

*Full Length Research Paper*

# **Bioprospective potential in the traditional use of herbal medicines in an institution in Central Brazil**

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**Medicinal plants are important natural goods for many different peoples, especially because of their use as herbal medicines resulting from the traditional knowledge emerged from the direct contact with nature. The great experience of regional, traditional communities on the management and use of plant resources available in their regions led different populations to create and use several medicines. Even though the scientific literature presents studies on the identification and acknowledgement of environmental services, important for the economy of local populations, as well as the preservation of their natural resources by retrieving a regional, popular knowledge, Brazilian biomes, especially Cerrado, a neotropical savanna, have an abundant flora diversity and are confronted with a land occupation scenario marked by the expansion of agricultural and live stocking activities, which threatens the maintenance of herbal medicines supply. In this context, this study introduces the case of the Grupo Espírita da Paz, a group that provides the cultivation, sustainable extraction and processing of medicinal plants by highlighting the value of traditional herbal medicines as informational resources for pharmacological bioprospection, thus favoring the conservation of biomes that offer genetic resources.**

**Key words:** Herbal medicines for traditional use, Grupo Espírita da Paz, bioprospection, Brazilian tropical.

## **INTRODUCTION**

The traditional knowledge on the use of medicinal plants integrates the culture of peoples who live in regional communities and are closely related to nature. Thus, surrounded by the flora and having experienced a cumulative process of information on the different uses of medicinal plants, traditional or regional communities – indigenous, *quilombolas*, *raizeiros*, among others – preserve common knowledge on the use of such plant resources through their culture (Silva et al., 2015). Such knowledge has been passed from generation to

generation often transmitting the responsibility to pass on beliefs and values that constitute life views and choices particular to each group (Silva and França, 2012). Santos et al. (2007) also state that the use of plants as medicinal resource in popular culture is associated with practices of spells, mysticism and rituals.

The contact of the Brazilian society with the benefits of using medicinal plants results from a cultural knowledge generated by indigenous, African and European peoples and incorporated to the Brazilian cultural formation since

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the early colonization of the country (Badke et al., 2016). During that period, extracts of native medicinal plants were used by foreigners throughout the national territory to treat diseases, a practice that was later disseminated in the context of large cities (Bruning et al., 2012).

The process of acknowledging the importance of herbal medicines for human consumption is partly associated with the support of international policies. The World Health Organization (WHO, 2011), for example, admitted the need to appreciate the alternative medicine of herbal medicines by observing that 70 to 90% of the population in developing countries rely on such modality in the scope of primary health service. Furthermore, this type of treatment already integrates the context of alternative medicine in developed countries where the use of plant-based products is fairly strong, even when used as complement to conventional therapy (WHO, 2011).

In Brazil, the legal landmark of the public inducement regarding the use of medicinal plants and herbal medicines in the context of public health services is the Política Nacional de Plantas Mediciniais e Fitoterápicos (PNPMF) – National Policy of Medicinal Plants and Herbal Medicines, in 2006 (Ministério da Saúde, 2006). This policy supported a set of institutions to regulate the use, production, and commercialization of medicinal plants and herbal medicines from guidelines conceived for two production axes: agricultural-plant-industrial and traditional (Badke et al., 2016).

Additionally, it is possible to identify a set of institutional incentives to the use of natural products, including those that seek to stimulate a sustainable relationship between humans and plant diversity by linking popular knowledge, or cultural recovery, to the economic value of these relations (Lima, 2008; Silva and França, 2012; Silva et al., 2015).

Cerrado, a tropical savanna (Oliveira, 2002), highlights among Brazilian biomes for its rich biodiversity (Felfili et al., 2005) and as the shelter of many traditional communities whose lifestyle is closely related to natural resources (Ferreira, 2006; Lima, 2008). Therefore, by considering the potential of the biodiversity found in Cerrado, especially its flora, this biome has a remarkable capacity to offer services of plant resources supply for encompassing 44% of the biodiversity of the Brazilian native flora (Ministério do Desenvolvimento, 2018).

The scientific literature presents studies on the identification and acknowledgment of environmental services, especially regarding the flora in Cerrado, aiming at promoting the use and recommendation of these resources, from food, decorative, culinary, to medicinal purposes, etc., fundamental to support species conservation and sustain the economy of the local population (Souza and Neto, 2010; Pereira et al., 2014; Moraes et al., 2016). However, it is worth mentioning that these studies have not seemed to generate the effect necessary or efficient policies to promote the conservation/preservation of such plant resources. Thus,

in addition to the areas of occurrence of species continuing to decrease, there is also an advance in the indiscriminate exploitation of plants because of predatory extractivism actions, adding factors that put biodiversity at risk (Steenbock, 2003; Azevedo and Silva, 2006; Silva et al., 2015).

In this context, case studies are essential to describe the value of herbal medicine in the scope of regional communities for reviving topics of interest to traditional science that have remained poorly investigated (Ferreira, 2006).

Furthermore, as some authors suggest (Cavalcanti, 2005; Andrade and Romeiro, 2015), to deepen the perception on the value of ecosystem services considering the sociocultural, ecological and economic aspects involved, contributes to both the preservation and conservation of the environment, which fosters a sustainable regional development by revealing the social, economic, cultural and environmental value of medicinal plants to strengthen local institutions from solid economic arguments regarding the preservation of ecosystems. According to Borges (2013), it is fundamental to guarantee the appropriation of traditional knowledge by their owners, since the use of such knowledge is the ground for the development of new herbal medicine products in the context of biotechnology, lowering the costs with research by locating and finding their therapeutic indication, dosage, synergy of active substances, etc.

Ethnobotany is the science that ingrates the relationships between men, in their varied cultural forms of association, and plant diversity. Used either in the context of scientific production and business activities, studies approaching this perspective guide the actions of bioprospection, a field that explores biological diversity to seek genetic and biochemical resources of commercial value by acknowledging their use from the traditional knowledge of the community and/or individual user (Pereira, 2008) to popularize it aim at an economic appropriation (Andrade, 2006).

Pereira (2008) reported that bioprospection can use the knowledge from traditional communities to survey the associated biological, genetic or even methodologic resources to provide humankind with many benefits. Therefore, to explore such knowledge anticipates the finding of the proper material consequently shortening research protocol.

Therefore, it can point out a profitable activity to the communities that work with medicinal plants by providing them with the improvement of species management techniques and production technology. Still, through educational and research institutions, along with public policies, bioprospection can contribute to regional development by integrating the environment to agrobusiness seeking to support the preservation and conservation of biomes, such as Cerrado, also fostering the appreciation of medicinal plants (Viganó et al., 2007;

Oliveira and Menini, 2012; Liporacci and Simão, 2013; Silva et al., 2015).

It is through such perspective that the Convention on Biological Diversity proposes bioprospection activities aiming at preserving biological diversity, promoting a sustainable use of its components, and reaching an egalitarian distribution of the benefits generated from traditional knowledge (Pereira, 2008).

However, as pointed out by Andrade (2006), the local communities studied are not always acknowledged or appreciated equally by scientists or companies that carry out bioprospection investigations. Because of this, Silva et al. (2015) alerted that the loss of traditional knowledge leads to disregard the conservation of plant resources, or even generating loss of biological diversity.

Therefore, the field of ethnobotany should embrace the perspective of inducing the retrieval of traditional knowledge and appreciation of biodiversity resources to strengthen the integration between popular and scientific knowledge (Hamilton, 2004). Thus, new paths can be glimpsed for new, efficient strategies to foster socioeconomical and environmental development.

The Grupo Espírita da Paz (GEP), the object of study, manufactures yearly thousands of bottles of herbal medicines derived from medicinal plants (around 360 thousand bottles of medicinal teas). The institution has been active for over 38 years ranging the entire production chain of herbal medicines, since the sustainable extraction, cultivation, and processing of medicinal plants to the elaboration and free distribution of herbal medicines throughout the country (Paz, 2018).

Because of this, it is expected in this study that such association, considering the range of services offered to the regional population, constitutes a representative object of study in the context of the issue approached in this research. This institution has accumulated experience on traditional knowledge on the management of medicinal plants and the production of herbal medicines and has reached a wide range of users, who, in turn, are likely to express a preference for certain components, such as the value of supply services of medicinal plants in Cerrado.

All the context mentioned earlier allows to formulate questions of interest to scientific investigation to promote information, knowledge and stimulation to the development of this sector: What is the scenario of medicinal herbs management and the production of herbal medicines carried out in the association GEP? What are the aggregated values to the use of medicinal plants found by their users? How is the appreciation of Cerrado perceived by this community of specific consumers?

From the context presented and seeking to elucidate these questions, this study aims at conducting a scientific investigation to understand the sociocultural aspects of the environmental resource (medicinal plants native to Cerrado), regarding the scope of the community GEP,

which traditionally uses these resources, presenting this community as a potential provider of information for bioprospective studies

## MATERIALS AND METHODS

### Classification and type of research

To meet the objectives proposed, this research encompasses an ethnobotanic case study based on the range of GEP and its activities of management, processing, and dispensation of medicinal plants and herbal medicines.

By revealing information from the popular knowledge of GEP agents, this study sought to associate the effectiveness of such therapeutic alternative with the sociocultural parameters of the population studied, as well as with the ecological perception of the users of herbal medicines produced by the group.

To analyze the dynamics of the traditional management of medicinal plants conducted by the GEP, we used approaches of both document and exploratory research (Sá-Silva et al., 2009) involving survey of secondary and field data through the method of ethnobotany. The exploratory research consisted of an investigation on an object of study about which little information is available (Dalfovo et al., 2008). According to Yin (1989), a case study is an empiric investigation (i) to analyze a contemporary phenomenon in the context of a real situation, (ii) presents clear frontiers between the phenomenon and its context, and (iii) uses multiple sources of evidence.

The present investigation confronted the databases by cross-checking the information aiming at establishing a comparative analysis of the theme studies. We also surveyed secondary data by consulting relevant bibliographical references on the production systems of medicinal plants, production and extraction of these plants by family farmers and extractivists, commercialization, cultural importance, and threats to preservation and conservation in the context of Cerrado.

This study adopted an intentional non-probabilistic sampling: "involving a selection of elements of the population to compose the sample partially according to the criteria of the researcher or field interviewer" (Oliveira, 2001).

The agents involved in the process regarding the production of herbal medicines cultivated by the GEP, as well as their dispensation and consumption were consulted.

### Ethnobotanist method

According to Souza (1999), in ethnobotany it is necessary to describe the forms of interaction between the population and the plant resources available by assuming that their planning of extractivist activities is based on a sustainable model from the point of view of species conservation. In addition, the techniques of data collection are based on the consensus of informants (interviewees) on the frequent use of certain plant resource. Therefore, at this stage, the information of the GEP managers were confronted with the literature, which pointed out to the most used plants in the formulation of herbal medicines in the context of internal activities in the GEP.

Lima (2008) stated that ethnobotanic information survey the most important and used species to benefit the identification of the plant resources used by the community studied and to retrieve the traditional knowledge on the use of plants in the context of those individuals.

The questionnaires were applied along the month of November 2017 at the headquarters of the GEP and the homes of their consumers of herbal medicines, located in Goiatuba-GO, Brazil.



**Figure 1.** Location of the municipality of Goiatuba – Goiás.  
Source: Goiás (2017).



**Figure 2.** Headquarters of *Grupo Espírita da Paz* in Goiatuba-GO.  
Source: Paz (2018).

Altogether, a sample of 58 interviewees was gathered. We also applied questionnaires to the owner and the paid employee responsible for the cultivation and extraction of medicinal plants in the GEP. The questionnaires include particularities regarding the different roles of every agent in the community.

## RESULTS AND DISCUSSION

This research introduces the GEP as object of a case study regarding a traditional community that consumes

herbal medicines produced from medicinal plants found in the biome of Cerrado using a management based on practices of production and extraction.

The following results were obtained from interviews and describe the institution to allow specific analyses that meet the goals of this investigation.

### Grupo Espírita da Paz (GEP)

The GEP is located in the municipality of Goiatuba-GO (Figure 1), in the south of the state of Goiás, approximately 174 km from the capital (Goiânia-GO), central-west of Brazil. Goiatuba has over 33 thousand residents and encompasses an area of 2,475.107 km<sup>2</sup> with a climate characterized as tropical, warm, and wet (Goiás, 2017).

The GEP (Figure 2) is a non-governmental organization (NGO) of philanthropic purposes, in addition to promoting social and religious activities. It was founded in January 20, 1982 and had been previously known by the name of *Procáritas*. Later on, in 1985, it became GEP (Peace Spiritist Group).

This association emerged in order to meet the necessities of the local population seeking to develop several activities to promote social wellbeing. Herbal medicines are in the context of these services and the related practice ranges the entire extension of the production chain, from the process of cultivation/extraction, crop, harvest, and drying to the manufacture of herbal medicines in the form of teas, distributed at no charge throughout the country (Paz, 2018).

The group also counts with trained employees regarding the practices of laboratory production of herbal medicines. Additionally, the GEP also conducts the domestication and cultivation of medicinal plants in their own headquarters (Figure 3). Their staff of paid employees also includes a collector/extractivist responsible for the cultivation and collection of medicinal plants. The institution has recently established a partnership, in the form of lending contract, that allows the sustainable exploration of a legal reserve of approximately 50 ha in the range of a rural property near the its headquarters.

In addition to the activities related to the production of herbal medicines teas, the institution promotes other practices, such as religious activities in the context of spiritist studies, educational lectures on health and self-help, philanthropic services to the population through the regular production and distribution of food, such as bread and soup, blankets, baby clothes, among others.

The GEP yearly produces around 360 thousand bottles of herbal medicines teas (Paz, 2018) to assist the population. Their headquarters is open to visitation and it is possible to see and record images of the laboratory where they carry out the preparation and packaging of the herbal medicines, properly labeled and organized.





**Figure 3.** Steps of the production process of herbal medicines: cultivation, extraction, plantation, crop, drying and herbal medicine production.  
Source: Results of research.

Currently, the group has a research partnership with the Federal University of Goiás and is undergoing a process of validation of the medications produced in the context of Traditional Herbal Medicines according to the regulation RDC n 26/2014 (ANVISA, 2014).

### Owner and founder of GEP

The owner of the GEP is a 78-year-old lawyer graduated in agrarian law and has spent 38 years learning about herbal medicine. His experience with medicinal plants started after finishing his graduate course and began working with land legalization in Mato Grosso (MT), where he had the opportunity to interact with the local ecosystem, Pantanal, and the regional residents, especially indigenous individuals, whose culture involves the experience with herbal medicine.

The interviewee particularly emphasized that at the time he was suffering of some diseases, especially malaria, which were all easily healed upon the use of natural medicines derived from specific plants produced by a *raizeiro* (traditional regional people), causing him to be touched by the efficiency of the treatment. Afterwards, he constantly received intuitive information through mediumship about his mission to work with herbal medicine. According to Kardec (2003), intuitive mediumship refers to people who are sensitive to the presence of spirits and the transmission of their thoughts.

Notwithstanding, the interviewee reports having learned a lot from indigenous guidance, especially shamans',

which aggregated the experience in pharmacology he had already had from working with his father, a pharmacist who worked with herbal medicine and homeopathy, along his childhood and adolescence. However, he finds it fundamental to his trajectory the knowledge that he had contact with through the work of Chico Xavier, especially the indications about formulations during the time he spent with the medium since the 1980s. In addition, Chico Xavier confirmed to him that his mission was to work with herbal medicine, which motivated the foundation of the GEP, in 1982.

It is important to highlight that Chico Xavier (1910-2002) was a Brazilian medium recognized as the greatest psychographer of all times, having psychographed 451 books, translated to the mother language of several countries (Ebiografia, 2018). During the decade of 1970, Chico Xavier's psychography helped in the acquittal in three murder cases to which the justice system accepted posthumous statements in favor of the defendants (Pinheiro, 2007).

When asked about the mediumistic information on herbal medicines, he explained that the whole process starts with the projection of a certain plant in his mind for a limited period of time, and the composition of the medication is later authorized by evolved spirits (physicians, Indians, scientists, etc.) who also recommend the percentage of concentration and prescription in the formulation of the herbal medicines, normally composed of more than one medicinal plant species. He emphasized that the communication with higher spirits and the consequent clearance/prescription

only occurs when he (the interviewee) is in line with these spirits, which requires a preparation regarding the form of meditation/prayer focused on establishing a synchrony with good feeling and virtuous thoughts.

Therefore, in addition to the mediumistic information along with those obtained from several *raizeiros* and shamans over his experience with the theme, he started a trajectory of research on books covering the milieu of medicinal plants, which he has been improving since then, now benefiting from internet resources.

Furthermore, he elucidates that according to his researches, validated by Chico Xavier at the time, the compound formulations are more efficient than simple ones (using only one plant as active principle) for using principles of synergy and systemic approach. This perception is corroborated by Satoh (2013), according to which traditional Japanese medicine makes reference to "Kampo" formulations, derived from the same principles of compound formulations of traditional Chinese medicine, called "Fang ji". The effects of Kampo medicine (mixture) are never just a sum of each effect induced by a lot of ingredients. For elder persons, furthermore, Kampo medicine exerts more effective actions.

When asked about the quantity of formulations, he described having started with only two, one of them named "*Mais Vida*", currently object of publication on a scientific journal (Côrrea et al., 2006; France et al., 2011); However, 38 years later, the GEP works with 100 prescriptive formulations. "It was a slow process because it demanded wider researches, in addition to mediumistic improvement since it is very difficult to establish a connection between the medium and spiritual entities" (Owner of the GEP).

When asked about the safety and efficiency of the medications produced, he informed on the existence of a user's monitoring file containing their report on the effects observed. He exemplified it through a case including the records of some consumers who claimed having felt higher blood pressure at the time when the formulations contained sodium benzoate (preservative), which he concludes having resulted from the sodium content in the preservative, subsequently replaced. According to the interviewee, some other cases reported occasional dizziness, especially with the use of the medication *Calma*, leading to the recommendation of interruption and medical assistance for a more accurate diagnosis; in addition, no further complaints were recorded regarding other side effects over his experience in the GEP in the scope of herbal medicines dispensation.

### Extraction process of herbal medicines in Cerrado by the GEP

According to the aforementioned information, the GEP has the right of sustainable exploration of a legal reserve near their headquarters through a lending contract. The

type of extraction composes of 40% of the medicinal plants supply to manufacture herbal medicines, while the remaining 60% refer to the type of cultivation, which will be approached onward. Thus, in that area approximately 70% of the medicinal plants used by the GEP are extracted using this type of production (extraction). This legal reserve covers cultivations of soybean (*Glycine max*), maize (*Zea mays*), and sorghum (*Sorghum bicolor*), in addition to having pastoral areas. Despite the conventional model of the cultivations, which requires the use of pesticides, both the owner and the extractivist collaborator report their effort to extract the plants in the interior of the reserve respecting a security range, or buffer zone. According to Costa et al. (2013), a buffer zone (BZ) is a legally established area around a Conservation Unit with the purpose to protect it against negative impacts of pressure from the exterior environment. Thus, the BZs represent important strategies for the management of protected areas.

About the collection, the owner guaranteed that the group has the responsibility to preserve and perpetuate the species. From his point of view, extraction does not represent a factor that favors the reduction of medicinal plants occurrence. He also informed to use techniques of grafting and reproduction using tubers and roots as compensatory measures for the repopulation of species of interest at the extraction sites (Figure 4).

In addition to the extraction process in the legal reserve, the GEP conducts excursions for exploratory research purposes and medicinal plants collections in several regions of Brazilian Cerrado. The owner reported having visited other biomes, but the cost-benefit ratio involved in moving to other biomes is not favorable since, according to him, Cerrado offers the greatest diversity of medicinal plants to produce herbal medicines.

When asked about the ecological characteristics of the collection sites, he answered that the highest visitation frequency (70%) occurs in the region of Campo Limpo and 30% in Cerradão, but with occasional visits to the area of Cerrado Ralo. The modal distance from the GEP headquarters to the collections sites is 4 km; however, for certain plants, considered rarer, such as the plant "Infalível" (*Mandevilla velutina*) or endemic, like "Canela-de-ema" (*Vellozia squamata*), they carry out excursions that ranges up to 500 km from the GEP. The exploratory purpose of these excursions aims at finding sites sheltering a higher occurrence of the species.

Still in the scope of occurrence, he mentioned the difficulty to find certain species of Cerrado, such as Infalível (*M. velutina*), Carobinha (*Jacaranda caroba*), Catuaba (*Anemopaegna arvensis*), Japocanga (*Smilax brasiliensis*), and Nó-de-cão (*Heteropterys tomentosa*) due to factors like cattle (stamping), deforestation, and sugarcane (*Saccharum officinarum*) cultivation, variables that, in his opinion, reduce the incidence areas for medicinal species.

His perception is corroborated by Ferreira et al. (2016).



**Figure 4.** Samples of the herbal medicine species planted in the areas of Legal Reserve of the partner rural property. An extension of the plantation activities of seedlings and subsequent sustainable collections. Popular/scientific names: (a) Algodãozinho/*Cochlospermum regium* (Mart. ex Schrank) Pilger; (b) Amarelinho/*Plathymenia foliolosa*; (c) Assa-peixe branco/*Vernonia Polyanthes*; (d) Barbatimão/*Stryphnodendron adstringens*; (e) Canela de velho/*Miconia Albicans*; (f) Capim gordura/*Melinis minutiflora*; (g) Ceboleira/*Clusia nemorosa*; (h) Coité/*Crescentia cujete*; (i) Erva lagarta/*Diodia alata*; (j) Faveiral *Parkia* spp.; (k) Gabiroba/*Feldmanesia xanthocarpa*.

Source: Results of research.

For these authors, the most relevant agricultural and live stocking activities, respectively, for the scenario of forest areas converted into other models of land use are sugar-alcohol crops, soybean and cattle culture, covering around 80% of the area destined to agricultural and live stocking practices in Goiás. This demonstrates the relationship between scientific studies and field observation carried out by individuals who live in constant contact with the environment, demonstrating the value of their perceptions and how these can benefit science when investigating the reality.

When asked about the sustainable collection of rare or endangered species, he declared that despite their reduction, they continue to collect these species, but wait around four years to return to the collection site for the species to recover and can be removed again.

In the scope of inspection, he explained that over his experience, he witnessed only one approach that he considered aggressive by the supervisory body, Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), in which they ordered that the collection should occur at a certain area of Caldas Novas,

GO, a hydrothermal resort located in the south of Goiás, without specifying the motivation for such order.

For the owner of the GEP, the most important characteristic of Cerrado is the combination of insects, plants, and animals (ecosystem services) triggered especially through pollination, which he regards as important for other biomes as well. He understands preservation as a very important action, especially for the development of herbal medicine, “that is why it is important to produce, and for this end we need to collect, but always replanting”. According to his description, the GEP release seeds of many species of native plants over the areas of Cerrado during the collections.

The 63-year-old extractivist collaborator of the GEP appears to be a professional of remarkable experience at identifying medicinal species in the field, gathered over 30 years of practice in the institution. He considers the animals, plants and fruit to be the most important characteristics of the biome Cerrado, as well that “it is very important to preserve the medicinal plants in Cerrado because every human being will need them during life because of their healing potential”. In addition

to being present in almost every excursion, he is also responsible for the cultivation of medicinal plants in the GEP.

According to his descriptions, in some locations, extraction is not to be conducted anymore since certain areas in Cerrado are now used for soybean (*G. max*) plantations. He also points out that because of deforestation, opening of roads, and cattle raising, many species have disappeared, such as Infalível (*M. velutina*), Catuaba (*A. arvense*), and Velame branco (*Macrosiphonia velame*).

The employee reported that whenever the specimens are found, the collection occurs alternately, leaving in the field some vegetative parts with capacity for reproduction. Additionally, seedlings and seed are taken to the field in an attempt to domesticate the species. He also adds that upon removing the bark of the plant stem, 20% should be taken and the remaining parts should be left untouched.

Even though the owner reported having experienced only one inspection approach, the extractivist collaborator described the occurrence of some of these approaches during the collections, occasions in which the inspectors authorized their permanence at the extraction sites, especially for knowing the activities of the GEP. Therefore, a prohibition was never an issue, except at biological reserve or Conservation Unit, which they ceased to visit. Furthermore, most of the visitations occur in legal reserves under previous consent of their owners.

The period informed as the optimum season to extract medicinal plants is between October and May (rainy season), since during the dry period, plants develop less hampering root extraction. For the collection, the group uses a variety of equipment, such as: machete, scissors, trimmer, sickle, hoe, pickaxe, and ploughshare; in addition to small-load vehicles for material transportation. Normally, from 50 to 300 kg of plants are collected during each excursion depending on the need and availability of the plants found.

### **Cultivation and processing of herbal medicines in the GEP**

The cultivation of medicinal plants represents the activity responsible for providing the highest quantity (60%) of raw material used to produce the herbal medicines in the GEP. Approximately, 90 species are cultivated, mostly exotic, and some native or endemic to Cerrado, especially rare ones that were successfully domesticated.

According to the owner of the institution, the species of medicinal plants used to meet the herbal medicine demand of GEP are identified on a book of this authorship (Abdala, 2018). This enabled us to know the quality of the medicinal plant species used by the group, around 152, including their leaves, fruit, root, stem, tree trunk bark, seeds, etc. The book also brings information on 69 different types of formulations, named according to

the corresponding disease (Annex). Among the 152 species of medicinal plants used in the formulations composed in the GEP, the following 10 plants are the most used: babaçu (*Attalea speciosa*), moringa (*Moringa oleifera*), alho (garlic) (*Allium sativum*), hortelã (mint) (*Mentha* species), maracujá (passion fruit) (*Passiflora edulis*), mil-em-ramas (*Achillea millefolium*), cavalinha (*Equisetum* species), erva-de-bicho (*Persicaria punctata*), velame branco (*M. velame*), and artemísia (*Artemisia vulgaris*).

The GEP uses the following native and/or largely occurring species in Cerrado: assa-peixe (*Vernonia polysphaera*), babaçu (*A. speciosa*), barbatimão (*Stryphnodendron adstringens*), buriti (*Mauritia flexuosa*), canela-de-ema (*V. squamata*); carne-de-vaca (*Clethra scabra*), carobinha (*Jacaranda puberula*), catulé (*Syagrus oleracea*), embaúba (*Cecropia*), fava d'anta (*Dimorphandra mollis*), ginseng brasileiro (para-tudo) (*Pfaffia paniculata*), japeçanga (*S. brasiliensis*), jatobá (*Hymenaea courbaril*), laranjinha-do-campo (*Styrax ferrugineus*), lobeira (*Solanum lycocarpum*), mama cadela (*Brosimum gaudichaudii*), mangaba (*Hancornia speciosa*), nó de cão (*Heteropterys aphrodisiaca*), perobinha do campo (*Paratecoma peroba*), pororoca vermelha (*Rapanea guyanensis*), sucupira (*Pterodon emarginatus*), and velame branco (*M. velame*).

Lima (2008) wrote a thesis in quantitative ethnobotany of medicinal plants from Cerrado and related some species to the shared use in the GEP as well, such as mangaba, jatobá, sucupira, which form a set of very important plants for the sustainable management in a community located in the north of Minas Gerais. Comparing medicinal plants from Cerrado and their respective therapeutic indications with a study by Oliveira and Menini (2012), who reported the result of an ethnobotanic study in the village of Lima Duarte (MG), we found that despite the difference regarding the therapeutic indication for some species, convergent reports were more expressive.

The cultivation carried out in greenhouses or outdoors follows the norms for organic production (IFOAM, 1998), according to which synthetic inputs are not allowed. The fertilizer is produced in the same location based on the formation of earthworm castings or composting of residue from the manufacture of herbal medicines using bovine manure.

The beds occupied with a sequence of varied species cultivations, also rotated with different species at every production cycle. Despite the low occurrence of plagues and diseases, mechanic or organic methods are used whenever some forms of control are needed, such as repellents and insecticides based on plant extracts (*Azadirachta indica*, *Capsicum frutescens*, *Nicotiana tabacum*, etc).

Irrigation is performed using sprinkler and bore water from a well of 150 m in depth, also used for all the remaining activities involved (processing and production





**Figure 5.** Dry medicinal herbs stored and identified for processing.  
Source: Results of research.

of the medications). Despite the good quality of the water used at all production stages, we did not verify any reuse technology.

Upon reaching their maturation level, the cultivated plants are harvested, washed and subjected to pre-drying (Figure 5).

Subsequently, those that are to be promptly used are immediately grounded and the remaining ones are kiln dried. After being dried, the plants are packaged, identified and stored in proper location to be grounded in the moment of use. We highlight that the plants collected in form of extractivism receive the same treatment when arriving at the GEP, starting from the washing step.

### **Production and dispensation of herbal medicines**

The herbal medicines produced in the GEP are formulations composed of a set of medicinal plants species. Manufactured in the form of herbal teas, according to Art. 22, Decree 8.077, from August 14, 2013 (DOU, 2013), under the guidance of the responsible pharmacist. During the conduction of this research, the medications were undergoing a validation process according to the protocols indicated by ANVISA (National Health Surveillance Agency) to integrate the category of herbal medicines of traditional use.

Even though the manufacture process is restricted for hygiene and confidentiality matters, we were able to verify a set of descriptive elements. The milled plants are immediately subjected to a decoction process, for the harder parts, or infusion, for the softer parts, in stainless steel containers to produce the medicinal teas. This process is performed in a previously disinfected environment by trained employees; after cooling, the liquid is separated from the “sludge” (Figure 6a) and

added with preservative under the responsible pharmacist supervision. Subsequently, the tea is stored in its simple form (Figure 6b) for the further formulation composed of the herbal medicines (Figure 6c, e, d). We highlight that the storage of simple formulations occurs for up to one week since the production of the medications is weekly.

After formulation, the medications are packaged in sterilized, labeled bottles indicating the name and expiration date (one year) and stored until dispensation. The list of the medications produced can be accessed on the website [www.paz.org.br](http://www.paz.org.br). According to the owner's information, details on the label currently represent an adequacy to the ANVISA regulation. In addition, partnership with the Federal University of Goiás aims at forming a commission to verify the efficiency of the formulations composed for adequacy purposes to the decree for herbal medicines of traditional use ruled according to regulation RDC 26/2014 (ANVISA, 2014).

The process of dispensation of the medications occurs regularly and uninterruptedly every Thursday for the residents in the municipality of Goiatuba-GO as well as every Friday for visitors. Before the dispensation, the users meet with the owner, or some representative, to be instructed on healthy life habits (behavior and food) in an environment of prayer. The prescription occurs in their own pharmacy, where each consumer is served individually.

### **Users of herbal medicines in the GEP**

#### ***Socioeconomic profile***

Composing 87.93% of the sample, most of the users were interviewed live in Goiatuba-GO; however, we were



**Figure 6.** Pressing for sludge separation (a); storage of simple formulation (b); formulation of compounds (c and d) in the production process of herbal medicines in the GEP.  
Source: Records of the GEP.

able to find consumers in other cities in the state of Goiás or Minas Gerais, even though, according to owner, excursions from other regions of Brazil to obtain the herbal medicines are common.

Seventy-three percentage of the interviewees are female and distributed according to the following age groups: 1.72% are 16-25 years; 3.44%, 26-35 years; 18.96%, 36-45 years; 31.03% ranging 46-55 and 56-65, and 13.79% are over 65 years old. Approximately 75% of the users are over 46 years old.

Regarding the level of education of the interviewees, the distribution of the average frequency indicates that 8.62% have no level of education at all; 20.69% completed the elementary school level; 27.59% did not complete elementary school; while 12.07% finished high school, and 5.17% did not finish high school. In addition, 13.79% have higher education level; 3.45% did not complete higher education, and 8.62% have graduate level. Grouping the categories even more, it is possible to observe that most of the interviewees (74.5%) have completed up to high school and 25.5% are above such level.

In the scope of occupation, only one individual reported being unemployed, while most of them are housewives (24.14%), retired (18.97%), and related to general

services (10.34%). The remaining ones are teachers (5.17%), seamstresses (3.45%), maids (3.45%), security guards (5.17%), and mechanic (3.45%). The following occupations were reported for only one interviewee each: family manager, assistant manager, hairdresser, collector, trader, elderly people caretaker, hired servant, rancher, street cleaner, farmer, veterinarian, educator, construction worker, and secretary.

Regarding family income, most of the interviewees (~73%) receive up to three minimum wages monthly, predominance (44.83%) of up to one minimum wage.

Therefore, the results from the socioeconomic profile indicate that the sampled population can be characterized as predominantly local, female and elderly, of low income, and low level of education.

Badke et al. (2016) aimed at knowing the profile of users of medicinal plants in the urban region of the northwestern Rio Grande do Sul, located in the south of Brazil, and found a predominance of female individuals with low income (up to three minimum wages), and mostly above 35 years old. The authors explained that such predominance may be related to the fact that adult women are the main caretaker in the family and stands out as a figure associated with family health care and the transmission of knowledge on the use of medicinal plants.

## Use of herbal medicine in the GEP

Despite a high frequency (especially monthly) of constant visitation to the GEP (43.10%), most of the interviewees (56.90%) reported visiting the institution sporadically; annually, after all their medication had ended, or to start a new treat. All the interviewees commended the work of the GEP with herbal medicine, having assessed it as excellent (65.52%) or good (34.48%). Regarding the regularity of use, most of the interviewees (81.03%) reported taking the herbal medicines as indicated on their labels, few of them (10.34%) stated being able to follow the treatment accurately only sometimes, while the remaining ones (8.62%) answered negatively to the same question.

The most used herbal medicines produced by the GEP according to the interviewees (Table 1) are the following: *Fígado* (Liver) (29.31%), *Pomada* (Ointment) (29.31%), *Gripe* (Flu) (27.59%), *Calma* (Calm) (18.97%), *Ansiedade* (Anxiety) (17.24%), *Gastrite* (Gastritis) (17.24%), *Obecoltri* (17.24%), and *Rins* (Kidneys) (15.52%).

Table 1 also shows the period of use - the amount of time that drug has been used (based on the oldest use response) and the treatment time, which indicates the maximum treatment period necessary to perceive the desired effects. According to these indicators, it was possible to evidence the use of certain medications for 30 years which may be evidence of their effectiveness. Some consumers use the herbal medicines produced by GEP since the beginning of the institution and start a new treatment to control, prevent or cure a disease when they are in need. The time of treatment perceived as effective varied between one month and eight years and seems to be related to the purpose of the treatment. When questioned about side effects, 96.55% of the interviewees reported never having had any problems either during or after the treatment, and only two interviewees stated having felt a side effect when using the herbal medicine "*Calma*" (Calm), involving dizziness, low blood pressure, and discomfort, leading the members of the GEP to interrupt the treatment and seek medical advice. Viganó et al. (2007) had found these same symptoms when interviewees reported that some of the plants caused some discomfort, regardless of the form of use; however, despite such adverse reactions in some cases, most of the interviewees described that these same plants had been responsible for their healing.

According to the highlights in the introduction, the objective of this study did not include the medical evaluation of herbal medicines, but to present the ethnobotany involved in the activities developed in the GEP. Nonetheless, according to Maciel et al. (2002), the popular perception on the efficiency of medicinal plants is a relevant aspect to publication and benefits researchers in the selection of species for further studies (botanic, pharmacological, and phytochemical). When questioned about their perception on the efficiency of the results

obtained from using the medications, the interviewees had to choose a score to each herbal medicine that they had used, in which 10 refers to "healing achieved" and 0 is "no benefits at all". The results (Table 2) demonstrate that the perception of most of the interviewees (88%) is above the score 5, out of which over 90% attribute a score higher than 8 to the natural medications that they used. Only 12.07% of the interviewees reported not having reached any degree of healing after the treatment.

Among those who chose the values between 10 and 5, a high frequency appeared for the score 10 regarding medications such as: *Afrodísíaco* (Aphrodisiac), *Anti-inflamatório* (Anti-inflammatory), *Articulação* (Articulation), *Bronquite* (Bronchitis), *Colesterol* (Cholesterol), *Displasia Mamária* (Breast dysplasia), *Dor* (Pain), *Enxaqueca* (Migraine), *Estomatite* (Stomatitis), *Francisco de Assis*, *Gases* (Stomach gases), *Hemorroida* (Hemorrhoids), *Enfartol*, *Infecção* (Infection), *Jesus de Nazaré*, *Madre Tereza*, *Memorial*, *Menopausa* (Menopause), *Neuropatia* (Neuropathy), *Próstata* (Prostate), *Psoríase* (Psoriasis), *Reumatismo* (Rheumatism), and *Sinusite* (Sinusitis). *Antidepressivo* (Antidepressive), *Calma* (Calm), *Coração* (Heart), *Mais Vida* and *Vesícula* (Gall bladder) were the natural medications with a perceived healing frequency of 50%. We highlight that regarding the medication "*Mais Vida*", object of pharmacological research on an article published in 2006 (Côrrea et al., 2006; France et al., 2011), a consumer reported full cure of cancer tumor nodes.

The number of cases indicated in Table 2 is related to the number of users who use that medication, the results show that the most sought after medications are: liver, flu, gastritis, kidneys, labyrinthitis, uterus, throat, memory, thyroid, calm, anxiety, anti-inflammatory, sinusitis and depression, respectively. This result highlights the diseases resulting from inflammatory processes, which can be correlated to the bad habits of the population, resulting from the population's way of life in the 21st century. In addition, it offers an opportunity for medical research to deepen this analytical scope providing therapeutic information that improves the well-being of the population.

For the interviewees, the importance of herbal medicines is a consensus since 86.21% consider them to be very important, 13.79% regard them as important. The individuals feel very satisfied with the results obtained from the use of natural medications, especially in the scope of preventing and treating common diseases.

By being questioned on the reason to believe in the importance of herbal medicines, the frequency of the responses indicates that most of the individuals (43.10%) highlight the absence of side effects, followed by their efficiency (32.76%), integration in the culture (12.07%), faith in the healing power of plants (8.62%), economic viability (5.17%), and affinity to the GEP (1.72%); only 3.45% of the interviewees were not able to answer.

**Table 1.** List of the most relevant herbal medicines produced by the GEP and regularly used by the interviewees followed by their respective period of use.

<b>Name of the herbal medicines in the GEP</b>	<b>Period of use (treatment time)</b>	<b>Percentage of consumers</b>
<i>Afrodisíaco</i> (Aphrodisiac)	10 - 2 years	1.72
<i>Ansiedade</i> (Anxiety)	12 years - 1 and a half month	17.24
<i>Antidepressivo / Depressão</i> (Antidepressive / Depression)	20 years - 1 and a half month	13.79
<i>Anti-inflamatório</i> (Anti-inflammatory)	28 years - 8 months	12.07
<i>Articulação</i> (Articulation)	12 years - n.i.	1.72
<i>Artrite</i> (Arthritis)	15 years - 6 months	6.90
<i>Artrose</i> (Arthrosis)	12 years - 6 months	5.17
<i>Bronquite</i> (Bronchitis)	10 years - 3 months	1.72
<i>Calma</i> (Calm)	20 years - 1 and a half month	18.97
<i>Chico Xavier</i>	4 years - n.i.	1.72
<i>Circulação</i> (Circulation)	5 years - 6 months	10.34
<i>Colesterol</i> (Cholesterol)	6 - 3 months	3.45
<i>Coluna</i> (Spine)	15 years - 2 months	10.34
<i>Coração</i> (Heart)	1 and a half year - 6 months	3.45
<i>Depur</i>	30 - 4 years	5.17
<i>Diabetes</i>	8 years - 1 year	6.90
<i>Displasia mamária</i> (Breast dysplasia)	8 - 3 years	1.72
<i>Dor/ Sem dor</i> (Pain/No pain)	20 years - 6 months	5.17
<i>Enxaqueca</i> (Migraine)	20 - 2 years	3.45
<i>Estômago / Estomatite</i> (Stomach/Stomatitis)	12 years - 1 month	5.17
<i>Fígado</i> (Liver)	30 years - 1 month	29.31
<i>Francisco de Assis</i>	3 years - n.i.	1.72
<i>Garganta</i> (Throat)	25 years - 1 year	8.62
<i>Gases</i> (Stomach gases)	3 years - n.i.	1.72
<i>Gastrite</i> (Gastritis)	20 years - 2 months	17.24
<i>Gripe</i> (Flue)	30 years - 2 months	27.59
<i>Hemorroida</i> (Hemorrhoids)	8 - 3 years	3.45
<i>Infartol</i>	1 and a half year	1.72
<i>Infecção</i> (Infection)	6 years - n.i.	1.72
<i>Jesus</i>	4 years - n.i.	1.72
<i>Labirintite</i> (Labyrinthitis)	15 - 5 years	10.34
<i>Madre Tereza</i>	30 years - n.i.	1.72
<i>Mais Vida</i>	30 - 4 years	5.17
<i>Memoriol</i>	15 years - 1 month	10.34
<i>Menopausa</i> (Menopause)	10 years - 1 week	3.17
<i>Neuropatia</i> (Neuropathy)	30 - 4 years	3.45
<i>Obecoltri</i>	28 years - 1 week	17.24
<i>Pomada</i> (Ointment)	30 years - 3 months	29.31
<i>Pressão / Hipertensão</i> (Blood pressure/Hypertension)	30 - 8 years	6.90
<i>Próstata / Prostatite</i> (Prostate/Prostatitis)	7 - 2 years	3.45
<i>Psoríase</i> (Psoriasis)	10 years	1.72
<i>Reumatismo</i> (Rheumatism)	12 years - 1 year	1.72
<i>Rins</i> (Kidneys)	30 years - 6 months	15.52
<i>Sinusite</i> (Sinusitis)	n.i - 6 months	3.45
<i>Tireoide</i> (Thyroid)	28 years - 1 year	10.34
<i>Tio Nunes</i>	5 years - n.i.	1.72
<i>Tosse</i> (Cough)	10 - 2 years	6.90
<i>Tromboflebite / Trombose</i> (Thrombophlebitis / Thrombosis)	4 years - 2 months	5.17
<i>Útero</i> (Uterus)	25 years - 1 year	12.07



**Table 1.** Contd.

<i>Verme / Vermífugo</i> (Worm / Vermifuge)	30 years - 3 months	8.62
<i>Vesícula</i> (Gall bladder)	10 years - 6 months	6.90
<i>Vitam / Vitamina</i> (Vitamin)	12 years - 3 months	5.17
Total = 56		

Source: Results of our research.  
n.i. = not informed

**Table 2.** Perception of the interviewees on the efficiency of the herbal medicines in the GEP, values in %.

Herbal medicines - number of cases	Score 10	Score 9	Score 8	Score 7	Score 6	Score 5
<i>Afrodisíaco</i> (Aphrodisiac) - 01	100	-	-	-	-	-
<i>Ansiedade</i> (Anxiety) - 10	70	10	-	20	-	-
<i>Antidepressivo / Depressão</i> (Antidepressive / Depression) - 07	50	25	-	12.5	-	12.5
<i>Anti-inflamatório</i> (Anti-inflammatory) - 10	100	-	-	-	-	-
<i>Articulação</i> (Articulation) - 01	100	-	-	-	-	-
<i>Artrite</i> (Arthritis) - 03	66.67	-	-	-	33.33	-
<i>Artrose</i> (Arthrosis) - 03	50	25	-	-	25	-
<i>Bronquite</i> (Bronchitis) - 01	100	-	-	-	-	-
<i>Calma</i> (Calm) - 11	45.45	27.27	9.09	9.09	-	9.09
<i>Chico Xavier</i> - 01	-	-	-	-	-	-
<i>Circulação</i> (Circulation) - 06	83.33	16.67	-	-	-	-
<i>Colesterol</i> (Cholesterol) - 02	100	-	-	-	-	-
<i>Coluna</i> (Spine) - 06	80	-	20	-	-	-
<i>Coração</i> (Heart) - 02	50	-	50	-	-	-
<i>Depur</i> - 03	66.67	-	-	33.33	-	-
<i>Diabetes</i> -04	66.67	-	33.33	-	-	-
<i>Displasia mamária</i> (Breast dysplasia) - 01	100	-	-	-	-	-
<i>Dor/ Sem dor</i> (Pain/No pain) - 03	100	-	-	-	-	-
<i>Enxaqueca</i> (Migraine) - 07	100	-	-	-	-	-
<i>Estômago / Estomatite</i> (Stomach/Stomatitis) - 03	100	-	-	-	-	-
<i>Fígado</i> (Liver) - 44	76.47	17.65	-	5.88	-	-
<i>Francisco de Assis</i> - 03	100	-	-	-	-	-
<i>Garganta</i> (Throat) - 12	80	-	20	-	-	-
<i>Gases</i> (Stomach gases) - 02	100	-	-	-	-	-
<i>Gastrite</i> (Gastritis) - 28	90	-	10	-	-	-
<i>Gripe</i> (Flue) - 36	87.50	-	12.50	-	-	-
<i>Hemorroida</i> (Hemorrhoids) - 05	100	-	-	-	-	-
<i>Infartol</i> - 02	100	-	-	-	-	-
<i>Infecção</i> (Infection) - 05	100	-	-	-	-	-
<i>Jesus</i> - 03	100	-	-	-	-	-
<i>Labirintite</i> (Labyrinthitis) - 15	83.33	-	16.67	-	-	-
<i>Madre Tereza</i> - 02	100	-	-	-	-	-
<i>Mais Vida</i> - 02	50	50	-	-	-	-
<i>Memoriol</i> - 12	100	-	-	-	-	-
<i>Menopausa</i> (Menopause) - 08	100	-	-	-	-	-
<i>Neuropatia</i> (Neuropathy) - 04	100	-	-	-	-	-
<i>Obecoltri</i> - 04	77.78	-	22.22	-	-	-
<i>Pomada</i> (Ointment) - 36	88.24	-	5.88	-	5.88	-
<i>Pressão / Hipertensão</i> (Blood pressure/Hypertension) - 04	75	-	25	-	-	-
<i>Próstata / Prostatite</i> (Prostate/Prostatitis) - 07	100	-	-	-	-	-
<i>Psoríase</i> (Psoriasis) - 03	100	-	-	-	-	-

Table 2. Contd

<i>Reumatismo</i> (Rheumatism) - 02	100	-	-	-	-	-
<i>Rins</i> (Kidneys) - 25	75	-	12.5	-	-	12.5
<i>Sinusite</i> (Sinusitis) - 09	100	-	-	-	-	-
<i>Tireoide</i> (Thyroid) - 14	71.43	-	-	14.29	14.29	-
<i>Tio Nunes</i> - 02	100	-	-	-	-	-
<i>Tosse</i> (Cough) - 08	100	-	-	-	-	-
<i>Tromboflebite / Trombose</i> (Thrombophlebitis / Thrombosis) - 05	-	-	100	-	-	-
<i>Útero</i> (Uterus) - 14	100	-	-	-	-	-
<i>Verme / Vermífugo</i> (Worm / Vermifuge) - 08	80	20	-	-	-	-
<i>Vesícula</i> (Gall bladder) - 09	50	25	-	-	-	25
<i>Vitam / Vitamina</i> (Vitamin) - 06	66.67	33.33	-	-	-	-

Source: Results of our research.

When asked about the reasons why they seek the services of herbal medicine, the spiritual context (72.41%) was largely mentioned, followed by medicinal (65.52%), cultural (25.86%), and economic (20.69%) reasons. Taking into account the degree of importance for each option chosen by the interviewees, the spiritual and medicinal reasons had a slight difference, either as first choice, 41.38 and 39.66%, and second choice. The economic aspect had the lowest occurrence of choice (12.07%), suggesting that the gratuity offered by the GEP is the least important reason for consumers to seek the service in the association.

Considering such perception on the importance of herbal medicine, 72.41% of the interviewees reported to be willing to cease using any type of industrial medication and utilize herbal medicines provided by the GEP exclusively. An attitude based firstly on efficiency (58.62%), followed by absence of side effects (29.31%), gratuity (5.17%), and faith in the healing power of plants (5.17%). The remaining 22.41% reported that they would not stop using industrial medications, such as those related to cancer, asthma, AIDS, and anticoagulants, but would easily replace this type of medications with herbal medicines prescribed for problems in the stomach, prostatitis, migrane, liver, anxiety, hypertension, diabetes, menopause, and kidneys.

The results found here indicate that the main motivation of the interviewees when reaching for the GEP is the acquisition of medications, which they consider efficient and/or free from side effects in the treatment of the diseases to which they are prescribed. Time of use, which indicates the interviewee's knowledge on the existence of the medication, revealed a high frequency of answers ranging from 20 to 30 years highlighting that tradition of such production of natural medications for the community. It is important to emphasize that the analysis developed here does not intend to validate, in the field of medicine, the efficiency of these medications since it does not employ a proper methodology to such end,

which would be beyond the scope of the investigation team.

However, our results corroborate with the analysis by Correa and Alves (2008) suggesting that the main motivations for user of herbal medicines include their perception on the low occurrence of side effects along with their efficiency. Additionally, the results seem to be consistent upon cross-checking the answers to questions on the importance of herbal medicine with questions on the reasons why users seek herbal medicine, in which the medicinal characteristics are more frequent, while the economic aspect is less frequent. In this context, the association with the economic analysis, presenting most users as belonging to the category of low income, represents another evidence to the medical motivation in detriment of the economic one.

Finally, the high frequency of spiritual motivation involved in the search for the herbal medicines provided by the GEP suggests the existence of a cultural and/or placebo effect in the perception of the efficiency of the prescribed medications. Confronted with the remaining results, this proves the necessity of medical and pharmacological researches to corroborate or refute the social benefits generated from a large-scale production in order to share it beyond the scope of the current traditional use in the community.

## Conclusions

The GEP, in Goiatuba – GO, proved to be a committed and dedicated NGO regarding the social work with herbal medicines. The group is composed of a qualified team whose efforts focus on the preservation of medicinal plants by respecting their development specificities in the context of sustainable extraction and cultivation processes. The GEP has been offering free services to the community for 38 years and relies on an understanding of the importance of naturally provided

plants as a source of cure and comfort to human health.

The capital of the institution is currently evaluated in US\$ 435.000,00, amount used for the annual production of 360,000 bottles of traditional herbal medicines free distributed to the consumers of several Brazilian regions. The quality of the institution management relies on the entrepreneurship of its founder, who, motivated by spiritual idealism, develops experience in the field by researching on the themes on sources of both the literature and traditional knowledge, in addition to all the information he has gathered from his mediumship practice.

The production of the herbal plants counts with the support of the collector/extractivist, who has the experience and traditional knowledge on the use of plant for medicinal purposes to administrate the management activities, either in the forest reserve or agricultural property (acquired through a leading contract) and their own headquarters using a substantiated production technique.

Similarly, to manufacture the traditional herbal medicines, the GEP counts with the collaboration of professionals who dedicate to meet the demands of good production practices determined by ANVISA and generate products of proper quality to consumption, but still require certification. Its organization and work are notoriously recognized by the consumers of its products, who enjoy the social and religious activities frequently held at their facilities. These users live in the same municipality where the institution is located, in addition to other regions, and most of them have attended its facilities and consumed herbal medicines for over 10 years, including those who have been frequenting the foundation since its opening.

The extraction of plants conducted in the Legal Reserve through a lending contract with the rural property is able to meet around 40% of the needs of the institution, representing 10% of the operational costs of production and processing of raw material in the GEP, which illustrates the importance of this type of partnership to consolidate herbal medicine and the preservation of Cerrado. The GEP conducts a sustainable extraction that is evident when observing the regularity of flow of the raw material obtained from the reserve and other sources used by the institution, in addition to implementing compensatory measures at the extraction sites through techniques grafting and reproduction by tubers, seeds, and roots.

During the expeditions destined to collect rare specimens, the institution has observed a reduced occurrence of reserves that provide such species, which has been attributed to agricultural, live stocking expansion, especially involving soybeans and sugarcane, which has hampering the success of these expeditions and lowering their frequency. Furthermore, the institution has found that the monitoring process in areas that are protected by law is incipient. Despite the obstacles, the

GEP persists in an effort to disseminate seeds of the native species found in Cerrado, wait for the period of recovery of these areas (around 4 years), and remove only the parts that do not compromise the reproduction of the plants.

The cultivation of the plant species used in the formulations is carried out in the facilities of the group headquarters, where approximately 90 species are cultivated – native and exotic that were successfully domesticated. The cultivation process meets the regulations for organic production and involves irrigation using sprinkler, rotation of species, and natural repellents.

The GEP also dedicates for the processing of raw material to have the necessary control for the acquirement of good quality material through good practices of processing and packaging. The elaboration of the formulation (herbal medicines teas) occurs in the GEP laboratory under pharmaceutical supervision and involves the use of decoction and infusion in disinfected material to extract principle substances, whose solution is added with preservative to further elaborate the formulations – resulting in the herbal medicines of traditional use.

The main motivating factor for the search for herbal medicines in the GEP is the efficiency felt by the consumers regarding their natural medications. In addition, they also believe faith to be responsible for their cure, which indicates the necessity of pharmacological researches to test the efficiency of the products studied. Considering the social and economic importance of the institution, it has the possibility to promote strategic information to the field of bioprospection through pharmacological studies to corroborate or refute the issue of efficiency, which would be essential to consolidate the importance of the institution, and similar ones, regarding its socioeconomic contribution to the production of herbal medicines and medications in general.

Most of the consumers of the natural medications produced in the GEP consider equally important that the herbal medicine promotes the preservation of Cerrado and the supply of inputs. They understand the importance of ecosystem services in the biome and regard the plants as the most important, since the interview highlighted the importance of medicinal plants.

This did not constitute a goal of this study to analyze the efficiency of the herbal medicines for their consumers; however, it is expected that the results from this analysis of perception represents an encouragement to the continuity of this research by institutions that are qualified to this end, such as scopes of biomedicine, ethnopharmacology, among others, to corroborate or refute the efficiency of these medications. In this context, it is worth emphasizing that if corroborated, the social benefits generated from their large-scale production could be shared beyond the current traditional use ongoing in the community.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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