinal plants showed promising inhibitory activities, which made the population seek to combat the symptoms caused by the coronavirus, in this case the literature reports several properties of the species mentioned, regarding the symptoms caused by COVID, but this does not mean that they are effective in fighting the virus.

We cannot rule out that the results from the use of medicinal species both in prevention and in positive treatment can also be a placebo effect, which according to Soares (2002) is defined as "any treatment that does not have a specific action on the patient's symptoms or disease, but that generally causes an effect". This concern about the use of medicinal plants and the occurrence of the placebo effect is also presented by Baracho et al. (2006), who state in their work on the use of medicinal plants as an alternative treatment, that the responses attributed as optimal may, in addition to coming from the properties of the species, also be the result of the placebo effect, that sick people believed and trusted in the cure was enough to achieve it.

In view of this, it is necessary to reaffirm that the only form of prevention against COVID-19 is vaccination and the necessary care, following all the rules and guidance protocols made available by the World Health Organization.



Table 4. Medicinal plants cited by the population of Carolina, MA, in the prevention and treatment of COVID-19 and their therapeutic indications described in the scientific literature. Legend: nc: not mentioned by the interviewee; Ok: quoted by the interviewee; NL: not found in the literature.

Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Allium cepa L.</i>	Onion	OK	OK	Effective in the treatment of gastrointestinal tract disorders; aiding in the control of diabetes and as a hypoglycemic agent; reducing the risk of developing esophageal, gastric and breast cancer.	Teixeira (2011)
<i>Allium sativum L.</i>	Garlic	OK	OK	Antibacterial property; antiviral; Antifungal; antiprotozoa; antiparasitic; cicatrization; antidiabetic; antihypertensive; antitumor effects; liver protectors/detoxifiers; antioxidants and radioprotectants; diuretic activity; Digestive;  COVID-19	Alam; Hoc; Uddin (2016)  Thuy et al. (2020)
<i>Aloe barbadensis Mill.</i>	Aloe	OK	OK	Antimicrobial action; topical treatment of burns and superficial wounds as a healing agent; inflamed hemorrhoids; bruises, sprains and rheumatic pain; Used in the cosmetics and pharmaceutical industry with laxative properties.	Lorenzi; Matos (2008)
Species Name	Popular name	Prevention	Treatment	Therapeutic indications	Bibliographic reference
<i>Alternanthera brasiliana (L.) Kuntze</i>	Meracillin	Ok	Ok	Anti-inflammatory, analgesic action and also the inhibiting activity of the herpes simplex virus.	Delaporte et al. (2002)



<i>Azadirachta indica</i> A. Juss.	Before	Ok	Ok	Antidermal; antifungal; antihelminth; antituberculosis; antitumor; antiseptic; contraceptive; cosmetics; ear pain; burns; diabetes; catapora; smallpox; warts; Dandruff and galdular tumors.	Brazil (2013)
<i>Bixa orellana</i> L.	Annatto	Ok	Ok	Antifungal activity; antibacterial and antimalarial.	Vilar et al. (2014)
<i>Carica papaya</i> L.	Papaya	Ok	Ok	Digestive action; diuretic; laxative; asthma; diabetes; vermifuge; emmenagogue; antipyretic; stomach; sedative and calming; respiratory tract disorders; Antibacterial and anthelmintic properties	Lorenzi; Matos (2008)
<i>Chenopodium ambrosioides</i> L.	Mastruz	Ok	Ok	Anti-parasitic, anti-fungal, antitumor, anti-inflammatory, analgesic, insecticidal and repellent activity.	Matos (2011)
<i>Cinchona</i> L.	What	Ok	Ok	Action against malaria; Fevers; indigestion; ailments of the mouth and throat; cancer; cardiac action - against arrhythmia and other problems; stomatic, tonic; febrifuge; treatment of physical weakness; anaemia; dyspepsia; appetite stimulant; gastrointestinal disturbances and general fatigue.	Lorenzi; Matos (2008)
<b>Species Name</b>	<b>Popular name</b>	<b>Prevention</b>	<b>Treatment</b>	<b>Therapeutic indications</b>	<b>Bibliographic reference</b>
<i>Citrus aurantifolia</i> Swingle	File	Ok	Ok	Antibacterial activity; Antifungal; antiaflatoxicogenic; anticancer/cytotoxic; antioxidant; immunomodulatory; anti-obesity; antifertility; cardiovascular activity; effects on bone; anthelmintic; It prevents the formation of kidney stones and facilitates their dissolution.	Enejoh et al. (2015)



<i>Citrus aurantium</i> L.	Orange	Ok	Ok	Activity in the respiratory system; on the central nervous system; antiedematogenic; anorectic action; antispasmodic and antitumor.	Areas; Moura (2012)
<i>Citrus limom (L.)</i> Osbeck	Lemon	Ok	Ok	Anticancer activity; antioxidant; Inflammatory; Antimicrobial; antiparasitic; anti-allergic; hepatoregenerating; antidiabetic; anti-obesity; effects on the digestive system; cardiovascular system; influence on the nervous system and skeletal system.	Klimek-Szczykutowicz; Shed; Ekiert (2020)
<i>Cocus nucifera</i> L.	Coco	Ok	Ok	Anthelmintic activity; Antimicrobial; antiviral; assist in the treatment of gastric ulcer; against the genital herpes virus; energy and in the treatment of constipation; rehydrating and diuretic.	Lorenzi; Matos (2008)
<i>Coffea sp</i> L.	Coffee	Nc	Ok	Clean the blood; hypoglycemic; curative action on eye conditions; influence on blood fat levels; protective effect against arteriosclerosis; stimulates reasoning; decreases drowsiness and fatigue; effect on digestion; cases of hypotonia; cold and migraine associated with analgesics.	Lorenzi; Matos (2008)
<b>Species Name</b>	<b>Popular name</b>	<b>Prevention</b>	<b>Treatment</b>	<b>Therapeutic indications</b>	<b>Bibliographic reference</b>
<i>Curcuma longa</i> L.	Saffron	Ok	Ok	Anti-inflammatory activity; antioxidant; antiprotozoa; nematode; Antibacterial; antivenin; Anti-HIV - with antiviral and antitumor activity.	Araújo; Lion (2001)
<i>Cymbopogon citratus</i> (DC.) Stapf	Sweet Grass	Ok	Ok	Gentle soothing and spasmolytic action; antimicrobial activity; Analgesic; used for the relief of uterine and intestinal colic; treatment of nervousness and states of restlessness.	Lorenzi; Matos (2008)





<i>Dioscorea Trifida</i> L. f.	Yam	Ok	Ok	Anti-inflammatory drugs are used in the treatment of food allergies.	Mollica et al. (2013)
<i>Gomphrena globosa</i> L.	Life	Ok	nc	Antithemic activity; antidiarrhea; febrifuge; eupeptic and emmenagogue; used against dyspepsia and various poisonings; cases of colitis and enteritis; general weakness and intermittent fevers.	Lorenzi; Matos (2008)
<i>Gossypium herbaceum</i> L.	Cotton	Ok	Ok	antibacterial tivity; diuretics; anti-ulcer; antioxidant; scarring; antiepileptic; antidiabetic; anti-fertility; Anti-helminthic and anti-urolithic.	Chikkula; Monty; Kottumukkula (2018)
<i>Licaria puchury-major</i> (Mart.) Kosterm	Pens	nc	Ok	Antimicrobial and antioxidant.	Grace (2015)
<i>Lippia alba</i> (Mill.) N.E. Br. ex Britton & Wilson, P.	Lemon Balm	Ok	Ok	Gentle soothing and spasmolytic action; analgesic activity; sedative; anxiolytic; mucolytic activity facilitating expectoration; effective in relieving uterine and intestinal cramps; treatment of nervousness and states of restlessness.	Lorenzi; Matos (2008)
<b>Species Name</b>	<b>Popular name</b>	<b>Prevention</b>	<b>Treatment</b>	<b>Therapeutic indications</b>	<b>Bibliographic reference</b>
<i>Malva sylvestris</i> L.	Mallows	Ok	Ok	Antiepileptic action; anti-inflammatory and antiseptic.	Lorenzi; Matos (2008)
<i>Matricaria chamomilla</i> L.	Camomile	Ok	Nc	Emmenagogue action; Digestive; sedative; facilitate the elimination of gases; cramps and stimulate appetite; immunostimulant property; spasmolytic; bacteriostatic action; trichomonicides; anxiolytic property; skin healing; inflammation of the gums and as an antiviral.	Lorenzi; Matos (2008)
<i>Mauritia flexuosa</i> L. f.	Moriche palm	Ok	Ok	Healing activity.	Barros et al. (2014)



<i>Mentha spicata</i> L.	Mint	Ok	Ok	Expectorant action; bronchodilator; fatigue; indigestion; flatulence; diarrhoea; poisoning of gastrointestinal origin; liver disorders; nervous vomiting; External use in scabies and dental neuralgia.	Macedo (2016)
<i>Momordica charantia</i> L.	Melon of São Caetano	Ok	Ok	Treatment of worms; inflamed hemorrhoids and diarrhea; anti-diabetic properties; antitumor and antiviral.	Lorenzi; Matos (2008)
<i>Ocimum gratissimum</i> L.	Alfavaca	Ok	Ok	It has antimicrobial properties; hypoglycemic; antioxidants and anti-inflammatories.	Santos et al. (2021)
<i>Peumus boldus</i> Molina	Boldo	Ok	Ok	Antioxidant; anti-inflammatory; antibacterial and antifungal.	Ruiz et al. (2008)
<i>Phyllanthus niruri</i> L.	Quebra Pedra	Ok	Ok	Treatment of renal and hepatic disorders and antispasmodic activity.	Oliveira et al. (2019)
<i>Pyrus malus</i> L.	Apple	Ok	Ok	NL	NL
<i>Platonia insignis</i> Mart.	Bacuri	Ok	Ok	Leishmanicidal activity; antioxidant; Antimicrobial; genotoxic effect; anticonvulsant and anti-inflammatory.	Lorenzi; Matos (2008)
<b>Species Name</b>	<b>Popular name</b>	<b>Prevention</b>	<b>Treatment</b>	<b>Therapeutic indications</b>	<b>Bibliographic reference</b>
<i>Plectranthus barbatus</i> Andrews	Seven sorrows	Ok	nc	Treatment of liver ailments and digestion problems; gastric hyposecretory action; gastritis control; dyspepsia; heartburn; gastric malaise; hangover; stimulant of digestion and appetite.	Lorenzi; Matos (2008)
<i>Pterodon pubescens</i> (Benth.) Benth	Fava de Sucupira	nc	Ok	Antiarthritic effect; anti-inflammatories; antinociceptive and antiparasitic.	Hansen; Haraguchi; Alonso (2010)



<i>Rosmarinus officinalis</i> L.	Rosemary	Ok	nc	Headache; dysmenorrhoea; weakness; poor memory; hypertension; digestive problems; loss of appetite; rheumatism; spasmolytic properties; liver protective; antitumor; Healing; Antimicrobial; scalp stimulant; diuretic; cholagogue; choleric; carminative and anti-inflammatory bowel drugs.	Lorenzi; Matos (2008)
<i>Senna spectabilis</i> (Schrad.) H. S. Irwin & Barneby	Year	Ok	Ok	Diuretic action and febrifuge activity; used to treat liver and dropsy disorders, anemia, flatulent dyspepsia and other menstrual disorders; emmenagogue and purgative effect; antimicrobial activity and wound healing and combat impingement and white cloth.	Lorenzi; Matos (2008).
<i>Senna obtusifolia</i>	Fed	OK	Nc	Laxative; insomnia; headache; intestinal constipation; cough; blurred vision; double vision; hypertension; Beneficial action against psoriasis and dermatoses caused by fungi and bacteria.	Lorenzi; Matos (2008)
<b>Species Name</b>	<b>Popular name</b>	<b>Prevention</b>	<b>Treatment</b>	<b>Therapeutic indications</b>	<b>Bibliographic reference</b>
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	Gervão	OK	OK	Anti-inflammatory effect; anti-ulcerogenic; antinociceptive; leishmanicidal; antibacterial and antioxidant properties.	Souza et al. (2010)
<i>Zingiber officinale</i> Roscoe	Ginger	OK	OK	Anti-ulcer activity; Inflammatory; cardiovascular and antioxidant effect.	Moghaddasi; Kasani (2012)

Source: Prepared by the author.

## CONCLUSIONS

From the results obtained, it can be concluded that the interviewees used it in the prevention, treatment of COVID-19 and both cases. The species with the highest citation was *Peumus boldus*



(boldo), also using the leaves and tea at the time of preparation, planted in its own backyard. The reasons that led them to use it would be because it is a natural remedy and the family members would be the influencing agents regarding their indication.

Regarding the effects of medicinal plants, most may have shown positive activity related to the infection, but this does not mean that they are effective in fighting the Coronavirus. Many species were used for prevention and treatment, showing a cultural behavior, which sought ways to combat mainly the symptoms caused by COVID-19.

The low participation of home remedies containing active therapeutic properties by health professionals indicates the need to qualify these professionals so that they are able to provide guidance on their use, since the health system has become saturated and the population has found it difficult to obtain medical care. This made people consume home remedies on their own. Several of the species mentioned have properties consistent with those mentioned by the population, but self-medication is dangerous and requires care in the preparation of home remedies.

### **ACKNOWLEDGEMENTS**

The authors thank the Institutional Program for Scientific Initiation Scholarships (PIBIC) of the Federal University of Northern Tocantins, for the encouragement and support in the research. The present work was carried out with the support of the National Council for Scientific and Technological Development -CNPq – Brazil, which provided the scientific initiation scholarship for the first author.



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