An Acad Bras Cienc (2023) 95(3): e20220832 DOI 10.1590/0001-3765202320220832
Anais da Academia Brasileira de Ciências | *Annals of the Brazilian Academy of Sciences*
Printed ISSN 0001-3765 I Online ISSN 1678-2690
www.scielo.br/aabc | www.fb.com/aabcjournal

SOCIAL SCIENCES

Discourse of the collective subject of river dwellers in the Brazilian Amazon regarding the transmission of knowledge about medicinal plants

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Abstract: This paper investigates the perception of river dwellers in the Brazilian Amazon region about factors that influence the transmission of Traditional Ecological Knowledge (TEK) regarding medicinal plants. Semi-structured interviews were conducted with 43 residents of Vila Franca community (Pará, Brazil). The data were analyzed using the methodological strategy of the Discourse of the Collective Subject. The determining factors in the transmission of TEK were found to be: illness, family coexistence, and necessity, which were represented in the discourses as the most important factors for the acquisition of TEK. In the community context, the locally developed Natural Remedies Project, the beneficial effects of natural remedies, and the lack of resources to purchase allopathic medicines were cited as collaborative factors in the maintenance of TEK. Finally, the most significant determining factors in the decrease or loss of transmission of TEK found in the interviews were: lack of commitment, disbelief, and the valorization of allopathic medicines. A complex network of interactions between the villagers and their natural environment affects the transmission of TEK about medicinal plants. However, we found that the perpetuation of TEK is being threatened by various socio-economic and cultural factors.

Key words: Traditional ecological knowledge, ethnobotany, social representations, cultural transmission, intergenerational transmission.

INTRODUCTION

The Amazon Rainforest harbors the greatest plant biodiversity in the world (Cardoso et al. 2017). However, ongoing deforestation threatens such richness through the expansion of logging activity and agriculture, and increased frequency of large-scale forest fires (Newbold et al. 2015, Skirycz et al. 2016). In Brazil, the Amazon Rainforest contains a variety of botanical species widely used in traditional medicine to treat different symptoms and diseases (Valença et al. 2015, Kffuri et al. 2016, Odonne et al. 2017). The Amazon is also home to a cultural complex carrying a traditional set of values, attitudes, beliefs, and ways of life that influence the social organization and the system of knowledge, practices, and uses of natural resources (Albuquerque & Andrade 2002). The set of medicinal plants that make up the medical system of a given culture results from a long process of cultural validation (Araújo et al. 2014).

Traditional Ecological Knowledge (TKK) has been defined as a complex of interactions between human communities and their natural environment, encompassing a broad spectrum of experiences and knowledge, allowing for

the appropriation of the natural environment and the survival of populations (Berkes 2017). This accumulated body of knowledge, practices, and beliefs that are involved in adaptive processes, is passed down across generations through cultural transmission (Berkes 2017). This process, in turn, corresponds to the acquisition of behaviors, attitudes, or technologies through imprinting, conditioning, teaching, and active learning, or combinations of these (Cavalli-Sforza & Feldman 1981). In traditional societies, an essential function of culture has been to maintain knowledge, practices, and beliefs that are fundamental to cultural and ecological resilience through the process of cultural transmission between generations (Cavalli-Sforza & Feldman 1981, Posey 1993). The culturally established use of natural resources, such as locally available medicinal plants, contributes to improved health and nutritional status for these populations (Reyes-García 2010).

However, traditional knowledge about medicinal plants around the world has been vulnerable to loss (Case et al. 2005). This loss of cultural knowledge based on biodiversity is occurring both globally and in local communities, even though plants represent important resources for the health of these populations and for their livelihoods (Phillips & Gentry 1993, Zent & Zent 2007). The loss of natural resources to an increasingly globalized, cultural homogenized society and the desire for modernization are some of the factors associated with the general decline in cultural knowledge about plants and the disappearance of traditional practices involving these resources (Balick 2007, Zent & Zent 2007).

Understanding the different aspects of traditional knowledge about medicinal plants helps preserve this knowledge and give it value, considering that environmental degradation and the infusion of new cultural values into traditional lifestyles can reduce the knowledge transmitted to future generations (Estomba et al. 2006, Philander et al. 2011, Mathez-Stiefel & Vandebroek 2012). In this context, this study was aimed at accessing the discourse of the collective subject of river dwellers from a traditional community in the Brazilian Amazon region in order to answer the following question: What factors potentially influence the process of the transmission of TEK about medicinal plants?

MATERIALS AND METHODS

Study area

The Vila Franca community (Figure 1) is located at the meeting of the Tapajós and Arapiuns rivers, 55° 1'32.64" W and 22° 0'43.64" S (Santarém, Pará, Brazil). There are 74 families living there, with a total of approximately 298 residents (Projeto Saúde e Alegria 2012). The region has a continental equatorial megathermal humid climate typical of the Central Amazon, with a predominant vegetation typology of dense ombrophilous forest. Patches of savanna also occur in the region, in addition to dense ombrophilous alluvial forests ("*igapós*"), secondary vegetation, and pasture areas (ICMBio 2014).

Culturally, the community still preserves many indigenous aspects (Projeto Saúde e Alegria 2012) and agriculture is the main local economic activity. Most families in Vila Franca survive on jobs such as the production of manioc, corn, or tapioca flour. Local agroforestry farms contribute to the food security and health of the community, with rich medicinal species that not only improve the health of local residents, but also help maintain the associated traditional knowledge (Projeto Saúde e Alegria 2012). Vila Franca has traditional midwives and other women who make natural medicinal products, such as medicinal liquors, teas, and

Figure 1. General view of the riverine community of Vila Franca in the Tapajós–Arapiuns Extractive Reserve, Pará State, Brazil (Photograph by Markos Rogério L. Mota).

soaps, within a Natural Medicine Project (Projeto Saúde e Alegria 2012).

Data collection

To select the interviewees, non-probability intentional sampling was used, with nomination done using the Snowball technique (Bailey 1994). A semi-structured interview script (Albuquerque et al. 2010) was applied between May and November 2018, with three key questions: 1) "Throughout your life, what moments do you consider to have been most important for you to learn about or increase your knowledge about medicinal plants?"; 2) "In your point of view, what has helped maintain knowledge about the use of medicinal plants in the community?"; and 3) "Do you think that knowledge about medicinal plants has been decreasing in the community? If yes, what has hindered the perpetuation of this knowledge?" The interviews included the nominees selected as well as the people who lived with them, as long as they were 18 years or older and were present in the house during the visit. This was done in order to be able to reach different generations in the community. For data analysis purposes, generations were divided into three age categories: young (18 to 29 years old), adult (30 to 59 years old), and elderly (≥ 60 years old).

The interviews were conducted individually to avoid possibly compromising the data due to the influence of other people, such as a relative of the interviewee or another person from the community. Each informant indicated the best date, time, and place for the interview. The dialogues were voice-recorded and the verbal material was later transcribed in full to a digital file in text format. In the transcriptions, each interviewee received an alphanumeric code consisting of a sequence formed by a letter referring to the interviewee (E), followed by a number (e.g. 1 = first interviewee; 2 = second interviewee, etc.), a gender code (M = Male and F = Female), and their age. Example: E1M35.

Data analysis

A qualitative analysis of the statements collected was performed, in order to identify the factors that influence the transmission of knowledge about medicinal plants, from the perspective of the community residents. To do so, the methodological strategy known as the Discourse of the Collective Subject (DCS), proposed by Lefèvre & Lefèvre (2005), was adopted. This technique recommends organizing and tabulating qualitative data of a verbal nature, obtained from statements and interviews, in order to express the thinking of the group. It is based on the social representation theory and its sociological assumptions (Gondim & Fisher 2009). The DCS is a technique for the construction of collective thinking that aims to reveal how people think, attribute meaning, and express positions on a given subject. It is a sharing of ideas within a social group with the discourse understood to include every position argued (Lefèvre & Lefèvre 2005).

To build the DCS, the following methodological models were used: 1) Key Expressions: pieces or excerpts of material (discourse) that form literal descriptions of the statements, revealing the essence of the content of the representations or the theories underlying them; 2) Central Ideas (CI): names or linguistic expressions assigned to the identified content to categorize the meaning built for the key expressions. The DCS is built from these expressions and ideas, and is written to show the thought of a group as if it were an individual speech (Lefèvre et al. 2003, Brito et al. 2022).

The procedures followed to build each DCS were: 1 – Define the key expressions; 2 – Identify the CIs; 3 – Create categories that encompass the shared CIs; 4 – Build the DCSs themselves. Each interviewee may have contributed more than one CI to each DCS.

The relative frequencies (%) of the interviewees' answers were obtained for each category analyzed. Based on this, a complementary quantitative analysis using the chi-square test of adherence verified significant differences between the frequencies of the established categories ($p < 0.05$).

Ethics approval and consent to participate

All interviewees were previously informed about the study and its objectives, risks, and benefits. After that, they agreed to participate by signing an Informed Consent Form. The protocol of this study was approved by the Ethics Committee on Human Research of the State University of Pará – Campus XII Tapajós, according to CAAE # 86066918.2.0000.5168, Opinion # 2.602.678. The study was also registered in the National System for Genetic Heritage and Associated Traditional Knowledge Management, with registry # AC3A561, and in the Biodiversity Authorization and Information System, with authorization # 62993-1.

RESULTS

The sampling strategy used made it possible to include interviewees from all age generations categorized in the community. Forty-three people were interviewed, 58.14% female and 41.86% male, making up 14.42% of the community's total population. The age of the interviewees ranged from 18 to 80, being: 25.58% young, 34.88% adults, and 39.53% elderly.

Determining factors in the transmission of TEK about medicinal plants

Ten categories emerged within the group of DCSs formed from the interviewees' perceptions about the moments in their lives that were most important for them to learn or increase their knowledge about medicinal plants. The following

CIs revealed the most important factors in the construction of TEK: A – Illness (31.25%); B – Family life (14.58%); C – Necessity (10.42%); D – Distance from the community (8.33%); E – Prevention (8.33%); F – Recognition of the medicinal value of plants (8.33%); G - Family constitution (6.25%); H – Natural remedies project (6.25%); I – Class (4.17%); and J – Community life (2.08%). Significant differences were observed among the categories (χ^2 = 29.083; p = 0.001) (Figure 2).

In the interviews, it was found that situations of illness (A - Sickness, 31.25%) are those that contributed most to the acquisition of TEK about medicinal plants, for each speaker, as the following DCS points out:

> *I learned to treat illnesses, avoid diseases, and then I went on to spread the word. We sought after it because we had a problem, when one of us got sick, I would run to her side. She taught us whenever a woman got sick and we would run there with her and she taught us, and it was always about viruses, flu, these things. It was more with these things that we used to make medicines, syrup for the children. I used to make medicine for my children when they were sick. Any little illness they have, I immediately make medicine for them, to take care of them. So, it was like this, as I'm telling you, about the illness, when we got sick or when they got sick. (E6M80, E9M55, E11M44, E15F48, E17F25, E20F62, E22M64, E27M65, E30F76, E31M75, E32F37, E34F50, E35F25, E37F27, E41F18.)*

Family relationships have also been shown to be important for the transmission of TEK, when information about medicinal plant resources is shared during day-to-day life (B - Family life, 14.58%):

> *With my mother, on a daily basis, because when we grow up we already start to observe right, our mother. I lived together with her. My parents helped me at this time. My mother would plant and I would go there. When she was here, she had platform with plants in cans, she planted everything in these cans. I paid attention to what she did, how she did it. I saw her doing it right here at home. I watched everything she did. Then I learned, and my*

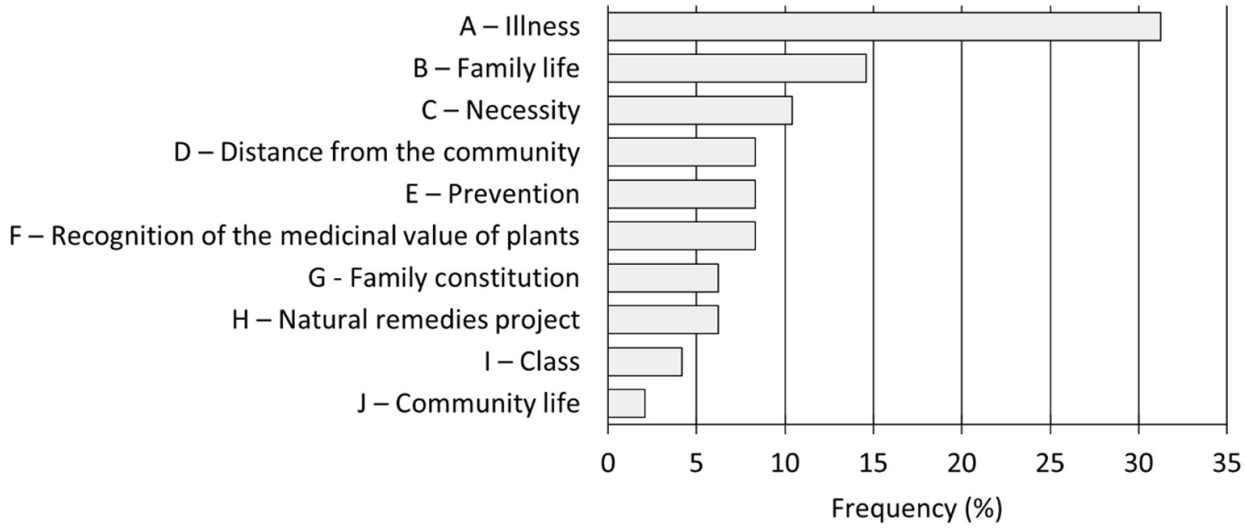

Figure 2. Frequency of categories obtained from the interviewees' responses about the most important moments for the interviewees to learn or increase their knowledge about medicinal plants.

> *mother already knew, the remedies that she used to make tea, the tea business was good...then I started learning. Then we went along in life like this, learning. (E8M59, E24F74, E25M60, E26F78, E30F76, E33M80, E36M46.)*

For another group of interviewees, the needs of the community are an important factor that raises interest in obtaining traditional knowledge about medicinal plants. The CI (C – Necessity, 10.42%) was the third most frequently mentioned category, expressed by the following DCS:

> *It was while observing the necessity that we felt from the community, and even the social desire of wanting to learn, because we need it." (E10F58, E12F34, E28M72, E39F18, E40F22.)*

The dialogues about what has helped to maintain and transmit TEK about medicinal plants in the community generated 14 DCSs, represented by the following categories: CI: A – Natural remedies project (28.07%); B – Accessibility to natural remedies (8.77%); C – Beneficial effects of natural remedies (8.77%); D – Beneficial composition of natural remedies (7.02%); E – Harmful composition of allopathic medicines (7.02%); F - Necessity (7.02%); G – Teachings of older generations (7.02%); H – Belief (7.02%); I – Willingness to prepare natural remedies (3.51%); J – Lack of resources to buy allopathic medicines (3.51%); K – Lack of resources to travel to the city (3.51%); L – Training on natural remedies (3.51%); M – Lack of medicines at the health post (3.51%); and N – Cultural tradition (1.75%). The categories showed significant differences among themselves (χ^2 = 42.965; $p < 0.001$) (Figure 3).

The Natural Remedies Project, developed by women, emerged as the most important factor for maintaining TEK about medicinal plants

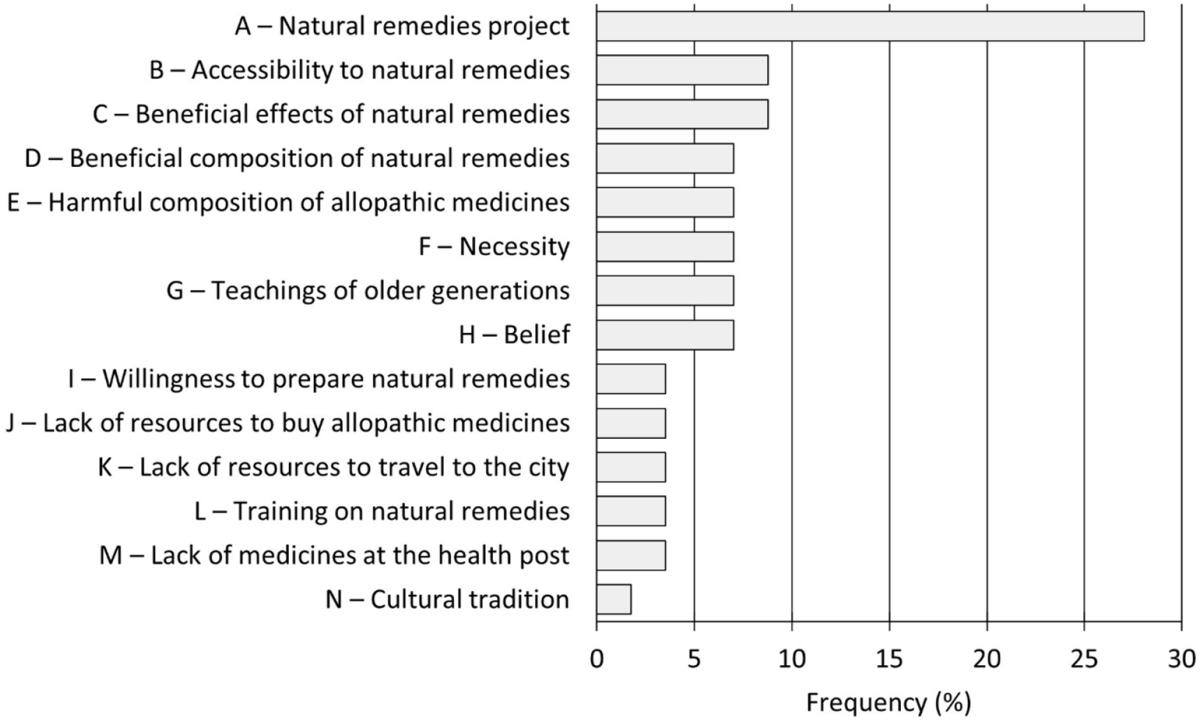

Figure 3. Frequency of categories obtained from the interviewees' responses about what they think has helped maintain knowledge about the use of medicinal plants in the community.

in the community. This was the category most often expressed (A – Natural remedies project, 28.07%) among the interviewees, resulting in the following DCS:

> *It was with the women's movement; they have the project and through them we gained the knowledge. A group to make the medicines. There are some women here that work with home remedies and they pass some information to us. They teach us and we learn. Then the people work on it, they even make pills from the plants. The women, they do things. We go there with them and they make the remedies and mainly they use the plants to make the remedies, mainly these plants that we have there, this medicine garden helped a little bit also. This was a women's project. I think that it was the key point of general knowledge that they were seeking to bring to the community and expanded here to the community and to the region. It was significant because we embraced the cause and it worked a little bit. They do these studies through medicinal plants, they work with this, they have a scheme with these plants now. We had a meeting with some women that came to give us a talk about medicine and all this was talked about, and we took notes. I think this part was very good, right, because we didn't know and we were searching for more. It became more recognized for us to do. (E2F79, E3F58, E4F25, E5M56, E6M80, E7F43, E8M59, E9M55, E11M44, E13M59, E14M38, E18F74, E22M64, E24F74, E31M75, E34F50.)*

The ease in obtaining natural medicines produced with plants in the community led 8.77% of respondents to share this CI (B - Accessibility of natural remedies). The following DCS was built based on this CI:

> *I think because it is easier right, from the plants that you need to prepare medicine. Because many people have them at home. I think that because it's a natural remedy, it is faster for those who are close to us to make it. Before we can get to Santarém we'd die, right, and so they use this home remedy and do it. You see that there is a place to buy the home remedy in our city. Instead of buying it at the pharmacy, I have it here. (E6M80, E25M60, E27M65, E33M80, E35F25.)*

Category C (Beneficial effects of natural remedies 8.77%) also stood out as a positive factor in the conservation of TEK about medicinal plants, showing that the positive results of using these remedies can contribute to the residents sharing this information among themselves:

> *I believe because it works, right. The medicine, the home medicine works very well, because the people who treat themselves with the medicinal plants, they do well. They do well, I do well too, it works, it's working. Many home remedies have been very beneficial, because they are good for us. (E6M80, E28M72, E33M80, E36M46, E41F18.)*

Determining factors for the decrease or loss of transmission of TEK about medicinal plants

The majority of the interviewees (83.72%) stated that TEK about medicinal plants has been decreasing in the community. The 10 DCSs obtained include the following CIs about determining factors for this loss of transmission of TEK: A – Lack of commitment (36.73%); B – Disbelief (22.45%); C – Valuing allopathic medicines (16.33%); D – Devaluation (8.16%); E – Modernization (4.08%); F – Influence of modern medicine (4.08%); G – Accessibility of allopathic medicines (4.08%); H – Commercialization

of natural remedies (2.04%); I – Lack of encouragement from older generations (2.04%). Significant differences among the categories were identified ($\chi^2 = 50$; $p < 0.001$) (Figure 4).

According to the interviewees, the factor most harmful to the transmission of TEK in the community is a the lack of commitment (A – 36.73%) on the part of the residents with regard to learning about this traditional knowledge, including the use of medicinal of plants, through not participating and not helping with the community activities that involve the production of medicines from medicinal plants. The DCS below highlights this perception:

> *Nowadays they don't want to do anymore, they don't want to have that knowledge anymore, even because there are some of them who are lazy about doing it and only want to do use is already ready. People are not as interested in following, for lack of will, because people don't want to take care, make the remedies, take care of the garden, right? They don't want to take care of them, they don't want to plant them. It's a lack of interest, especially among the youth, because the youth are not interested, they don't want to get involved in these projects and other things here in the community. The younger people are, as they say, wanting to enjoy themselves, they don't want to...they only come to seek medicine when they are already sick. I believe that what is happening is that many don't want to take the trouble to deal with the plants. It is also the laziness of people about doing it, because there are many people who have a fever and the mother goes and runs to those who already know, they don't try to plant any plant. I think that for me, what is wasting a lot of time is people who don't care, don't care about this, about medicinal plants. They don't want to do it. They don't try to learn and, on the contrary, they criticize, you know, they don't believe. What doesn't develop is the question of collective participation, of the community, because we don't help each other. But the others, you know, we have to have more and more. One goes, but others don't. I think we are the ones who harmed ourselves, because we didn't help each other and*

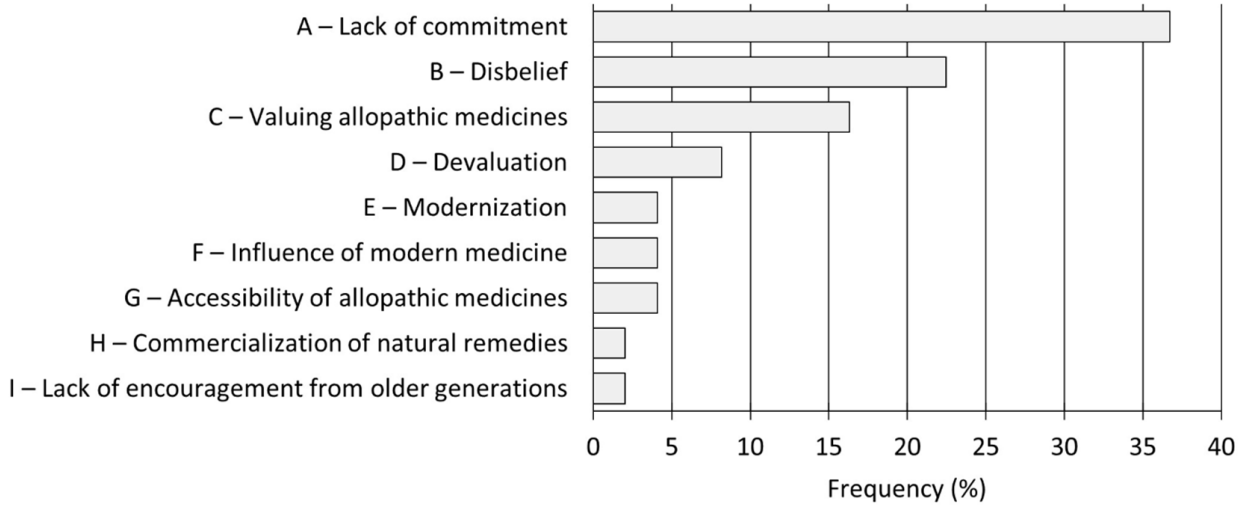

Figure 4. Frequency of categories obtained from the interviewees' responses regarding decrease in knowledge about medicinal plants in the community and what has hindered the perpetuation of this knowledge.

then, one doesn't go and another doesn't go. It is a lack of unity in the community, because we don't care. It's that we don't help each other and then there is no more medicine, no more plants. (E1F64, E2F79, E3F58, E4F25, E5M56, E6M80 E7F43, E10F58, E12F34, E13M59, E15F48, E18F74, E20F62, E24F74, E28M72, E31M75, E33M80, E35F25.)

Disbelief in natural herbal medicines was another significant factor (B – Disbelief, 22.45%). For example, many local residents no longer believe in healing through the use of these medicines. The following DCS describes this view:

Look, it's because many don't believe. For me, they don't believe anymore, because if they get a snake bite, they immediately go to the city. There are many people who don't believe that the medicine will cure them. From generation to generation, there are many people - in this case, children - who don't want to believe. The new generations, they don't believe, they don't value it, they think it is an old man's tale. I also believe that there are many people who don't believe in these remedies, that they will be good, right, that only the city's medicine is good. There are some who believe in medicinal remedies, but there are some who say: "Oh, why do you take it?" What hurts is not believing. I've already heard someone say that they don't believe in home remedies. They don't believe in it. They don't have much faith in this remedy. They don't want to trust the plants themselves anymore. (E2F79, E3F58, E14M38, E17F25, E27M65, E28M72, E29F61, E30F76, E32F37, E41F18, E42M23.)

Another representative factor that hinders the cultural transmission in the community is the valorization of allopathic medicines (C - 16.33%). According to the residents, the natural remedies are being replaced by allopathic medicines, i.e. pharmacy drugs:

It has disappeared quite a lot, hasn't it? People don't look anymore, they look for the doctor, for the pharmacy remedies, because they give more importance to the pharmacy remedies. They only want the ready-made medicine from Santarém, from the pharmacy, because I mean, there's already a clinic, so: "Ah, you're going to drink this tea, this leaf tea, not me!" Then they go to the clinic to ask for the medicine there, because the medicine there is what they think cures us. There are people who tell me: "Ah, because so-and-so is... make a medicine, a tea, that will make this pain go away... why don't you look for a doctor, for pharmacy medicine?" They only want to know about the pharmacy, right: "The only good medicine is from the pharmacy." Sometimes they stop buying here to go buy in the city and then it builds up, right? They want more from the pharmacy, the medicine that comes from outside, the pharmacy. (E3F58, E6M80, E26F78, E28M72, E30F76, E34F50, E37F27, E40F22.).

DISCUSSION

A complex network of interrelationships among and between villagers and their natural environment affects the transmission of TEK about medicinal plants. Two processes are fundamental to the cultural dynamics around medicinal plants: the individual production of knowledge and the transmission of this information (Soldati et al. 2015). In the analysis of the discourse of the river dwellers, the determining factors for the transmission of knowledge and the determining factors for its

decrease or loss were categorized. The cultural transmission of traditional knowledge occurs mainly in three ways: vertical – when transmission is between individuals of different generations within the same family; horizontal – when transmission is between members of the same generation; and oblique – when transmission occurs between unrelated generations, from teachers, and from mass media (Cavalli-Sforza & Feldman 1981).

The CI most relevant to the transmission of TEK in this community is that of illness. This can be understood as the moment when medicines are needed to alleviate symptoms or treat a disease. The use of medicinal plants constitutes the first therapeutic strategy for 80% of developing countries and the majority of the global population (87.5%) uses traditional herbal medicine to treat health problems (Pešić & Stanković 2015). The use of medicinal plants for the treatment of diseases dates back throughout all of human history. Human beings have sought for tools in their environment to recover from illness, and plants were the principal treatment of choice. When using medicinal plants because of illness, it is necessary to seek knowledge from whoever has it in the community. In general, if illness is the main idea that maintains traditional ecological knowledge about medicinal plants, it is indispensable that there be people who know which plants are needed to treat the sick person, in addition to the collection of plants to be used in this process. Local medical systems are supported by plant diversity and traditional knowledge (Díaz-Reviriego et al. 2016) and play an important role in the health of millions of people worldwide (Eshete & Molla 2021). Unfortunately, ethnobotanical knowledge about medicinal plants is what is most significantly impacted by the loss of local ecological knowledge (Aswani et al. 2018). Necessity as a major factor in transmission is directly related to the person possessing knowledge about the plants and having access to the remedies.

After illness, the most relevant CI cited was family interaction. This item presupposes that someone in the family has knowledge about the use of medicinal plants. This result may speak to the predominance of vertical transmission of knowledge about medicinal plants (Lozada et al. 2006, Eyssartier et al. 2008, Reyes-García et al. 2009) that occurs between generations within a family and is common in many populations worldwide (Nankaya et al. 2019, Mattalia et al. 2021, Silva & Zank 2022). Sociocultural systems where the transmission pattern is primarily vertical have greater heterogeneity of knowledge among community members, as each family has its own specialties and experiences (Soldati et al. 2015). But the extent of vertical transmission in ethnobotanical studies is often overestimated and thus may seem more important than it really is, especially when based on answers to questions in interviews (Soldati & Albuquerque 2016). Nevertheless, in a community in which knowledge is transmitted primarily through the vertical route, we can infer that the kinship-based model is an important learning bias (Cavalli-Sforza & Feldman 1981). Affinity with those who recommend or prescribe a remedy, in this case family, is an important factor and shows that trust in the remedy depends on cultural factors (Menendez-Baceta et al. 2015). Beyond this, there is a psychological component to the manner in which the treatment with plants operates, which is the psychological context that includes who administers it, and how, where or when it is administered. All of these cultural aspects are essential in giving the remedy a healing meaning (Menendez-Baceta et al. 2015). Many ethnobotanical studies point to women, especially mothers and grandmothers, as the main actors in the transmission of knowledge and treatment with medicinal plants

within the family (Voeks 2007, Eyssartier et al. 2008, Costa et al. 2021, El-Ghazouani et al. 2021), especially with regard to exotic and cultivated plants (Torres-Avilez et al. 2016). The cultural aspect was also shown to be important in the acquisition of TEK, observed also in the Cultural Tradition and Belief categories. Many communities believe that plants and natural medicines can be effective not only because of their pharmacological action, but also because of the cultural significance attributed to them (Hoeffel et al. 2011).

The CIs that were cited less frequently were the Natural Remedies Project in the community and the courses on medicinal plants. These were, however, the most cited factors that have helped maintain TEK in the community. These categories can be pointed to as sources of horizontal knowledge transmission. Horizontal sources are prevalent as secondary sources of medicinal plant knowledge transmission in traditional communities (Costa et al. 2021, El-Ghazouani et al. 2021, Kaushik et al. 2021). In literate societies, the transmission of knowledge about medicinal plants through texts and, more recently, other media containing local and non-local knowledge has a more immediate and longer effect than oral transmission (Leonti 2011). However, among Romanians living in Ukraine and among Hutsuls, where knowledge transmission is predominantly vertical, there are individuals who do not use books on the premise that "we read books and forget" (Mattalia et al. 2021).

The data obtained in this survey indicate that 87.72% of the interviewees stated that TEK has been decreasing and that its perpetuation is threatened by different socioeconomic (Mota et al. 2021) and cultural factors, which could lead to the loss of TEK that had accumulated over several generations and, consequently, to its disappearance. The current loss of medicinal plant diversity and its associated traditional knowledge has been recorded worldwide and has, as principal causes, the increased exposure of communities to economic pressures (Reyes-García et al. 2005), environmental degradation and decreasing biological and cultural diversity (Mathez-Stifel et al. 2012, Sujarwo et al. 2014, Barreau et al. 2016), agricultural expansion, population increase (Ssenku et al. 2022), and the displacement of people from their natural environments to urban regions (Pinto et al. 2006). Cristancho & Vining (2009) present other potential threats that contribute to the gradual loss of TEK, such as cultural assimilation, loss of traditional territories, ecosystem destruction, urbanization, poverty, climate change, and the death of community elders. Although the community under study has strong traditional aspects and is geographically remote from the city, interviewees cited modernization as detrimental to TEK. Quilan & Quilan (2007) reported similar results in the village of Bwa Mawego, Dominica, where this factor was responsible for decreasing TEK among the study population.

The loss of traditional knowledge is also compounded by the expansion of modern education, which causes the younger generation to underestimate their traditional values, resulting in the deterioration of traditional practices (Abebe & Terefi 2021). In this context, divergent ideas were found regarding the transmission of traditional medicinal plant knowledge to young people. Some authors consider that it is necessary to integrate traditional ecological knowledge into the formal educational system in order to reverse the loss of local and traditional ecological knowledge (Gómez-Baggethun et al. 2010, McCarter & Gavin 2011). However, Downey (2010) and Marchand (2010) argue that local ecological knowledge is acquired primarily through competition and

context, not through verbal communication. There is still mixed evidence regarding the persistence of knowledge where traditional practices were being consciously maintained and where there was hybrid knowledge production (Aswani et al. 2018). In the community under study, there was a small number of young people interested in learning about medicinal plants in medicinal plant courses and this knowledge was not incorporated into formal education.

The lack of commitment to using medicinal plants, the disbelief in their effectiveness, and the appreciation of allopathic medicines were pointed out in this study as the main factors that accelerate the decrease or loss of TEK. A lack of commitment to the use of plants may be associated with disbelief in their effectiveness precisely because of the valorization of allopathic drugs, leading to intergenerational cultural loss. The fact that allopathic drugs remain out of reach of some populations has enabled the preservation of traditional medicine (El Babili et al. 2021). There is a scarcity of studies about the preference for the use of traditional versus allopathic medicines. Quiroga et al. (2012) point out that, in indigenous communities in Bolivia, there are diseases preferentially treated by allopathic medicines (respiratory diseases, diarrhea, and parasitosis in children under 5 years old) and others for which the use of traditional medicines is preferred (gastrointestinal diseases). There are records of communities giving preference to traditional medicines (Ssegawa & Kasenene 2007, Withers et al. 2018, Oliveira et al. 2020, Chali et al. 2021), giving preference to allopathic medicines even in isolated places in the Amazon (Brierley et al. 2014, Williamson et al. 2015), and preferring mixed use of these medicines (Adhikari et al. 2021). In Pakistan, the ethnobotanical study of the Okara region concluded that, unfortunately, traditional knowledge about medicinal plants is decreasing day by day as the young generation depends on allopathic medicines (Munir et al. 2022).

In the community studied, culturally established socio-ecological relationships were found to influence the process of cultural transmission of TEK about medicinal plants between generations. There is a generational perception about the decrease in transmission of TEK. From the DCSs constructed, there is evidence of threats to its continued maintenance. The data gathered suggest the need for strategies that conserve TEK in the community, as loss of knowledge can have negative impacts on the resilience of social-ecological systems and can also negatively impact bioprospecting efforts, given that TEK is an important source of information for new drug research. Problems with intergenerational transmission of this knowledge require action plans that simultaneously address individual, environmental, and sociocultural aspects that appear to be affecting this process locally. Finally, research such as this, which seeks to understand how TEK is transmitted, may be useful in predicting the variability of this knowledge for different groups and the stability of traditional medical systems over time.

Acknowledgments

The authors would like to thank the Vila Franca community, especially Maria Carmem Borges Corrêa, Maria de Nazaré Alves Assunção, and José Joaquim Sousa da Conceição, for their participation, hospitality, and assistance in the field; the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq-Brazil), for a Masters scholarship received by MRLM; the Graduate Program in Environmental Sciences and Technologies (UFSB/IFBA), and the Graduate Program in Society, Environment and Quality of Life (UFOPA), for financial support to JSN; and Veracel Celulose/Fapex, for a Postdoctoral Fellowship received by CWK. This publication was also financially supported by resources from the UFSB through the public procurement PROPPG/UFSB # 07/2022, Process 23746.002054/2022-52.

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How to cite
NOVAIS JS, MOTA MRL, KFFURI CW & LAUER-LEITE ID. 2023. Discourse of the collective subject of river dwellers in the Brazilian Amazon regarding the transmission of knowledge about medicinal plants. An Acad Bras Cienc 95: e20220832. DOI 10.1590/0001-3765202320220832.

Manuscript received on September 28, 2022;
accepted for publication on July 9, 2023

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JSN, MRLM and IDLL conceived the main research question, and designed the field procedures. MRLM collected and analyzed the data, and wrote the manuscript original draft. JSN and IDLL were the academic advisors and project supervisors, acquired the research funding, supervised data collecting and analysis. JSN, IDLL and CWK revised and edited the final version of the manuscript. All authors read and approved the final text submitted for publication.