

Perception and knowledge of medicinal plants in a school in southern Brazil

ABSTRACT

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Ethnobotany seeks to understand the use of plants by humans over time, including those used as medicinal plants. The transmission of information about these species is considered a cultural practice, and a wide range of reference sources is available, including the school environment. However, there are still few studies addressing the role of schools in the transmission of knowledge of medicinal plants. In view of the above, the present work aimed to investigate the access of schoolchildren to medicinal plants, as well as the source of this knowledge. To this end, a group interview was conducted by using a questionnaire, which sought to shed light on how the informants relate to medicinal plants. The interview was followed by the projective technique, performed with images of medicinal plants, aiming to awaken the informants' visual memory. The participants of the study were students in the final grades of Elementary School. The students mentioned 33 species that are used for medicinal purposes. The most common mode of preparation was tea (75 mentions), and the most frequently reported use was for treatment of abdominal pain (17 mentions). The informants obtained samples of the species mostly from their own yard, and their main source of knowledge about medicinal plants was their mother and grandmother (transgenerational knowledge). The study showed that students in the final grades of elementary school learn about medicinal plants mostly from their families; however, they show interest in broadening this knowledge in the school environment. This theme can be addressed across several school subjects through projects, workshops, exhibitions, among other activities.

Keywords: ethnobotany; transgenerational knowledge; fond memories.

Percepção e conhecimento sobre plantas medicinais em uma escola no sul do Brasil

RESUMO

A Etnobotânica busca compreender a utilização de plantas pelos seres humanos ao longo do tempo, incluindo aquelas utilizadas como medicinais. A transmissão de informações sobre essas espécies é considerada cultural, possibilitando grande variedade de fontes de referências, incluindo o ambiente escolar. Entretanto, ainda são poucos os estudos que abordam o papel da escola na transmissão do saber sobre plantas medicinais. Diante do exposto, o presente trabalho objetivou investigar o acesso de escolares às plantas medicinais, bem como a fonte de origem deste conhecimento. Para isso, foi realizada uma entrevista de grupo, com aplicação de questionário, que buscou compreender a relação dos estudantes com as plantas medicinais. Seguido da Técnica Projetiva, realizada com imagens de plantas medicinais, visando despertar a memória visual dos alunos. Os participantes da pesquisa foram estudantes das séries finais do Ensino Fundamental. Foram registradas 33 espécies citadas pelos alunos para fins medicinais. A forma de preparo mais utilizada foi chá com 75 indicações e o uso mais citado está relacionado ao tratamento de dores de barriga (17 citações). A principal forma de obtenção das espécies foi o quintal próprio e a principal fonte de origem do conhecimento dos alunos sobre plantas medicinais foi por meio da mãe e da avó (transgeracional). O estudo revelou que estudantes das séries finais do Ensino Fundamental aprendem sobre plantas medicinais principalmente com seus familiares, entretanto demonstram interesse em aprofundar esse conhecimento no ambiente escolar. Essa temática pode ser abordada por meio de projetos, oficinas, exposições, entre outros, considerando as diversas disciplinas escolares.

PALAVRAS-CHAVE: etnobotânica; conhecimento transgeracional; memórias afetivas.

INTRODUCTION

Ethnoscience is the field of study dedicated to understanding the different interactions between human beings and the environment, through techniques, theories, methods, and analyses (Silva; Almeida & Albuquerque, 2010). One of the branches of this science is Ethnobotany, which seeks to provide further insights into the use of plants by humans over time, including those used as medicinal products.

According to Mendieta et al. (2014), the ancient practice of using medicinal plants in human health care is closely linked to the early days of medicine, and it is based on the transmission of information across generations. This transmission is a cultural practice, and it was defined by Mesoudi (2013, p.131) as “the process by which knowledge, beliefs, skills, practices, norms, values and other forms of non-genetic information are passed from individual to individual via social learning mechanisms such as imitation and teaching”. In this sense, because transmission of knowledge is cultural, individuals can gain knowledge throughout their existence through a variety of sources other than parents, such as cousins, uncles, experts, and even media such as television and radio (Soldati, 2014).

As sources of cultural knowledge, schools can also pass on information that will help improve students' well-being and quality of life. In Brazilian education, the Contemporary Multidisciplinary Subjects (CMSs) present in the Common National Core Curriculum (CNCC) offer a curriculum structure that allows schools to address relevant and current topics, such as health and environment (Brasil, 2019). In this context, the theme medicinal plants is integrated into both areas of knowledge.

However, there are still few studies addressing the role of schools in the transmission of knowledge of medicinal plants to students. A study conducted with farmers in southern Brazil, in the State of Rio Grande do Sul, showed that schools were not among the major agents for sharing knowledge about the use of plants in health care practices (Ceolin et al., 2019). A survey conducted with children in the Amazon showed that approximately 50% of them know that medicinal plants are healing plants, and they are interested in learning more about the topic at school (Mera et al., 2018). In Uganda, a study with a sample of children showed that the school was hardly a source of this knowledge (Tabuti et al., 2012).

Therefore, the present study was motivated by the need to understand the main forms of transmission of knowledge about the subject. Moreover, it investigated the students' forms of access to medicinal plants and their levels of knowledge about how to use them. Another objective is to investigate whether the school environment can be responsible for providing students with knowledge of herbal medicine.

METHOD

The study was carried out in the municipality of Içara, located in the extreme south of the state of Santa Catarina. According to IBGE (2023), the municipality has a territorial area of 230.393 km², with a population of approximately 58,055 inhabitants. The school where the research took place, Escola de Ensino Básico Antônio Colonetti, is located in the Jaqueline neighborhood, in the aforementioned municipality.

This is a descriptive study that relates knowledge and perception of medicinal plants. The study is characterized as Group Interview (Schrader, 1978), followed by the Projective Technique (Kay, 2001), with subsequent analysis of the results.

Group interview is a methodology that consists of data collection in which several people, simultaneously present in a room, individually fill out a questionnaire, after an introduction to the topic made by an interviewer, who remains available for clarification. This is considered an excellent method for the classroom, because it addresses elements that are grouped in an environment (Schrader, 1978).

The participants of the study were students aged between 10 and 14 years old, attending classes in the final grades of Elementary School (6th to 9th graders) of the elementary and high school Antônio Colonetti, in the municipality of Içara, in southern Santa Catarina. The school has 75 students from the 6th to the 9th grades in the morning classes and, of these, 29 participated in the interview (38%).

For selection of the students to be interviewed, the researchers previously talked to the Sciences teacher and the students to check which of them used medicinal plants. This previous selection was important so that the research participants could bring samples of the species that they use for the purpose of botanical identification.

All students who participated in the study had mentioned being acquainted with using medicinal plants. The interviews were conducted on September 4, 2023, at school hours. The selected students were sent by the Sciences teacher to the auditorium of the school, where they answered a questionnaire that evaluated how they relate to and what they know about plants that they use for medicinal purposes. Prior to the application of the questionnaire, the questions were read out loud to the students in the classroom and then each of them answered in writing the questions about their knowledge of medicinal plants.

After this first stage, each informant was asked to bring a sample of the medicinal plant(s) that they had mentioned and leave it at the school reception for correct botanical identification. They could fetch the samples back later. The plant species brought by the respondents were botanized and sent for identification to the Herbarium Fr. Dr. Raulino Reitz (CRI) at the Universidade do Extremo Sul Catarinense (UNESC).

After the application of the group interview, the Projective Technique was used to access the students' visual memories about the species that they used for medicinal purposes. This technique helps gather information that had not been verbalized by the respondents through direct questions (Kay, 2001). The Projective Technique was applied with the support from biologists/botanists and pharmacists, who work with research on medicinal plants. They assisted in the selection and botanical identification of the species used in the technique. The experts selected six species widely used for medicinal purposes in the study region, namely: *Matricaria chamomilla* L. (chamomile), *Cymbopogon citratus* (DC.) Stapf (lemon grass), *Achyrocline satureioides* (Lam.) DC. (marcela), *Mentha piperita* L. (mint), *Zingiber officinale* Roscoe (ginger), and *Rosmarinus officinalis* L. (rosemary). After this selection, high-resolution photos of the six selected plants were arranged on a A4 sheet. Blank space was left at the bottom for note-taking.

The respondents were asked to observe the photos and use the blank spaces to describe, in writing, what they knew about each plant species, for example, common name, indication, ways of use, part of the plant that is used, and how they had acquired the knowledge of the species in question.

Data analysis was performed through reading, followed by categorization of the students' answers, as well as through discourses built on the basis of collective manifestations on the subject of interest. This type of analysis stems from the Collective Subject Discourse (CSD) method, which allows access to the thought of a large number of individuals on a particular subject. The nature of CSD is based on the systematization of the set of discourses collected, and its analysis has a descriptive nature, with a qualitative approach to the knowledge, attitudes, conduct, and involvement of the study subjects (Lefèvre & Lefèvre, 2005). In this way, all the answers were analyzed and categorized. All the answers that corroborated a given affirmative statement were placed in the same category. Thus, the researcher can observe which aspects the respondents' answers were relevant.

Before starting the interview, the researcher contacted the school principal and asked the teacher responsible for the students about his interest in participating in the study. The principal signed the Informed Consent Form (TCLE), in accordance with Resolution N. 466 of December 12, 2012 of Brazil's National Health Council (Brasil, 2012). The personal data of the teacher and the students were treated as confidential, that is, they were not disclosed. The project was submitted to and approved by the Human Research Ethics Committee of UNESC on June 30, 2023 (CAAE: 70675623.60000.0119).

RESULTS AND DISCUSSION

ETHNOBOTANICAL SURVEY

A total of 33 species of medicinal plants were mentioned by the respondents. Two of them could not be identified botanically, and two others were identified only at the genus level (Table 1). The mentioned species belong to 19 botanical families; the most prominent were Lamiaceae, with seven species, and Asteraceae with three, a result that confirms the findings of other studies carried out in southern Brazil (Humenhuk; Leite & Fritsch, 2020).

Of the 33 species, 21 are exotic and only eight are native to Brazil. According to Ming et al. (2012), the larger number of exotic species indicates that both foreign and Brazilian researchers have been putting a great deal of effort and time into studying these species. This implies the need for further studies on the Brazilian flora, whose therapeutic resources are still little known.

The botanical families that stand out in the category of medicinal plants include Lamiaceae, with plants such as lavender, mint, and rosemary. They are well known for producing essential oils with a wide range of uses, for example, aromas, condiments, and medicines (Harley et al., 2004). The plants belonging to this family are famous for accumulating a significant diversity of substances, such as steroids, iridoids, flavonoids, and terpenoids, which exhibit various beneficial properties: antifungal, antioxidant, antitumor, antibacterial, anti-inflammatory, anti-hypoglycemic, among others (Lemes; Ferri & Lopes, 2011).

In addition to Lamiaceae, the family Asteraceae stands out with plants such as chamomile, guaco (*Mikania glomerata*), and carqueja (*Baccharis trimera*); it is recognized as one of the families that contain the greatest number of plant species with medicinal potential (Di Stasi & Hiruma-Lima, 2002). According to the authors,

several species belonging to Asteraceae have traditionally been used as medicines, raising a growing therapeutic interest and, consequently, leading to extensive research on their chemical and pharmacological properties.

The most used form of preparation was infusion (tea), with 75 indications. Five respondents mentioned using fresh plants; three used them as internal medicines while two, as external medicines; only one respondent mentioned using the essential oil. The most frequent indication was for treatment of abdominal pain (17 mentions), but also as a sedative (14), and for unspecified pain (six), weight loss, nausea, and influenza (five), stomachache (four). The other ethnoindications appeared in a smaller number (Table 1).

Table 1

Species mentioned by the students of Escola de Ensino Básico Antônio Colonetti in a questionnaire completed during an interview on medicinal plants, presented in family/species, where UN = unnamed; CN = common name; O= Origin (N= native, E = exotic); # ment. = number of mentions for the species; mode of preparation; indication; where to find the plant, and Know. Src. = knowledge source.

Family/ Scientific name	CN	O	# ment.	Mode of preparation	Indication	Where to find the plant	Know. Src.
Aquifoliaceae							
<i>Ilex paraguariensis</i> A.St.-Hil.	mate, yerba mate	N	2	tea (2)	swelling, nausea	market (2)	mother, aunt
Asparagaceae							
<i>Aloe vera</i> (L.) Burm.f.	aloe vera	E	2	fresh, mixture	burns, hair moisturizer	grandparents' yard, their own yard	grandmother (2)
Apiaceae							
<i>Pimpinella anisum</i> L.	fennel	E	2	tea (2)	flatulence, abdominal pain	their own yard, market	grandmother, mother
Asteraceae							
<i>Achyrocline satureioides</i> (Lam.) DC.	marcela	N	1	tea	abdominal pain	their own yard	Mother
<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. ex Walp.	bitter leaf	E	2	tea (2)	abdominal pain (2)	Grandparents' yard (2)	grandmother (2)
<i>Matricaria chamomilla</i> L.	chamomile	E	14	tea (14)	Sedative (9), headache	their own backyard (8),	mother (9), grand

Family/ Scientific name	CN	O	# ment.	Mode of preparation	Indication	Where to find the plant	Know. Src.
					(2), pain, abdominal pain, stomach	market (6)	mother (4), father, alone
Cactaceae							
<i>Pereskia aculeata</i> Mill.	Barbados gooseberry	N	1	eating	increases immunity	their own backyard	Father
Celastraceae							
<i>Monteverdia ilicifolia</i> (Mart. ex Reissek) Biral	<i>espinheira-santa</i>	N	2	tea (2)	stomach, nausea, vomiting	grandparents' backyard, their own backyard	Mother (2)
Cucurbitaceae							
<i>Sicyos edulis</i> Jacq.	chayote	E	1	tea	abdominal pain	their own backyard	grandmother
Equisetaceae							
<i>Equisetum</i> sp.	horsetail	N	1	tea	kidney	their own backyard	Grandmother
Lamiaceae							
<i>Lavandula</i> sp.	lavender	E	2	tea (2), essential oil	sedative (2)	their own backyard (2), market	grandmother (2)
<i>Mentha piperita</i> L.	mint	E	3	tea (3)	sedative, headache, nausea, vomiting	their own backyard (3)	mother (2), grandmother
<i>Ocimum carnosum</i> (Spreng.) Link & Otto Ex Benth.	fennel	N	1	tea	sedative, headache	their own backyard, grandparents' backyard	grandmother, mother
<i>Origanum vulgare</i> L.	oregano	E	1	tea	To reduce bloating	their own backyard	Mother
<i>Plectranthus barbatus</i> Andr.	woolly plectranthus	E	9	tea (9)	abdominal pain (5), stomachache (2),	their own backyard (9), school,	mother (4), grandmother

Family/ Scientific name	CN	O	# ment.	Mode of preparation	Indication	Where to find the plant	Know. Src.
					influenza (2), sore throat, cough, nausea	neighbors	r (4), school, father, alone
<i>Rosmarinus officinalis</i> L.	rosemary	E	1	tea	abdominal pain	their own backyard	Grand mother
<i>Stachys byzantina</i> K.Koch	lamb's ear	E	2	eating (2)	high blood pressure	their own backyard (2)	mother, grand mother
Lauraceae							
<i>Cinnamomum verum</i> J.Presl	cinnamon	E	1	tea	sore throat, cough	their own backyard	Father
<i>Laurus nobilis</i> L.	laurel	E	1	tea, seasoning	weight loss, vitamins	market	Grand mother
Malvaceae							
<i>Hibiscus rosa-sinensis</i> L.	hibiscus	E	2	tea (2)	weight loss (2)	market (2)	grand mother
<i>Malva sylvestris</i> L.	mallow	E	2	tea (2)	sore throat (2), flu	their own backyard (2), market	grand mother, mother
Myrtaceae							
<i>Psidium guajava</i> L.	guava	E	1	tea	Stomach	market	grand mother
Monimiaceae							
<i>Peumus boldus</i> Molina	woolly plectranthus	E	6	tea (6)	abdominal pain (3), pain (2), nausea	market (6)	mother (3), grand mother (3)
Phyllanthaceae							
<i>Phyllanthus niruri</i> L.	gale of the wind	N	1	tea	kidney	market, drugstore	grand mother

Family/ Scientific name	CN	O	# ment.	Mode of preparation	Indication	Where to find the plant	Know. Src.
							r, doctor
Poaceae							
<i>Cymbopogon citratus</i> (DC.) Stapf	lemon grass	E	2	tea (2)	Sedative	their own backyard (2)	mother, grand mother
Rosaceae							
<i>Rosa alba</i> L.	white rose of York	E	1	tea	Conjunctivitis	their own backyard	mother
Rutaceae							
<i>Citrus limon</i> (L.) Osbeck	lemon	E	1	tea	Influenza	market	grand mother
<i>Citrus sinensis</i> (L.) Osbeck	sweet orange	E	3	tea (3)	abdominal pain (2), pain	their own yard (2), market, father's yard	mother, grand mother, father
Theaceae							
<i>Camellia sinensis</i> (L.) Kuntze	tea plant	E	3	tea (3)	weight loss, nausea, cooking	market (3)	grand mother (3)
Verbenaceae							
<i>Lippia alba</i> (Mill.) N.E.Br. ex Britton & P.Wilson	bushy matgrass	N	4	tea (4)	wounds, accident, influenza, pain	market (2), their own yard (2)	mother (3), grand mother
Zingiberaceae							
<i>Zingiber officinale</i> Roscoe	ginger	E	2	tea (2), seasoning	pain, influenza, weight loss, cough,	market, their own backyard	grand mother, father
UN	green grass	UN	1	tea	pain, wounds	neighbors	sister
UN	UN	UN	1	tea	kidney	grandparents'	grand mother

Family/ Scientific name	CN	O	# ment.	Mode of preparation	Indication	Where to find the plant	Know. Src.
						backyard	r

Source: Designed by the author (2024).

Among the 33 medicinal species mentioned by the respondents, the most cited (14) was *Matricaria chamomilla*, popularly known as chamomile, and tea was the only method of preparation mentioned. The most prominent indication of use was as a sedative, followed by general pain. The ways of obtaining the plants followed the general pattern mentioned for all species, namely, their own yard and markets. The source of knowledge, for the most part, was their mother and grandmother. According to Santos et al. (2020), *M. chamomilla* can be used for treatment of stomach pain, irritable bowel syndrome, and insomnia. Moreover, it has bactericidal and relaxing properties. In addition, it is validated by the National Health Surveillance Agency (ANVISA) as having antispasmodic, anxiolytic, and mild sedative effects (ANVISA, 2021). Therefore, the respondents' indication of use as a sedative corresponds to the findings in the scientific literature.

Plectranthus barbatus, commonly known as woolly plectranthus, was mentioned by nine students. Tea was the only form of preparation mentioned for this plant. The indications of use mentioned by the students were abdominal pain, unspecified pain, influenza, sore throat, cough, nausea, and stomachache. Most respondents obtain the plant in their own yard, or buy it in the market, and their mother and grandmother taught them how to use it. The literature on *Plectranthus barbatus* reports biological activities of medical interest, including bacteriostatic, fungistatic, and immunomodulatory activity (Cordeiro et al., 2021). The validation by ANVISA for recommended use as an antidyspeptic agent is consistent with the respondents' suggestions for abdominal pain and stomachache (ANVISA, 2021).

Another species commonly known by the respondents as woolly plectranthus was *Peumus boldus*. The species was mentioned by six participants, who bought it at the market, and used it for treatment of abdominal pain, unspecified pain, and nausea. Knowledge about woolly plectranthus was transmitted by their mother and grandmother. *P. boldus* is a species frequently sold to treat different pathologies, for example, diseases affecting the gallbladder and the liver, and digestive disorders that can result in various pathologies, such as hepatitis, biliary dyskinesia, cholelithiasis, as well as migraines associated with gallbladder dysfunction. Moreover, this compound can be used as a diuretic and an antispasmodic agent in cases of cystitis (Pereira & Gonçalves, 2021).

Peumus boldus, belonging to the family Monimiaceae, is a native tree species from central and southern Chile, where it occurs abundantly (Ruiz et al., 2008). Even though *P. boldus* is a herbal medicine, high doses or overuse can lead to high toxicity, resulting in several health risks, such as changes in serum cholesterol and transaminase levels, as well as reduction in total bilirubin, glucose, and urea levels (Ribas et al., 2020).

Three students mentioned *Ocimum carnosum*, commonly known by the respondents as fennel. It was also prepared as tea, and it was indicated for flatulence, colic, headache, and as a sedative. They mentioned their own yard as

the most frequent place where they obtained the plant, and they learned about it from their grandmother and mother. In vivo tests showed that the essential oil of this plant presented antispasmodic, antidiarrheal, and analgesic effects (UFSC, 2023). However, the species is not validated by the National Health Surveillance Agency according to the Phytotherapy Form of the Brazilian Pharmacopoeia (ANVISA, 2021).

Mentha piperita (mint) was also mentioned by three respondents who prepare it as tea. They recommended it as a sedative, and for a sore body, nausea, and vomiting. They mentioned their own yard as the only place where they obtained it. They learned about the plant from their mother and grandmother. The species is widely used for its antidyspeptic, antispasmodic, expectorant, and antifatulent properties (ANVISA, 2021). Scientifically supported use differs from the use indicated by the respondents, which shows that the species can present a wide range of therapeutic potentials.

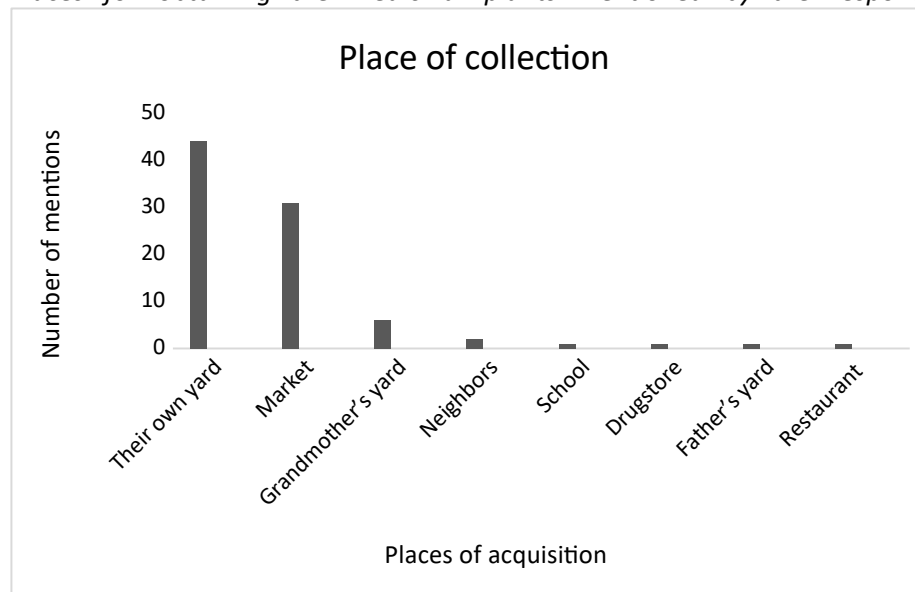
Tea was the mode of preparation for the species that are best known by the respondents. This type of preparation using medicinal plants is usual and can be carried out in different ways. In folk medicine, the most common processes for making tea are infusion, decoction, and maceration (Brito et al., 2009).

According to the Phytotherapy Form of the Brazilian Pharmacopoeia (ANVISA, 2021), infusion is the preparation that involves pouring boiling water on the plant matter, followed, if necessary, by closing or covering the container for a specific period. This method is recommended for vegetable matter with less dense texture, such as leaves, flowers, inflorescences, and fruits, or for matter containing volatile active components (ANVISA, 2021). Decoction, in turn, is a preparation that consists in boiling vegetable matter in drinking water for a specific period. It is recommended for plant materials with more dense consistency, such as bark, roots, rhizomes, stems, seeds, and leaves with firm texture (ANVISA, 2021). The maceration procedure requires the maintenance of the fresh plant or plant material, properly prepared by cutting, grinding, or spraying in the proportions specified in the formula, in contact with an appropriate extraction liquid, for a period determined for each type of plant. One should use an amber container or one that prevents exposure to light (ANVISA, 2021).

Among the locations where the students obtain medicinal plants, the ones that stood out most were their own yard (44) and the market (31), as shown in Figure 1.

Figure 1

Places for obtaining the medicinal plants mentioned by the respondents.



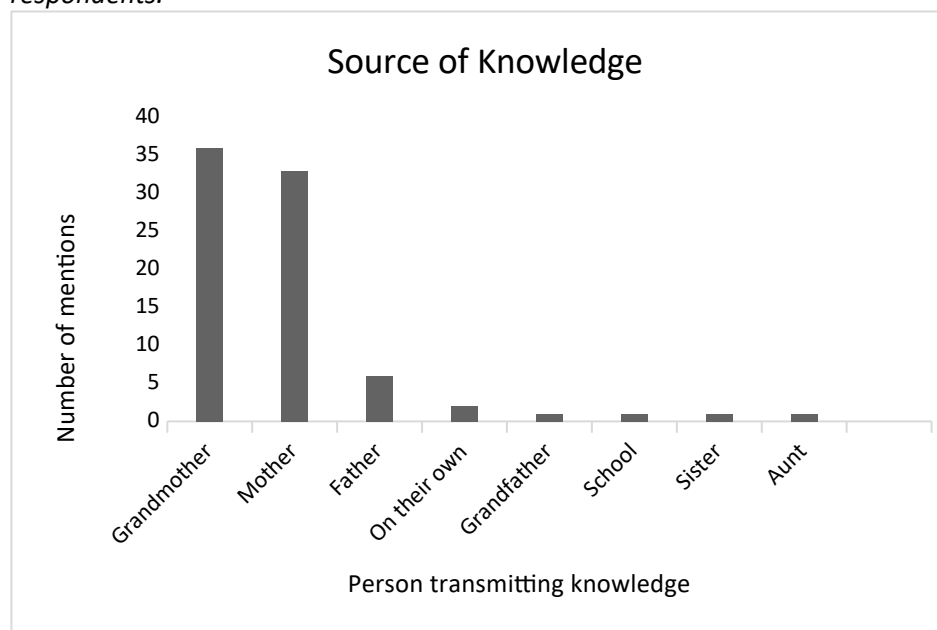
Source: Designed by the author (2024).

Figure 1 shows that the students' own yard appears as the most frequent place for obtaining medicinal plants. Yards have remarkable social importance, according to Novais et al. (2011), as these sites represent spaces for preservation and display of knowledge accumulated over time, transcending generations. In addition, yards can be considered as biodiversity reservoirs, since they act as preservation areas of unique or preferred varieties, and they serve as spaces to test new varieties (Oakley, 2004; Varela et al., 2022).

Regarding their source of knowledge, most of the respondents mentioned that they learned about use, preparation, and indication from their grandmother (36) and mother (33), as shown in Figure 2.

Figure 2

Source of knowledge about the use of medicinal plants mentioned by the respondents.



Source: Designed by the author (2024).

According to the results shown in Figure 2, the source of the students' knowledge in this study is transgenerational, i.e., knowledge is transmitted from generation to generation, through practices, stories, and traditions. This type of transmission is a “point of support for parents in the construction and exercise of values, goals, and educational strategies” (Magalhães, 2010, p. 12).

Another important factor about the source of knowledge that can be observed in this study was women's role in preserving and transmitting traditional knowledge of medicinal plants. These were the main sources of knowledge mentioned by the students. The main place to obtain the plants, which were the students' yards, and the source of knowledge of medicinal plants are connected, since women tend to have a deeper knowledge of the plants that grow near their homes, yards, and small farms, because they are mostly in charge of taking care of them (Maia & Sobrinho, 2019; Varela et al., 2022).

On this theme, Magalhães (2010) points out that gender roles differ between historical moments and between different cultures, but some aspects tend to be perpetuated and transmitted by the family. In this case, the relationship of care is historically seen as a female role because even when women have occupations that are not directly related to the provision of care, they are often in charge of caring for their families. This intensive care occurs both in the early stages of growth of some family member and in the processes of aging and illness (Guedes & Daros, 2009). This practice of daily care for their family ultimately leads these women to develop knowledge of medicinal plants used in primary health care and transmit it to other generations, as found in the results of this study.

BETWEEN MEMORIES: RECALLING MEDICINAL SPECIES

To recall some visual memories, the application of the projective technique allowed students to access their memories and experiences with the plants, even though they did not have to remember their scientific or common name. It also allowed them to deal with fond memories of the plant species, the people or family members who taught them about such species and, finally, their own experience with each medicinal plant species that they visualized, which are described below.

During the projective technique, of the 29 participating students, 17 recognized *Matricaria chamomilla* with the common name chamomile, three as daisy, and nine did not recognize the species. Both the mode of preparation and ethnoindication, and the source of knowledge followed the pattern mentioned in the ethnobotanical survey: tea, as a sedative, and taught by their mother, respectively.

In the survey conducted with the questionnaire, chamomile was mentioned by 14 students; however, it was recognized by 17 when the projective technique was used. This may be due to the fact that, in the projective technique, participants access visual memory, while in the questionnaire in which they mentioned the species in the form of a list, they needed to remember both the plant and the way of using it. Since participants are subject to momentary forgetfulness episodes, remembering more details can make it difficult to access the memory of that species; this way, they may return less information (Quinlan, 2005).

Six students recognized the species *Cymbopogon citratus* (lemon grass) as a “cana-cidreira”, six as “mate-doce”, four recognized it as “cidreira”, two as “erva-cidreira”, while 11 did not recognize the species. Several uses were indicated; the most mentioned use was as a sedative, and the most frequent mode of preparation was as tea. Four students reported learning about it from their mother.

For *Cymbopogon citratus*, there were many different common names, and such variation is usual from region to region, and also within the same community (Citadini-Zanette & Martins, 2011). However, one of the most important precautions when using medicinal species is to identify the plants correctly, because the wrong identification or the use of different plants with the same indication or common name can lead to poisoning (Rates, 2001). Thus, the plants used by the population need the efficacy and safety that are based on popular tradition, but they also need to be scientifically validated (Lorenzi & Matos, 2021).

In the case of *Achyrocline satureioides*, commonly known as marcela, only one student mentioned the popular name of the species as fennel. The other 28 students did not mention the name of the species. Although it is a widely used species, the lack of knowledge may be due to the fact that marcela does not occur abundantly in the study region; thus, this species is not part of their daily routines.

They recommended it as a sedative, and tea was mentioned as the mode of preparation. Their grandmother was mentioned as the source of knowledge. As for the mentioned indication as a sedative, a study confirmed that the species has potential for the treatment of nervous cramps (Pirker et al., 2012).

The species *Mentha piperita* was recognized with the common name of mint by 26 students. The species was largely recognized by the students possibly because it is abundant in the study region and can be easily grown. It was most

frequently recommended for abdominal pain, and tea was the most reported mode of preparation. They mentioned their mother as the most frequent source of knowledge. The indication “for tummy pain” mentioned by students may be due to intestinal problems; as reported by Nabarawi et al. (2017), the essential oil has a relaxing effect on the intestinal smooth muscles, reducing abdominal cramps, leading to the relief of “tummy pain” symptoms, as mentioned by the respondents.

Zingiber officinale was recognized by 25 students with the common name of ginger. This species is popular among the students because it can be easily found in greengrocers and markets. Thus, the informants have contact with the rhizome of the plant, and they remember the common name by which it is marketed. The indication that the informants mentioned most often was for treatment of a sore throat, followed by weight loss. They mentioned preparing the rhizome by boiling it directly in water and making tea. Only one of the informants reported having learned about it from their mother; the rest of them did not mention the source of knowledge.

In the area of traditional herbal medicine, *Zingiber officinale* is widely recognized by the public for its pharmacological properties in the treatment of colds, influenza, and gastrointestinal disorders (Tatagiba; Sousa & Oliveira, 2019). Several biological studies conducted by different researchers have confirmed the remarkable phytotherapeutic potential of *Z. officinale* for treatment of respiratory system diseases and gastrointestinal disorders. They also highlighted its anti-inflammatory, antimicrobial, diuretic, and antioxidant properties (Cutim et al., 2019; Ferreira et al., 2020).

In addition, ANVISA included this plant in its list of herbal medicines with simplified registration (Brasil, 2014) and in the second edition of the Phytotherapy Form for the Brazilian Pharmacopoeia (ANVISA, 2021). In this context, the rhizome of *Zingiber officinale* is recognized for its effectiveness in relieving symptoms of motion sickness (kinetosis).

Rosmarinus officinalis was recognized by 13 students by the common name of rosemary. Culinary use was the most mentioned indication. Although cooking is not considered a therapeutic indication, the students mostly remembered the use of the species as food. Many medicinal species are also used as food, especially as spices or condiments (Varela et al., 2022). One student mentioned learning about it from their grandmother and another informant reported learning from a video posted on the Internet. Regarding medicinal use, the species is validated by ANVISA (2021) for dyspepsia, spasmodic disorders of the gastrointestinal tract, and for its carminative and anti-inflammatory properties.

UNDERSTANDING HOW STUDENTS RELATE TO MEDICINAL PLANTS

To discover students' knowledge of medicinal plants, they were asked the question “What are medicinal plants?”. Only three respondents did not know how to answer the question, and four related them to mode of use, exemplifying it by the sentence “they are teas.” Many respondents mentioned using plants when they are suffering from some symptoms, such as abdominal pain, headache, abdominal cramps, among other diseases. Another 22 students correlated them with health care and use them when they are sick, while some of informants related the plants to their composition.

“...they are medical plants that help human beings. These plants have effects to help us, for example, to stop tummy pain” (Male, 14 y/o, 7th grader).

These answers by the respondents were aligned with the concept of medicinal plants established by the World Health Organization (WHO, 1998): “any plant which, in one or more of its organs, contains substances that can be used for therapeutic purposes, or which are precursors for chemo-pharmaceutical semi-synthesis”. Therefore, they showed that they understand the meaning of the term “medicinal plants”.

When asked if all plants have medicinal properties, three students did not know how to answer the question; one answered that they do not and mentioned the lack of studies on the species; three informants answered that they did not and associated this fact with the toxicity that the plants may have; four students answered that all plants have medicinal properties, but they did not justify their response; and 18 informants answered that they have no medicinal properties, but they did not justify their answer.

The fact that most students answered that not all species have medicinal properties demonstrates that they understand that while some species can be used, others cannot. This can be implied in answers like this one:

“... no, because some plants may contain harmful toxins and may even kill someone. This is why it’s important to know these plants well and then use them as medicinal plants” (Female, 14 y/o, 8th grader).

Another student went further, and answered: *“... no, or they haven’t been studied yet. I guess” (Female, 13 y/o, 8th grader).*

The last student established a relationship between medicinal properties of plants and scientific studies, which shows that some students are aware that further research is need to broaden the knowledge of the medicinal properties of plant species, so that they can be used effectively and safely.

The respondents were also asked about the presence of components in the plant that could harm human beings and how that would happen. Three students did not know how to answer; two answered negatively; three related the question to correctly cleaning the plants, which may be related to learning about how to clean food properly. Four of them mentioned the use of species, for example: *“...in a way, yes, when we use them in an uncontrolled way”* and *“...If we don’t use them correctly or overuse them”* (Female, 15 y/o, 9th grader). By stating that there is a specific way of using the plants, these students showed that they are aware of the rational use of the species. Rational use includes careful cultivation of species, indication, dose, toxicity, the age range of users, and the part of the plant to be used (Costa; Alves; Narciso, 2022).

As reported by Veiga Junior, Pinto & Maciel (2005), the toxicity of medicinal plant species is erroneously considered less relevant when compared to that of allopathic drugs. According to the authors, the adverse effects of adulteration, toxicity, and synergistic action (interaction with other drugs) make the toxicity of medicinal plants a worrying public health problem.

When asked about when they use medicinal plants, most students (24) said they use them when they are sick, which means that they use plants as a remedy. The last question asked students about their interest in learning about medicinal

plants at school; while one student reported lack of interest, 25 said that they were interested in learning about the topic. A large majority of students showed interest in learning about medicinal plants; however, 15 students mentioned never having heard about medicinal plants at school.

Although plant species are present in people's everyday life - in gardens, in flowerbeds, in squares, and in food, the value of botany is not properly acknowledged (Melo et al., 2012). Lack of appreciation of botanical content can be illustrated by the situation described in the study of Salatino and Buckeridge (2016): when humans look at the photo of an African savanna, they can easily describe which animals are present, but they are much less likely to mention the plants, which are ultimately considered background elements.

The study by Melo et al. (2012), which investigated the reasons why elementary school students have difficulty in learning botany, found that their greatest challenge is to understand the difficult language being used and the lack of connection with reality. Therefore, one of the ways to help students understand botany more clearly and find it relevant would be to help them relate botanical contents to their daily life. Thus, the theme Medicinal Plants, as reported by Silva & Costa (2019) and addressed in this study, is connected to the students' reality, and their previous knowledge may have increased acceptance of the theme among them.

The relationship between ancestral types of knowledge is clearly important; as argued by Messias et al. (2015), people who know better about medicinal plants are those who have learned from their ancestors. In Science and Biology classes, traditional knowledge should be integrated with scientific information to encourage students to recognize that society is not limited only to scientific knowledge as a reference source (Kovalski; Obara & Figueiredo, 2011).

Given the above, it is important to integrate this theme into the school curriculum. However, this inclusion should not be limited only to Sciences or Biology classes; it should take a comprehensive and interdisciplinary approach, that is, seeking connections with various school subjects to enhance the educational practices and students' knowledge of this topic (Mera et al., 2018).

There are actions that enable the integration between teachers of different subjects, and provide opportunities for the use of medicinal plants as a resource to explore various contents. Here are some examples of interdisciplinary initiatives: in Chemistry, addressing aspects such as composition, production of extracts, preparations and mixtures; in Biology, covering physiology and plant anatomy, correlations with the human body, health, origin of species, terrestrial biomes, and plant habitats; in the Arts, allowing students to draw and paint plants; in History, exploring the origin of species and agriculture; and in Geography, focusing on the centers of origin and diversity of plants (Mera et al., 2018).

In addition, this theme can be included in textbooks. According to Cunha et al. (2023), when it comes to medicines, textbooks still lack depth and clarity, failing to provide the essential resources for a critical evaluation of self-medication and for the formulation of health promotion strategies. In this perspective, with a view to integrating self-medication, rational use of medicines, and health promotion, there is a clear need to include information about the use of medicinal plants in the school environment.

FINAL REMARKS

In addition to knowing the names of medicinal plant species, the students showed that they could relate the names to indications similar to those validated scientifically, and they mentioned different uses for different species. The students most often collected the species from their own yard, and their mother and grandmother were the main sources of knowledge (transgenerational). These two aspects are interconnected, and women play a leading role in the preservation of knowledge about medicinal plants, since they are the ones largely responsible for passing on such knowledge in the family.

The projective technique showed that most species of medicinal plants were identified by the students, who visually recognized the six species that were presented. In addition to the names, students were able to link other information, such as the way they use the plants and for which diseases.

The answers to the questionnaire showed that the students know the term 'medicinal plants', even though most of them said that they had never studied the topic at school. Although the students' answers presented variations, most of them showed knowledge about the composition of plants and when they should be used, that is, about the existence of plant toxicity and the importance of rational use.

A total of 86% of the students showed interest in learning more about the species of medicinal plants at school; therefore, prior acceptance is an indication of the possibility of addressing the theme in the classroom. Therefore, there should be more studies on medicinal plants in schools to investigate students' knowledge on the subject and help preserve and acknowledge the value of common knowledge about medicinal plants.

A limitation of this study was that the participating students had difficulty in bringing over the medicinal species that they had mentioned in the interviews. Many students forgot to bring the species on the scheduled date; the researcher had to pay several visits to the school and rely on the support of the science teacher to remind them of the importance of bringing samples of the species that they had mentioned in their interviews for subsequent botanical identification.

Finally, it should be noted that the theme could be included in the school curriculum, both in the form of projects and in the classes of different subjects. Future research should focus on addressing medicinal plants with teachers of different school subjects, seeking to build methods that enable the teachers to include such plants as content to be explained in class; this way, students can learn through their own experiences with plants.

NOTES

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