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Article

Herbalists of Inaciolândia, Goiás: Ethnobotany and Use of Medicinal Plants

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ABSTRACT

Studies on medicinal plants play a fundamental role in the preservation and transmission of traditional knowledge, which offers an alternative for the treatment of various diseases. In this context, this research aimed to identify the herbalists residing in Inaciolândia, GO, analyzing their ethnoknowledge regarding the knowledge and use of medicinal plants. The research followed a mixed approach: qualitative, descriptive, and quantitative, using semi-structured questionnaires. Among the 11 herbalists interviewed, there was a higher representation of women, a pattern also reported in other ethnobotanical studies conducted in Brazil. There was concern about the continuity of traditional knowledge, considering that the age range of the participants varied from 40 to 83 years. Sixty-seven species of medicinal plants were recorded, distributed across 36 families and 58 genera, with Lamiaceae and Asteraceae being the families with the greatest species richness. *Mentha spicata* (mint), *Aloe vera* (aloe), *Ruta graveolens* (rue), and *Plectranthus barbatus* (boldo) were the most frequently mentioned in the interviews, indicating a high degree of agreement among participants regarding their use. The predominant use was of the leaves, and the main method of preparation reported was infusion. A wide diversity of therapeutic indications was observed, with a predominance of diseases associated with the digestive system, inflammatory processes, and pain.
Keywords: traditional knowledge; ethnobotany; traditional medicine; folk knowledge.

RESUMO

Os estudos sobre plantas medicinais desempenham um papel fundamental na preservação e transmissão de conhecimentos tradicionais, que oferecem uma alternativa para o tratamento de diversas doenças. Neste contexto, essa pesquisa teve como objetivo identificar os raizeiros que residem em Inaciolândia, GO, analisando o etnoconhecimento deles quanto ao saber e uso de plantas medicinais. A pesquisa seguiu uma abordagem mista: qualitativa, descritiva e quantitativa, utilizando questionários semiestruturados. Entre os 11 raizeiros entrevistados, observou-se maior representatividade feminina, padrão também relatado em outros estudos etnobotânicos realizados no Brasil. Verificou-se preocupação quanto à continuidade do conhecimento tradicional considerando que a faixa etária dos participantes variou de 40 a 83 anos. Foram registradas 67 espécies de plantas medicinais distribuídas em 36 famílias e 58 gêneros, sendo Lamiaceae e Asteraceae as famílias com a maior riqueza de espécies. *Mentha spicata* (hortelã), *Aloe vera* (babosa), *Ruta graveolens* (arruda) e *Plectranthus barbatus* (boldo) foram as mais citadas nas entrevistas, indicando elevado grau de concordância de uso entre os participantes. O uso predominante foi o das folhas e o principal modo de preparo relatado foi a infusão. Observou-se

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ampla diversidade de indicações terapêuticas, com predominância de enfermidades associadas ao aparelho digestivo, processos inflamatórios e de dor.
Palavras-chave: conhecimento tradicional; etnobotânica; medicina tradicional; saberes populares

Introduction

The use of plant parts for medicinal purposes, both by traditional rural and urban populations, encourages the appreciation of empirical knowledge as a basis for the production of new medicines and the discovery of bioactive principles. In this context, ethnobotany makes it possible to understand, record, and analyze how different social groups use plants, contributing to the understanding of popular knowledge related to plant resources (Silva et al. 2003; Martins et al. 2005).

The history of the use of medicinal plants has shown that they are part of human evolution and that they were the first therapeutic resources used by peoples. Ancient civilizations have their own historical references to medicinal plants, so that long before any form of writing appeared, humans were already using plants, either as food or medicine. The use of plants with phytotherapeutic properties is one of humanity's oldest therapeutic practices (Ichim et al. 2020) and has gained renewed interest in recent decades. This movement is associated with the search for natural therapeutic alternatives and the recent concern with microbial resistance related to the indiscriminate use of conventional drugs (Silva & Nogueira 2021). In this scenario, there has been an increase in the demand for natural remedies, which has sparked considerable interest among researchers and increased the need for studies on this practice (Duarte 2006; Barbosa et al. 2012; Pedroso et al. 2021).

In their experiences with herbs, users have had successes and failures, with plants often healing and, in other cases, killing or producing severe side effects. Due to poor social conditions and lack of access to health services and industrialized medicines, many communities rely primarily on the use of plants for primary health care (Dantas & Torres 2019).

Since the 1970s, the World Health Organization (WHO) has recognized traditional medicine, especially in populations with limited access to health systems. The commercialization of medicinal plants remains relevant in various sociocultural contexts, involving herbalists, popular markets, and specialized establishments (Monteiro & Brandelli 2017). Due to advances in science and biotechnology, the medicinal potential of plants has been widely researched and scientifically recognized (Nascimento et al. 2016).

In this context, studies on medicinal plants play a fundamental role in the preservation and transmission of traditional knowledge, which offers an alternative for the treatment of various diseases (Dantas & Torres 2019). This knowledge, historically built by different peoples and traditional communities, represents one of the oldest therapeutic resources used by humanity (Silva & Proença 2007). Medicinal plants contain active ingredients that provide therapeutic action; they are used both to relieve and treat diseases, as well as contributing to the development of medicines (Jales et al. 2023). Understanding how they are used, which parts are used, and where they are obtained also helps in the conservation of species, especially native ones.

In different regions of Brazil, especially in the Cerrado biome, there are "raizeiros" translated to "herbalists", individuals who have traditional knowledge about the identification, collection, preparation, and indication of medicinal plants. These social actors can commercialize plant species or cultivate them for their own and community use, and they are responsible for the intergenerational transmission of this knowledge ( ). According to Nery & Silva (2021), herbalists play an important role in promoting health through the recommendation and preparation of natural remedies. As they depend on the exploitation of medicinal plants, they usually play a crucial role in preserving biodiversity. With their deep knowledge of the properties of medicinal plants, they contribute to the conservation of local flora, as they often use sustainable methods of collection and cultivation, avoiding the predatory exploitation of plants (Guimarães et al. 2019, 2022).

According to França et al. (2008), herbalists face challenges due to changes in medicine, as their knowledge ends up being overlooked in the health field. This is a territory with multiple actors involved in the search for space in a field permeated by specific contours. In this territory, based on the ideas of Saquet (2019), herbalists assume a position of counter-hegemony, insofar as the power relations within the health territory are disharmonious and hinder the conquest of their space.

Given this context, this research aimed to identify the herbalists residing in the municipality of Inaciolândia, GO, analyzing their ethnoknowledge about the use of medicinal plants, their ways of life, the forms of species management, and the main therapeutic indications at the local level.

Materials and Methods

Study Area

This research was conducted in the municipality of Inaciolândia, located in the state of Goiás, in the Central-West Region of Brazil (Figure 1). The municipality is located 286 km from the capital, Goiânia, and has a territorial area of approximately 689.2 km². In 2022, the population was 5,954 inhabitants, with a population density of 8.64 inhabitants per km² (IBGE 2025).

The name of the municipality pays homage to its founder, José Inácio, who contributed to the local occupation process by donating land and establishing the first educational and religious institutions in the region (Inaciolândia 2017).

The municipality is located in the Cerrado phytogeographic domain, a biome characterized by high biodiversity and a high degree of endemism. In recent decades, a significant part of the native vegetation has been replaced by sugarcane crops, an activity of significant economic importance for the municipality.

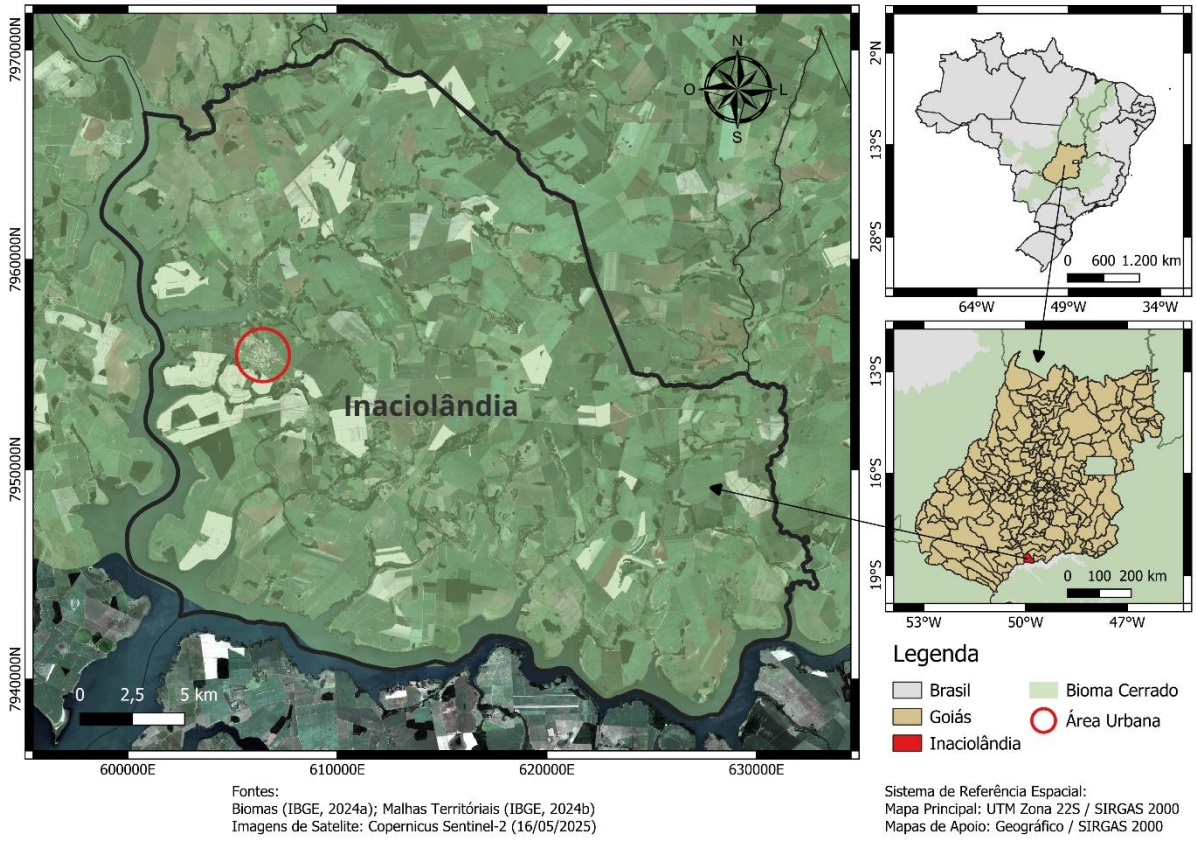

Figure 1. Location map of the study area: urban area (red circle) of Inaciolândia, GO. Source: prepared by the authors

Data Collection

This research was registered in the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (SisGen), under code A05B94A, in accordance with Federal Law No. 13,123/2015, which regulates access to and use of Brazilian genetic heritage and associated traditional knowledge (CTA), with the purpose of ensuring the protection of the rights of indigenous communities, quilombolas, and other traditional peoples and communities (Brazil 2015). This research was conducted under ethical precepts (in accordance with CNS 2016, 2024) and submitted to the Research Ethics Committee (Opinion No. 6.894.011).

The herbalists were identified using the "snowball" technique (Albuquerque et al. 2008), a process in which each participant indicates other potential collaborators. The participants' consent was formalized by signing the Free and Informed Consent Form, ensuring anonymity and explaining the objectives of the research.

The research followed a mixed approach: qualitative, descriptive, and quantitative, using semi-structured questionnaires (Pereira et al. 2018). Questionnaires administered in pre-scheduled interviews investigated folk medicine practices, the use and recommendations of medicinal plants, and diseases treated (Supplementary Material). A semi-structured interview script consisting of open and closed questions was applied to herbalists in the municipality of Inaciolândia, GO. Data such as age, place of birth, length of residence in the municipality, marital status, education, number of children, and connection to the community were addressed. Data were also collected on the plant species used, parts of the plant used, method of preparation, and diseases treated.

The collection of plants, carried out with the participants' permission, included only specimens in the reproductive stage. The herbarium collection followed the usual methodology, and the samples were added to the collection of the José Ângelo Rizzo Herbarium (JAR) at the State University of Goiás (UEG). Angiosperms were classified according to APG IV (2016). Species identification was performed by consulting specific literature, the main source being Lorenzi and Matos (2008).

Data on geographic distribution, endemism, conservation *status*, and scientific nomenclature were obtained by consulting each species individually at http://www.floradobrasil.jbrj.gov.br/ (Flora and Fungi of Brazil 2025). For exotic species, information from the Missouri Botanical Garden (MOBOT 2025) was used.

Based on the information obtained in the questionnaires, the species were distributed into eleven categories of medicinal uses: AD = diseases associated with the digestive system; AR = diseases associated with the respiratory system; PD = diseases associated with dermatological problems; ID = diseases associated with inflammation and pain; SN = diseases associated with the nervous system; SC = diseases associated with the cardiovascular system; PU = diseases associated with urological problems; DP = parasitic diseases; DG = gynecological diseases; PO = orthopedic problems; and SSG = general symptoms and signs, those with symptoms of various non-specific diseases and/or of cultural origin. The categorization was adapted from Guimarães et al (2019).

Results and Discussion

In the present study, 11 traditional healers were interviewed with the aim of categorizing their sociocultural profile and life trajectories. There was a predominance of women among the herbalists, representing 82% of the total (nine women). This result may be related to the traditional association of health care practices, especially through popular knowledge and the use of medicinal plants, with the female gender, within family and community contexts (Pasa et al. 2015). The greater female representation was also recorded in other ethnobotanical studies conducted in Brazil (Guimarães et al. 2019; Silva et al. 2021; Guimarães et al. 2022; Soares et al. 2023).

The age of the herbalists ranged from 40 to 83 years, indicating that this knowledge is rooted in more experienced generations. The absence of younger representatives in this craft is a worrying indication that this tradition is in the process of disappearing, as it is not being renewed among the younger generations. This reflects a possible break in the intergenerational transmission of traditional knowledge, which compromises the cultural preservation of this important intangible heritage (Rêgo et al. 2023). According to Oliveira (2015), the devaluation of the use of medicinal plants among younger individuals stems from a reversal of sociocultural values, driven by widespread access to industrialized medicines. These factors have contributed to the marginalization of traditional knowledge, which has come to be perceived as outdated in the face of modern therapeutic practices.

There was a predominance of herbalists from the Central-West region of Brazil, totaling five participants, followed by the Southeast region with three, the Northeast with two, and the South with one. This result corroborates previous studies that highlight the strong presence and activity of herbalists in the Midwest, associated with the wide plant diversity of the Cerrado biome and the deep traditional knowledge about the use of medicinal plants (Vargem et al. 2022; Silva 2022; Dias et al. 2023). In addition, historical factors, such as internal migration processes and the formation of traditional communities, as well as socioeconomic issues, such as limited access to formal health services, have favored the maintenance and appreciation of this practice in the region (Guimarães et al. 2019). These aspects highlight the cultural and ecological relevance of herbalists in the Midwest context, reinforcing the need for public policies aimed at preserving this traditional knowledge. In the context of Inaciolândia, this scenario highlights the municipality's insertion into a broader regional dynamic of conservation and transmission of knowledge associated with the Cerrado.

Among the eleven herbalists, nine identified themselves as belonging to the Catholic religion and attend church frequently. Queiroz (1968) recalls that syncretism with indigenous religions was not very significant, that is, they were silenced in the collective memory of the Brazilian people. On the other hand, religions of African origin stood out in several regions, mainly in the Northeast. In regions far from large cities, the popular Catholicism of the colonizer was better preserved, despite also mixing with other beliefs. Both “benzedeiros”, translated to “folk healer” and “raizeiros” have social origins marked by religion, but they practice their beliefs in a unique way, different from those proposed by the Roman Catholic Church. This is due to the transculturation between peoples of European origin, of Christian matrix, and indigenous peoples and those of African origin.

As for medicinal plants, 67 species were cited by the “raizeiros”, distributed across 36 families and 58 genera (Table 1). The most common botanical families were Lamiaceae, with eleven species mentioned, and Asteraceae, with nine. The other families were represented by four species or less. Lamiaceae and Asteraceae showed greater richness in other ethnobotanical studies (Lima et al. 2011; Guimarães et al. 2019, 2022; Soares et al. 2023; Lopes Neto et al. 2025), corroborating the results of this study.

Among the species, most are cultivated (43.28%, n = 29), followed by native (32.84%, n = 22) and naturalized (23.88%, n = 16). The predominance of cultivated species can be explained by the local tradition of planting species in backyards for food, ornamental, and medicinal uses, a common situation in small towns and rural areas. In addition, Inaciolândia is located in a region with intense conversion of native areas to monocultures, especially sugarcane.

Table1 . List and information on medicinal species cited by herbalists in Inaciolândia, GO, organized by family in alphabetical order. Origin: cult = cultivated; n = native; natu = naturalized. Phytogeographic domain: A = Amazon; Ca = Caatinga; Ce = Cerrado; MA = Atlantic Forest; Pa = Pampa; Pn = Pantanal. Conservation *status*: NE = not evaluated; LC = least concern.

Family	Species	Common name	Voucher	Origin	Phytogeographic domain	Conservation *status*	Number of citations	Part of the plant used	Method of preparation	Indicated for:
Acanthaceae	*Justicia pectoralis* Jacq.	pari-pari		n	A, Ca, Ce, MA	NE	1	Leaves and branches	Infusion or tea	Respiratory problems, muscle relaxant, and headaches
Adoxaceae	*Sambucus nigra* L.	elderberry		natu	A, Ca, Ce, MA, Pa, Pn	NE	1	Flowers and fruits	Infusion, syrup, or tincture	Colds, flu, fever, and expectorant properties
Amaranthaceae	*Beta vulgaris* L.	Beet		cult		NE	1	Root	Juice or cooking	Anemia, digestive disorders, and immune system strengthening
	Dysphania ambrosioides (L.) Mosyakin & Clemants	Santa Maria herb	1	natu	A, Ca, Ce, MA, Pa, Pn	NE	3	Leaves	Infusion or decoction	Vermifuge, gastrointestinal disorders, and colic
Amaryllidaceae	*Allium sativum* L.	Garlic		cult		NE	2	Bulb	Consumption Raw, oil, or tincture	Hypertension, high cholesterol, and antimicrobial properties
Anacardiaceae	*Schinus terebinthifolia* Raddi	aroeira		n	Ca, Ce, MA, Pa	NE	2	Bark and leaves	Decoction or infusion	Inflammation, urinary tract infections, and wound healing
Apiaceae	*Coriandrum sativum* L.	coriander	26	cult		NE	2	Fruits (seeds) and leaves	Infusion or seasoning	Digestive problems, flatulence, and as an antioxidant
	Pimpinella anisum L.	fennel	25	cult		NE	1	Fruits (seeds)	Infusion or essential oil	Digestive disorders, cramps, and expectorant properties

Araliaceae	*Polyscias fruticosa* (L.) Harms	tree of happiness		cult		NE	1	Leaves	Infusion or decoction	Rheumatism, stress, and nervous disorders
Asphodelaceae	*Aloe vera* (L.) Burm.f.	aloe		cult		NE	4	Leaf (internal gel)	Topical use or juice	Healing of wounds, burns, and digestive problems
Asteraceae	*Achyrocline satureioides* (Lam.) DC.	marcelinha		n	Ce, MA, Pa	NE	2	Flowers	Infusion or tea	Digestive disorders, anti-inflammatory and antioxidant
	Artemisia absinthium L.	wormwood	19	cult		NE	3	Leaves and flowering branches	Infusion or tincture	Digestive problems, vermifuge, and appetite stimulant
	Baccharis crispa Spreng.	gorse		n	Ca, Ce, MA, Pa	NE	3	Leaves	Infusion	Liver disorders and digestive problems
	Bidens pilosa L.	picão-de-ramo	23, 28	natu	A, Ca, Ce, MA, Pa, Pn	NE	1	Aerial part	Infusion or decoction	Inflammation, blood sugar control, and antimicrobial action
	Eclipta prostrata (L.) L.	buttonweed		n	A, Ca, Ce, MA, Pa, Pn	NE	1	Aerial part	Infusion or juice	Liver diseases, hair strengthening and healing
	Matricaria chamomilla L.	chamomile		cult		NE	1	Flowers	Infusion or tea	Anxiety, sleep disorders, and gastrointestinal problems
	Parthenium hysterophorus L.	mentrasto		natu	Ce, MA	NE	2	Aerial parts	Infusion (external use)	Wounds, skin inflammations (topical use)
	Solidago chilensis Meyen	arnica	5	n	Ca, Ce, MA, Pa	NE	1	Aerial parts	Infusion or decoction	Urinary diseases, anti-inflammatory and diuretic
	Vernonanthura ferruginea (Less.) H.Rob.	white fish		n	Ce	NE	3	Leaves	Infusion	Bronchitis, flu, and inflammatory processes

Bignoniaceae	*Fridericia chica* (Bonpl.) L.G.Lohmann	St. Anthony's broom, crajiru, pariri	20	n	A, Ca, Ce, MA, Pa, Pn	NE	1	Leaves	Infusion or maceration	Skin problems, healing, and anti-inflammatory
	Handroanthus impetiginosus (Mart. ex DC.) Mattos	purple ipê		n	A, Ca, Ce, MA, Pn	NE	1	Bark	Decoction	Infections, inflammations, and as an immune stimulant
Brassicaceae	*Coronopus didymus* (L.) Sm.	mentruz		natu	Ca, Ce, MA, Pa	NE	3	Aerial parts	Infusion	Respiratory problems, diuretic and anti-inflammatory
Celastraceae	*Monteverdia floribunda* (Reissek) Biral	espinheira-santa		n	A, Ca, Ce, MA, Pn	LC	1	Bark	Decoction	Respiratory diseases and as an expectorant
Costaceae	*Costus spiralis* (Jacq.) Roscoe	insulin		n	A, Ca, Ce, MA, Pn	NE	1	Stem and leaves	Decoction or infusion	Urinary disorders, diuretic and anti-inflammatory
Crassulaceae	*Kalanchoe crenata* (Andrews) Haw.	saião		natu	A, MA	NE	1	Leaves	Topical use or juice	Inflammation, wounds, and infections
Crassulaceae	*Kalanchoe pinnata* (Lam.) Pers.	fortune leaf, holy leaf	10	natu	A, Ca, Ce, MA, Pa, Pn	NE	1	Leaves	Topical use or juice	Healing, burns, and inflammation
Cucurbitaceae	*Momordica charantia* L.	bitter melon	7	natu	A, Ca, Ce, MA, Pn	NE	1	Fruits and leaves	Infusion or culinary consumption	Diabetes, digestive disorders, and anti-inflammatory
Dioscoreaceae	*Dioscorea bulbifera* L.	Yams, insulin potatoes	8	natu	Ca, Ce, MA	NE	1	Tubers	Cooking	Skin diseases and inflammation control
Euphorbiaceae	*Jatropha gossypiifolia* L.	pinhão-de-purga	27	n	A, Ca, Ce, MA	NE	1	Leaves and latex	Topical use (latex) or infusion (leaves)	Wounds, inflammation, and laxative properties

Fabaceae	*Anadenanthera colubrina* (Vell.) Brenan	angico		n	Ca, Ce, MA	NE	2	Bark and seeds	Decoction or powder (traditional indigenous use)	Respiratory problems and as an astringent
	Copaifera langsdorffii Desf.	copaiba		n	A, Ca, Ce, MA	NE	2	Oil-resin	Topical or oral use (in controlled doses)	Inflammation, infections, and healing
	Senna occidentalis (L.) Link	fedegoso	12	n	A, Ca, Ce, MA, Pn	NE	1	Leaves and seeds	Infusion or decoction	Constipation and skin problems
	Stryphnodendron adstringens (Mart.) *Coville**	barbatimão		n	Ca, Ce	LC	2	Bark	Decoction	Diarrhea, inflammation, and as an astringent
Iridaceae	*Pseudotrimezia juncifolia* (Klatt) Lovo & A.*Gil**	rui-barbo		n	Ce, MA	NE	1	Leaves	Infusion	Urinary problems and anti-inflammatory
Lamiaceae	*Aeollanthus suaveolens* Mart. ex Spreng.	catinga-mulata, macassá	15	cult		-	1	Leaves	Infusion	Respiratory and digestive problems
	Coleus amboinicus Lour.	fat mint		cult		NE	3	Leaves	Infusion or juice	Cough, asthma, and respiratory disorders
	Coleus barbatus (Andrews) Benth.	boldo	11	cult		NE	4	leaves	Infusion or decoction	Digestive disorders and hypertension
	Leonurus japonicus Houtt.	ruby	18	natu	A, Ca, Ce, MA	NE	1	Aerial parts	Infusion	Menstrual and uterine disorders

	Mentha piperita L.	peppermint		cult		NE	3	Leaves	Infusion or essential oil	Digestive problems, nausea, and headache
	Mentha pulegium L.	pennyroyal, rosemary mint	22	cult		NE	1	Leaves and flowers	Infusion	Respiratory problems and menstrual cramps
	Mentha spicata L.	mint, spearmint		natu	A, Ce, MA	NE	6	Leaves	Infusion	Digestive problems, nausea, and colds
	Ocimum basilicum L.	basil		cult		NE	1	Leaves	Infusion or seasoning	Digestive disorders and stress
	Ocimum gratissimum L.	basil, sweet basil, white basil	14	natu	A, Ca, Ce, MA	NE	1	Leaves	Infusion or decoction	Respiratory and digestive problems
	Origanum vulgare L.	Oregano	3	cult		NE	1	Leaves and flowers	Infusion	Colds, respiratory and digestive problems
	Rosmarinus officinalis L.	rosemary	2	cult		NE	3	Leaves	Infusion or essential oil	Digestive problems, muscle pain, and stimulant
Lauraceae	*Laurus nobilis* L.	bay		cult		NE	1	Leaves	Infusion or seasoning	Digestive problems and as an antioxidant
Lythraceae	*Punica granatum* L.	pomegranate		cult		NE	1	Bark and fruit	Decoction or juice	Diarrhea, inflammation, and antioxidant
Malpighiaceae	*Bunchosia glandulifera* (Jacq.) Kunth	caferana		cult		NE	1	Fruits	Culinary consumption	Glycemic control and digestive health
Malvaceae	*Abelmoschus esculentus* (L.) Moench	Okra		cult		NE	1	Rhizome	Cooking or flour	Gastrointestinal disorders and nutrition

Marantaceae	*Maranta arundinacea* L.	arrowroot		cult		NE	1	Leaves and fruits	Infusion (leaves) or juice (fruit)	Diarrhea, infections, and antioxidant properties
Myrtaceae	*Psidium guajava* L.	guava		natu	A, Ca, Ce, MA, Pa	NE	1	Root and leaves	Decoction or infusion	Inflammation, pain, and as an immunostimulant
Phytolaccaceae	*Alliacea petiveria* L.	Guinea	6	natu	A, Ca, MA, Pa	NE	2	Aerial part	Infusion	Kidney problems, urinary stones, and liver protection
Phyllanthaceae	*Phyllanthus niruri* L.	stone breaker	31	n	A, Ca, Ce, MA, Pa	LC	1	Aerial parts	Infusion or topical use	Inflammation and urinary disorders
Piperaceae	*Peperomia pellucida* (L.) Kunth	jaboti herb		n	A, Ca, Ce, MA	LC	1	Leaves	Infusion or poultice	Respiratory problems and healing
Plantaginaceae	*Plantago major* L.	transagem	4	natu	A, Ca, Ce, MA, Pa	NE	3	Aerial parts	Infusion	Diabetes, inflammation, and digestive disorders
	Scoparia dulcis L.	trapixaba, vassourinha	16	n	A, Ca, Ce, MA, Pa, Pn	NE	1	Leaves	Infusion	Anxiety, digestive problems, and fevers
Poaceae	*Cymbopogon citratus* L.	lemongrass, holy grass		natu	A, Ca, Ce, MA	NE	3	Fruits and bark	Juice or infusion	Colds, digestive problems, and antioxidant
Rutaceae	*Citrus aurantiifolia* (Christm.) Swingle	key lime		cult		NE	2	Fruits	Juice or infusion	Flu, digestive problems, and antioxidant
	Citrus ×limon (L.) Osbeck	lemon		cult		NE	3	Fruit and peel	Juice or infusion	Immune system and antioxidant
	Citrus sinensis (L.) Osbeck	orange		cult		NE	1	Leaves	Infusion or topical use	Menstrual problems, anxiety, and antispasmodic
	Ruta graveolens L.	rue		cult		NE	4	Bark	Decoction	Gastrointestinal disorders, fevers, and as an antimalarial

Urticaceae	*Cecropia pachystachya* Trécul	embaúba	9	n	A, Ca, Ce, MA, Pa, Pn	NE	1	Leaves	Infusion	Hypertension, anxiety, respiratory problems, and as a diuretic
Verbenaceae	*Lippia alba* (Mill.) N.E.Br. ex Britton & P.Wilson	cidreira-cupira, lemon verbena	32	n	A, Ca, Ce, MA, Pa, Pn	NE	3	Leaves	Infusion	Anxiety, insomnia, intestinal cramps, and digestive disorders
Zingiberaceae	*Curcuma longa* L.	turmeric		cult		-	3	Rhizome	Powder, tea, or tincture	Inflammatory processes, joint pain, antioxidant and hepatoprotective
	Curcuma zedoaria (Christm.) Roscoe	white turmeric		cult		-	1	Rhizome	Infusion or powder	Digestive disorders, flatulence, and anti-inflammatory properties
	Zingiber officinale Roscoe	ginger		cult		NE	1	Rhizome	Infusion, juice, or seasoning	Nausea, muscle pain, inflammation, and digestive disorders
	Zingiber spectabile Griff.	Honey ginger	24	cult		NE	1	Rhizome and inflorescence	Infusion or decoction	Inflammation, respiratory problems, and sore throats

Source: Prepared by the authors

In terms of occurrence, most native and naturalized species (76.31%, n = 29) are widely distributed in Brazil, occurring in six to four phytogeographic domains (Table 1). This result is consistent with research conducted by Lopes et al. (2025), who, when compiling ethnobotanical studies carried out in Goiás between 2014 and 2024, also verified this predominance. Although none of these species are endemic, *Vernonanthura ferruginea* has a distribution in Brazil restricted to the Cerrado. Most of these species occur in the phytogeographic domains of the Cerrado, Atlantic Forest, and Caatinga (Figure 2).

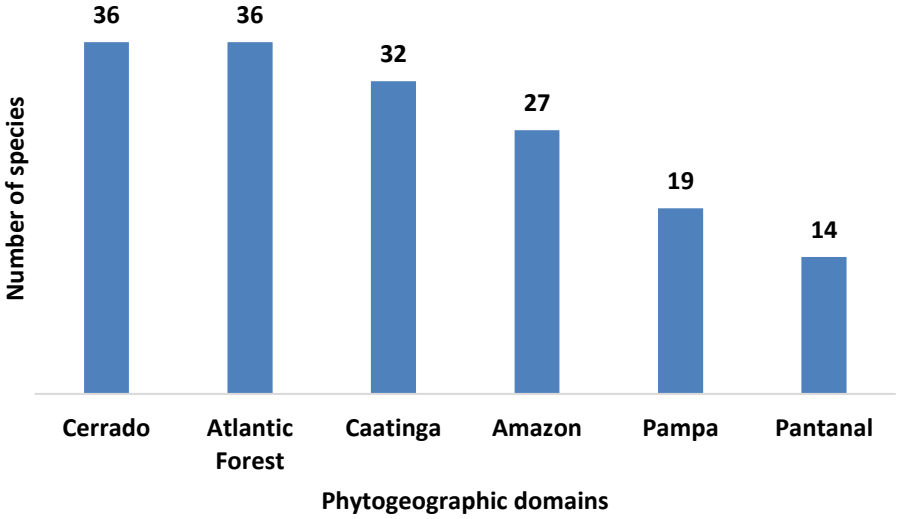

Figure 2- Number of native and naturalized medicinal plant species cited by herbalists in Inaciolândia, Goiás, by Brazilian phytogeographic domains.
Source: prepared by the authors.

Regarding conservation *status*, this information was available for 63 species. Among these, most have *a* conservation *status* of not evaluated (NE) (93.7%, n = 59). Given this result, further research is needed to assess the conservation *status* of medicinal plant species, especially native Brazilian species. Only four native medicinal species had *a* conservation *status* of least concern (LC): *Monteverdia floribunda*, *Stryphnodendron adstringens*, *Phyllanthus niruri,* and *Peperomia pellucida* (Table 1).

Among the plants mentioned, some stood out for their recurrence in the interviews. Mint (*Mentha spicata*) was the species most cited by herbalists, with six records. Mint is widely cultivated around the globe for its aroma and economic importance. Worldwide, the aerial parts of this plant are used to make tea. In addition, interest in mint cultivation is related to the commercial importance of its essential oil, which is among the ten most traded in the world (Scherer et al. 2013). In addition to being a food flavoring agent—as in the traditional Brazilian use of serving pineapple juice with mint or adding it to the preparation of kibbeh—this species is known for a range of medicinal uses, particularly in the treatment of colds, coughs, asthma, fever, obesity, jaundice, and digestive problems (Ilheo 2024). Mint is antibacterial, antifungal, antioxidant, hepatoprotective, antidiabetic, cytotoxic, anti-inflammatory, and has larvicidal, antigenotoxic, and antiandrogenic activity (Mahendran et al. 2021; El Menyiy et al. 2022). Thus, the widespread use of mint as a medicinal plant corroborates the fact that it was the species most cited by the herbalists of Inaciolândia and indicated by them for the treatment of digestive problems, nausea, and colds (Table 1).

Aloe vera, rue (*Ruta graveolens*), and boldo (*Coleus barbatus*) were also among the species most cited by herbalists, each being mentioned four times. Aloe vera is a succulent, drought-resistant, perennial plant and one of the most effective bioactive plants, containing around 75 nutrients and 200 bioactive compounds (Behaiyn et al. 2023). This species has several functional properties, including antimicrobial and antioxidant activities,

which make it effective in treating wound healing, diabetes, immunomodulation, aging, skin problems, among others (Basumatary et al. 2022). The leaves of the plant contain latex and gel, which are quite different from each other in their chemical composition and therapeutic uses. The gel is the more transparent inner mucilaginous pulp, which is a reservoir of many phytochemicals, including polysaccharides, amino acids, enzymes, glucomannans, lipids, sterols, vitamins, flavonoids, alkaloids, anthraquinones, anthrones, coumarins, chromones, and pyrones (Altinkaynak et al. 2023). The latex is the viscous yellow sap beneath the rind containing high levels of phenolic compounds, including flavonoids, phenolic acids, anthraquinones, anthrones, coumarins, chromones, and pyrones (Majumder et al. 2019). Aloe vera gel is known for its therapeutic uses in wound healing due to its ability to invade and sedate tissue, preventing microbial growth and inflammation. Due to its numerous health benefits, aloe vera gel has also been used in food products such as beverages, milk, ice cream, and yogurt (Adlakha et al. 2022). According to the herbalists of Inaciolândia, the gel is indicated for wound healing, burns (in both cases with topical application), and digestive problems (in the form of juice) (Table 1), which is consistent with the information from the studies mentioned here.

Rue (*Ruta graveolens*), on the other hand, is cultivated worldwide. The epithet of its scientific name, "*graveol*ens," means strong smell due to the strong and peculiar odor that emanates from its leaves. Most of its aromatic and medicinal properties are due to the presence of rutin and its essential oil. Although its taste is very bitter, the species is used in ethnic cuisines, such as coffee flavoring in Ethiopia, milk tea flavoring in Guangdong province, China, and to flavor grappa, a type of Italian brandy (Cheng et al. 2023). It was used in some medieval rites to protect the home from negativity. In the Middle Ages, rue was used to ward off the plague. In some Latin American countries, it is used as a fungicide and pesticide in organic farming (Donadu et al. 2021). As a medicinal plant, it is used to treat fever caused by colds, toothache, bruises and sprains, irregular menstruation, and childhood eczema (Luo et al. 2024), to treat coughs, diphtheria laryngitis, colic, and as an antidote in cases of mushroom poisoning, snake bites, and insect bites (Ilheo 2024). In addition, it has been used for its stimulant, stomachic, and emmenagogue effects, consumed as an infusion and to treat headaches, muscle and joint pain, as well as an anti-inflammatory using the oil or extract (Donadu et al. 2021). The species has anticancer and analgesic action, antiandrogenic activity, and antihyperglycemic and antihyperlipidemic effects (Shahrajabian 2024). These studies corroborate the indication for use by the herbalists of Inaciolândia, who use rue for gastrointestinal disorders, fevers, and as an antimalarial agent, using its bark in the form of a decoction (Table 1).

Boldo originates in Africa, and this species is widely cultivated throughout Brazil and commonly used in traditional Brazilian medicine (Brito et al. 2018; Cordeiro et al. 2022). Boldo has several medicinal uses. It is used as an analgesic, antidyspeptic, to relieve abdominal cramps, as a purgative, in the treatment of gastritis, intestinal spasms, liver and dental diseases, and in the treatment of asthma, bronchitis, pneumonia, and other respiratory diseases (Lukhoba et al. 2006). It is among the most cited species in ethnobotanical surveys of medicinal plants in Brazil (Oliveira et al. 2011; Freitas et al. 2015; Borges & Moreira 2016; Martinez et al. 2020; Rodrigues et al. 2021; Soares et al. 2023). A review of research published between 1970 and 2003 by Costa (2006) on the pharmacological actions of boldo ( ) highlighted its medicinal potential and justified its widespread use in folk medicine. This corroborates the potential use of boldo by herbalists in Inaciolândia for digestive disorders and hypertension.

There was wide variation in the part of the plant indicated by herbalists for use in the production of medicines (Figure 3). However, the predominant use was still the leaves (34.33%; n = 23) and the aerial parts (13.43%; n = 9). This result is corroborated by most ethnobotanical studies (Silva & Proença 2007; Alves et al. 2018; Guimarães et al. 2019, 2022; Soares et al. 2023). The use of leaves does not cause the death of the collected specimen, thus allowing for the perpetuation of plant individuals, both in cultivation and in their natural habitat.

Fifteen types of medicine preparation were mentioned by the herbalists, the most cited being infusion (43.59%; n = 51) (Figure 4). The infusion, which is a type of tea, is prepared by pouring boiling water over small pieces of the plant parts, in proportions that vary depending on whether the plant is fresh or dry and on the species. Then, it is mixed, covered, and left to rest for a few minutes before drinking. The temperature (hot or cold) of this preparation, as well as the dosage for consumption, varies according to the disease being treated (Lorenzi & Matos 2008). In addition, the use of medicinal plants varies according to the cultural context of those who use them. The planting, preparation, and dosage of medicinal plants may vary from one community to another (Di Stasi 2007).

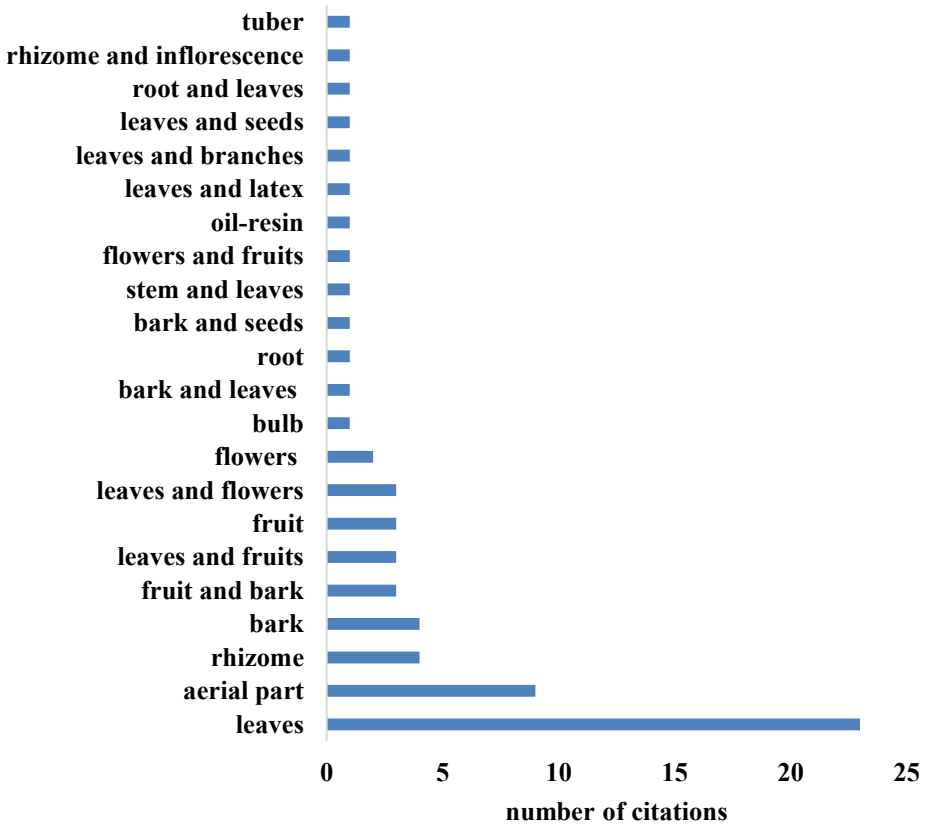

Figure 3. Number of citations of the plant part used for the production of medicines, according to herbalists in Inaciolândia, Goiás. Source: prepared by the authors.

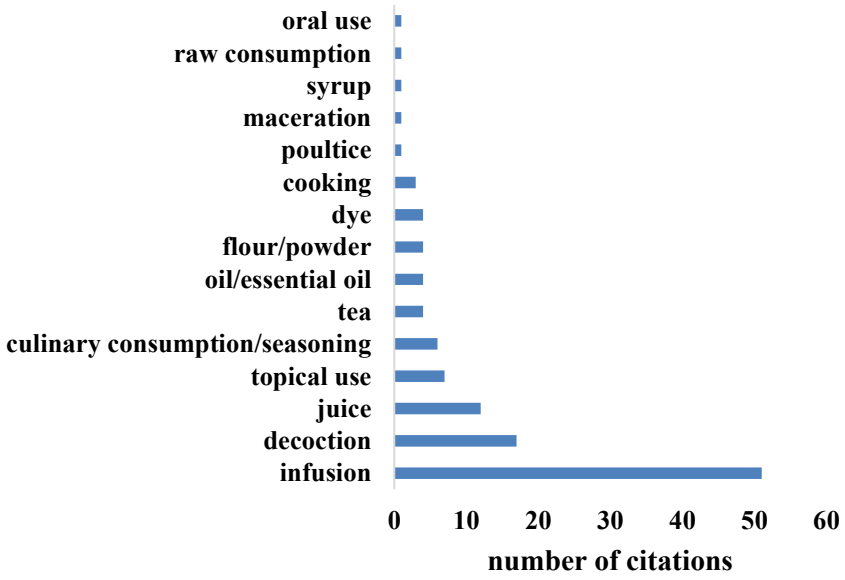

Figure 4. Number of citations regarding the form of preparation of medicines, according to herbalists in Inaciolândia, Goiás. Source: prepared by the authors.

The use of plants to treat diseases associated with the digestive system (DS) and inflammation and pain (ID) was predominant in the treatments indicated by herbalists (Figure 5), corresponding to 23.38% (n = 36) and 21.43% (n = 33), respectively. Several plants have already been tested empirically or in the laboratory for gastrointestinal disorders (Gois et al. 2016), with anti-inflammatory action (Santos et al. 2013; Leal et al. 2019) and for pain relief (Haeffner et al. 2012).

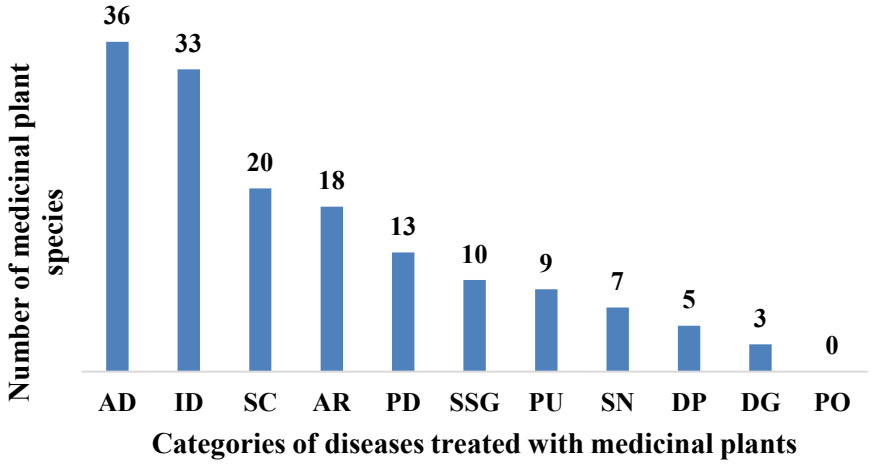

Figure 5 - Number of medicinal plant species cited by herbalists in Inaciolândia, Goiás, according to the categories of diseases treated. AD = diseases associated with the digestive system; AR = diseases associated with the respiratory system; PD = diseases associated with dermatological problems; ID = diseases associated with inflammation and pain; NS = diseases associated with the nervous system; CS = diseases associated with the cardiovascular system; U = diseases associated with urological problems; PD = parasitic diseases; GD = gynecological diseases; OP = orthopedic problems; and GSS = general symptoms and signs, those with symptoms of various non-specific diseases and/or of cultural origin. Source: prepared by the authors.

The predominance of the use of medicinal plants in Brazil to treat diseases associated with the digestive system is corroborated by other studies (Rodrigues & Andrade 2014; Brito et al. 2017; Durão et al. 2021; Schek et al. 2021; Santana et al. 2025). In a compilation of data from ethnobotanical articles conducted in Goiás and

published between 2014 and 2024, the treatment of diseases associated with the digestive system was among the main indications of the 169 medicinal plants cataloged (Lopes Neto et al. 2025). However, the studies cited here do not corroborate the predominance of the use of medicinal plants for the treatment of inflammation and pain, as indicated by the herbalists of Inaciolândia.

Inflammation and pain can be associated with various diseases, such as infections and autoimmune conditions, or be triggered by various factors, including physical injuries (cuts, bruises, burns, among others), irritating chemicals, and environmental factors. Inflammation is the body's response to aggressions, such as injuries or infections, characterized by signs such as pain, redness, heat, and swelling. It is a protective reaction of the immune system, aimed at tissue repair and the elimination of harmful agents (Etienne et al. 2021). According to a compilation of data by Ribeiro et al. (2018), 70 Brazilian plants have anti-inflammatory action, involving various mechanisms of action, according to data obtained from experimental tests with compounds obtained from crude or isolated extracts.

Pain is caused by irritation of nerve endings and pressure from swelling (Haeffner et al. 2012). Medicinal plants have several active ingredients, such as alkaloids, mucilage, flavonoids, tannins, and essential oils, among other substances, which act on the mechanism of analgesia (Lorenzi & Matos 2008). A study conducted with a community of Pomeranians in Rio Grande do Sul identified 23 medicinal plants as analgesics: pennyroyal, rosemary, nasturtium, lemongrass, marjoram, guava, mint, lemon balm, tansy, garden violet, melilot, fennel, mugwort, carqueja, espinheira-santa, lime, avocado, mil-em-ramas, penicillin, saffron, garlic, pitangueira, and anise (Schek et al. 2014). Lorenzi and Matos (2008) list 32 species of plants used medicinally as analgesics in Brazil. Therefore, the range of diseases that cause inflammation and pain and the high number of plant species associated with the treatment of these diseases corroborate the predominance of the use of medicinal plants indicated by the herbalists in this study.

Final Considerations

The investigation identified 11 herbalists in Inaciolândia, whose reports show not only the persistence of ancestral therapeutic practices, but also their resilience and adaptation in the face of advances in official medicine and contemporary sociocultural transformations. There was a predominance of women among the herbalists, which can be attributed to the traditional association of health care practices, especially through popular knowledge and the use of medicinal plants, with the female gender within family and community contexts. This greater female representation is also found in other Brazilian ethnobotanical studies.

The present study corroborates a concern about the perpetuation of popular knowledge inherent in the use of medicinal plants, given that the age of herbalists ranges from 40 to 83 years. The absence of younger representatives may culminate in the risk of discontinuity of ethnobotanical knowledge, as it is not being renewed among the younger generations. This compromises the cultural preservation of this important intangible heritage.

The traditional healers indicated 67 species of medicinal plants. Lamiaceae and Asteraceae were among the families with the greatest species richness, a result that has been found in other Brazilian ethnobotanical studies. These families are recognized for their widespread use in folk medicine and for containing species with bioactive compounds with recognized therapeutic action. *Mentha spicata* (mint), *Aloe vera* (aloe), *Ruta graveolens* (rue), and *Plectranthus barbatus* (boldo) were recurring species in the interviews, indicating a high degree of agreement among participants regarding their use.

As for the part of the plant indicated by herbalists to be used for the production of medicines, there was wide variation, but the predominant use was of the leaves, a result similar to that found by most studies. Fifteen types of medicine preparation were mentioned by the herbalists, the most frequently cited being infusion ( ).

There was a diversity of treatments for diseases indicated by the herbalists using medicinal plants, with a predominance of diseases associated with the digestive system, inflammation, and pain.

The wealth of medicinal species recorded in this study highlights the importance and use of ethnobotanical knowledge by herbalists in Inaciolândia, Goiás. The ethnobotanical indications described can provide relevant contributions to the conservation of the sociocultural and biological diversity of plant species, as well as to other ethnobotanical research.

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SUPPLEMENTARY MATERIAL

SEMI-STRUCTURED INTERVIEW GUIDE – HERBALISTS INTERVIEW No. _____ DATE: ____/____/2024 Interviewer: José Ferreira Lopes Neto

HISTORICAL CONDITION

a) Age?

_____

b) Place of birth?

_____

c) Marital status?

_____

d) How long have you lived here?

_____

e) What is your level of education?

_____

f) Do you have children? ( ) Yes / ( ) No / How many children?

_____

ECONOMIC AND SOCIAL CONDITION

a) Have you had any occupation other than handling homemade medicines? ( ) Yes / ( ) No / Which one?

_____

b) Do you charge for the home remedies you make? ( ) Yes / ( ) No

_____

c) Have you ever been paid for your services in other ways (gifts, products, or services)?

_____

ASPECTS OF RELIGIOUS BELIEF

a) Do you consider yourself to belong to any religion?

_____

b) Is your practice related to any religion?

_____

ASPECTS OF POPULAR RELIGIOSITY

a) Who taught you to be a herbalist?

_____

b) How old were you when you learned?

_____

c) Do people from more than one social class or from all social classes seek out your homemade medicines?

_____

d) How important is this practice to the community?

_____

e) Do you teach others your craft? Do you know other herbalists in Inaciolândia?

_____

g) Have you ever been persecuted in any way for being a herbalist?

_____

ASPECTS OF TRADITIONAL MEDICINE

a) What types of illnesses can be cured with homemade medicines?

_____

b) What are the most common illnesses you treat?

_____

c) Which plants are most commonly used in treatments? Which diseases are treated? Which parts of the plant are used? How are they prepared?

_____