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Herbal Medicine Use in Costa Rica:

A Case Study Examining Herbal Medicine's Utilization and Cultural Significance

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Abstract

Introduction: Herbal medicine has been widely used in the past and present, as it is deeply rooted in many cultures' histories.

Literature Review: Herbal medicines are used for health maintenance and treatment in Costa Rica. The country's rich natural environment, accessibility, and tradition led to prominent herbal medicine use. *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania* species (Guaco), and *Neurolaena lobata* (Gavilana) have commonly been used in Central American medications and have diverse indications based on their plant parts.

Case Study: A discussion with an herbalist, founder, and citizen of Longo Mai, a community in southern Costa Rica, was had about practicing herbal medicine. Herbal medicine was prominent in their lives due to its proximity and freshness. At the same time, while only some people in Costa Rica have practiced herbal medicine, knowledge of some herbal remedies has existed for generations in all families. *Annona muricata*, *Mikania* species, and *Neurolaena lobata* have been commonly used in Longo Mai, while *Uncaria tomentosa* is present but rarely used.

Discussion: Herbal medicines have been essential for Costa Ricans' health and culture due to the environment's robust and immense biodiversity and the medicines' accessibility, affordability, and strong cultural traditions. The research showed overlap, but slight variations, in how herbal medicines were prepared, strategically prescribed to reduce side effects, and their utilization. *Annona muricata* was the most discussed herbal medicine in Longo Mai, while *Uncaria tomentosa* was rarely used. The differences could be due to Longo Mai representing a small portion of Costa Rica. Therefore, these variations between the literature review and case study could be less in other areas of the country.

Conclusion: These findings demonstrate the significance of providers understanding herbal medicines' physical and cultural benefits, especially since it is widely practiced. This knowledge will allow providers to ensure that herbal medicines are used safely and improve shared decision-making by helping them support a patient's cultural and health beliefs. Ultimately, this could improve the quality and outcomes of patient care.

Keywords: herbal medicine, Costa Rica, Longo Mai, Central America

Introduction

Herbal medicine has been around far longer than modern Western medicine. It was first known to be practiced by ancient indigenous shamans in cultures worldwide. Historically, herbal medicine had been mentioned in biblical texts, papyrus in ancient Egypt, and cuneiform writing on Sumerian tablets. Today, herbal treatments and homeopathy are used for healing in eighty percent of the world.¹ Herbal medicines are made from plants and their materials, such as leaves, flowers, seeds, and roots. These herbs have medicinal qualities for both health maintenance and treatments for illnesses.² The active components of herbal medicines are removed from plants via various measures, including fermenting, steeping, macerating, and boiling. They are then compounded into different dosage forms. Herbal medicines are then dispensed as powders, extracts, salves, baths, infused cloths, teas, and other dosage forms.^{1,3} Natural medications have contributed to currently manufactured pharmaceuticals, including artemisinin and aspirin.⁴

Costa Rica has a strong history of herbal medicine use due to its vibrant culture and biodiversity. Its knowledge was passed down from generation to generation.^{5,6} In Costa Rica, herbal medicine knowledge has been maintained through strong generational and community ties and dedication to holistic medicine. Further aspects that drive herbal medicine use include accessibility and affordability, specifically in resource-limited locations.⁶ Four commonly studied Costa Rican herbal medicines, *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania species* (Guaco), and *Neurolaena lobata* (Gavilana), will be analyzed for their usage and cultural significance. This paper presents a case study with an herbalist, founder, and citizen living in Longo Mai, a community in Costa Rica, to help deepen the understanding of herbal medicines and give a real-world perspective of their implications in Costa Rican

healthcare. This case study aimed to determine the significance of herbal medicine use in Costa Rican culture and how the herbal medicines listed above are utilized in Costa Rica.

Literature Review

Herbal Medicine Use in Costa Rica

The practice of herbal medicine in Costa Rica originally began with an emphasis on faith, herbs, and magic. It started with the Bribri and Cabecar people, who honored a healing culture.^{7,8} The Bribri people practiced herbal medicine by combining herbs and spiritual healing. Similarly, the Cabecar people believed illness was due to turmoil and imbalance in one's relationship with nature. Therefore, specific herbs and lifestyle modifications could restore equilibrium to treat the condition.⁷ While many of these herbal medicines have been passed down through generations, one study reviewing 107 found that only thirty-four percent of the plants used are native to Costa Rica. The rest have been cultivated from many countries worldwide, including Southwest Asia, Europe, Indonesia, and the Mediterranean. Therefore, globalization has impacted and expanded the scope of herbal medicine in Costa Rica. In spite of this globalization, the lower percentage of native herbal medicines had not affected Costa Ricans' desired use or preference between native and cultivated plants.⁹

Despite variations in some cultural traditions and languages in Central America, there has been a common link due to their intimate connection to the natural environment and ethnobotanical healing traditions.¹⁰ People who practiced herbal medicine come from diverse backgrounds, including cooks, students, mothers, and artisans. One motivation to practice herbal medicine was to give back to the community's well-being. Another was to fill someone with positive energy, which had been believed to be essential for someone's overall health. Beyond practicing herbal medicine, their goal has been to promote traditional knowledge, conserve the

natural environment, and contribute to the overall well-being of their communities. It also has shown resilience, creativity, and the ability to problem solve. Beyond this, it gave people a feeling of freedom. Typically, knowledge was passed down orally through generations, but efforts have been made to share this message globally. A book was written in 2021 by a collection of Longo Mai herbalists and university professors from Central America and Arizona to help preserve and share the history and use of 24 herbal medicines. The goal of this book was not only to help maintain the knowledge of herbal medicine but also to elevate traditional herbal medicine practice and expand the reach of this information globally.³

In Central America, herbal medicines have often been chosen over Western therapy for various reasons. For instance, one study showed that Costa Rican women tend to opt for herbal medicines over hormonal treatment in menopause. One potential explanation for this is that some Costa Ricans state their preference for herbal medicine resulted from wanting to avoid Western medications, which they have seen as harmful.⁹ Herbal medicine tends to be safe if used in the proper dosage and length of treatment. Alternating plants for the same indication have been recommended rather than taking the same one daily to avoid potential side effects. Furthermore, herbal medicines are considered superior as they have been natural gifts from god.³ In other cases, herbal medicines might be the only treatment option available in resource-limited areas.^{11,12}

No complete list of herbal medicines in Costa Rica and Central America was found in the literature search. However, one study of herbal medicines used in Central America for diabetes and its comorbidities analyzed 607 plants for these specific indications.¹³ The closest comprehensive list of herbal medicines in the literature search focused on Mesoamerica.¹⁴ While only northern Costa Rica had been considered part of Mesoamerica, it was applicable since its

tropical environment is similar to that of Central America. The paper analyzed 28 papers about botanical drugs in Mesoamerica and found 2,188 plant taxa.¹⁵

Due to the lack of a comprehensive list sorted by frequency used, the herbal medicines selected for review were chosen after multiple journal searches using the database PubMed, which the National Institutes of Health maintains. Key search terms included utilizing the combination of the terms herbal medicines, herbal remedies, or natural medicine with the following geographical locations: Central America, Latin America, Costa Rica, and rainforest. After completing an extensive search of the literature, the four most common herbal medicines with published pertinent data were *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania species* (Guaco), and *Neurolaena lobata* (Gavilana).

Annona muricata (Soursop)

Annona muricata (Soursop) has been known as "guanabana" in Costa Rica. This herbal medicine is native to Central and South America. It is a fruit tree whose fruit, bark, and leaves have been used as herbal medicines in the form of essential oils, powders, and teas. It grows well in Costa Rica due to its tropical environment and economic importance. In general, the medicinal effects of *Annona muricata* are due to phytochemicals, mainly acetogenin, flavonoids, and alkaloids, which have been studied, showing antioxidant and antimicrobial properties.¹⁶ Common uses for this herb include treating pain, fever, diarrhea, infections, and allergies. In addition, *Annona muricata* has also been historically used as an anticancer and antispasmodic medicine.^{16,17} These benefits varied based on the parts of the plant used. Parasitic infections were targeted using its seeds, while the fruit is used for diarrhea and arthritis. The application of *Annona muricata* leaves has properties against headaches, cancer, insomnia, and cystitis.¹⁷ Regarding side effects, this herbal medicine has been reported to be relatively safe, but there is a

risk for neurodegenerative conditions. However, this had been mitigated by using the herb as needed and with appropriate doses. The production of these different aspects of *Annona muricata* involved drying the leaves and separating the seeds, peels, and pulp.¹⁶

Uncaria tomentosa (Cat's Claw)

Uncaria tomentosa (Cat's Claw), a tropical vine referred to as "uña de gato" in Costa Rica, is located in the rainforests of Central and South America.¹⁸ Its colloquial name was based on the fact that the hook-like thorns on the vine of *Uncaria tomentosa* appear like a cat's claws.¹⁹ Costa Rica's hot and sunny climate created an ideal environment for its growth.^{18,19} The secondary metabolite of its leaves, bark, and roots contain oxindole alkaloids and phenolic compounds, the main chemicals influencing the plant's medicinal qualities. Tetracyclic and pentacyclic indole alkaloids were the specific oxindole alkaloids in *Uncaria tomentosa* that have been found to affect the immune and central nervous systems. These two metabolites, in addition to phenolic compounds, were the reason for *Uncaria tomentosa*'s wide variety of purposes.²⁰ Indications for this herbal medicine include contraceptive needs, gastric ulcers, asthma, inflammation, urinary tract diseases, hemorrhage, cancer, and arthritis.^{18,20} Research has shown few side effects if the herb is taken in appropriate doses and durations.²⁰ Most often, the plant's root has been utilized for its therapeutic uses due to the higher concentrations of pentacyclic indole alkaloids. This chemical has been extracted to make various dosage forms, including capsules, aqueous extracts, tea, and tablets.¹⁸

Mikania species (Guaco)

Mikania species (Guaco), shrubs with characteristic four-floret flat heads, are native to Central and South America. They have been discovered to have anti-inflammatory, antipyretic, antibacterial, and analgesic properties. The multiple medicinal properties resulted from this

vine's chemicals, such as coumarins.²¹ In Central America, syrup had been commonly used for upper respiratory illnesses like cough, asthmatic bronchitis, and a hoarse voice. Mikania species had also been dried and formulated into a capsule.²² Tropical rainforests in the Americas had ancient traditions with the plant's leaves. They were used to produce tea or extract their juices for direct application to reduce hemorrhaging in snake bites.^{11,21} Also, indigenous people had warmed its leaves for dermatologic indications, such as pruritus and dermal eruptions.¹¹

Neurolaena lobata (Gavilana)

Neurolaena lobata (Gavilana), an herbaceous plant with yellow flowers, had been found in Central America and northwest South America.²³ It has been made into capsules, tea, and soaks.³ Traditionally, its leaves have been used as an anti-parasitic for infections such as ringworm, malaria, and intestinal parasites.²³ Another antimicrobial indication for this herb that indigenous Costa Ricans have used is for protozoan diseases such as Chagas disease. The anti-protozoan had been typically administered in the form of tea.²⁴ It had even been given as a topical application for mastitis in cows.³ In addition to infectious disease, *Neurolaena lobata* has been found to have anti-inflammatory properties due to the sesquiterpene lactones found in the plant. Additionally, it was extracted from crude leaves to be used in the treatment of ulcers and viruses, as well as an antinociceptive.²³ Other historical uses of *Neurolaena lobata* in Central America include cancer, diabetes, pain, and insect repellent.²⁵

Summary

Costa Rica has had a rich history of using herbal medicines due to its biodiversity, strong cultural history, and a strong preference for herbal over Western medication. A study showed research of over 2,000 herbal medicines in Mesoamerica, which has a similar tropical climate to Costa Rica and Central America.¹⁵ While there had been no data on the specific prevalence of its

use in Costa Rica or Central America, the World Health Organization found herbal medicine and homeopathy use quite prevalent in about eighty percent of the world.¹ Four of the most published herbal medicines used in Costa Rica, *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania* species (Guaco), and *Neurolaena lobata* (Gavilana), were analyzed. *Annona muricata*'s whole plant has been used for its antioxidant and antimicrobial properties.¹⁶ *Uncaria tomentosa*'s broad spectrum of indications was found to be due to its secondary metabolites. Coumarins found in the *Mikania* species allowed it to be used for many ailments, including respiratory illnesses and dermatologic conditions, and even to treat snake venom.²¹ *Neurolaena lobata* has been used as an insect repellent, systemic infections, inflammation, and even in preventative medicine.^{23,25} In general, these herbal medicines have multiple indications and preparations. They have tended to thrive in Costa Rica due to the biodiversity and environment that is tropical and sunny.^{18,19}

Case Study: Perspectives from Costa Ricans Living in Longo Mai

This case study was completed in a small "campensino" (farmer) community in the south lowland Amazon of Costa Rica, Longo Mai. Longo Mai is a national conservation area located four hours away from San José. It was developed in the 1970s as a refugee community for those living in conflict areas in Central America. A discussion with an herbalist, community founder, and citizen was had to discover their first-hand experiences and the modern-day practice of herbal medicine. The focus was to help determine herbal medicines' utilization and cultural significance in Costa Rica and how they are compared to information found in the literature review.^{3,26} Herbs that were explicitly focused on, due to their prevalence in Costa Rica and Central America, in a literature review included *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania* species (Guaco), and *Neurolaena lobata* (Gavilana). The evaluation of this

experience aimed to give a deeper understanding of the importance of herbal medicines in Costa Rica and, more specifically, the community of Longo Mai.

Herbalist Perspective

An herbalist in Longo Mai stated she started learning the art of herbal medicine when she was a little girl. She was sent into the forest to find herbs and plants to bring back home. Then, her mother and grandmother taught her about these herbal medicines from their wealth of knowledge. She continued this tradition by teaching her son about the plants and herbs in the community. In addition, the herbalist taught both citizens and tourists since she loved sharing this information with others and wanted the knowledge to be preserved so future generations could also benefit. The majority of the information had been passed down orally. However, a book was written by a collection of Longo Mai herbalists, including herself, and university professors from Central America and Arizona to help disseminate this wisdom. She continued practicing herbal medicine because they are a present from god. While her community might not be wealthy monetarily, she believed god blessed them with living in a place with an abundance of herbs and plants that can be used as medicines.

The frequency of herbal medicine use in Costa Rica varies quite a bit. Their use ranged from those who relied primarily on Western medicine to those who only used herbal medicines. While some Costa Ricans relied more on Western medicine, everyone knew at least a few herbal medicine recipes to share. She stated that the closer one got to the city, the more knowledge about herbal medicines was lost due to the lack of access to many of these plants and herbs. However, many Costa Ricans are intentional with how they cook to maintain their health by using spices as herbal medicines. For those who mixed Western and herbal medicine, herbal treatments were used to prevent Western medicine, such as surgery, from being necessary. The

herbalist told a story of a man with prostate problems who was to be reevaluated in three months for surgery. He was afraid of having surgery, and the herbalist had him take three different plants every day. When he returned to his follow-up for surgery, they found his prostate no longer enlarged, and he did not need it.

In Costa Ricans who only consumed herbal medicines, such as the herbalist herself, diagnostics in Western medicine was utilized if the cause of a person's symptoms was unknown and not initially resolved with herbs. For instance, someone with an undiagnosed condition, such as diabetes mellitus, went to a Western medicine provider to have labs drawn for a diagnosis. Then, they returned to the herbalist, who gave them herbal medicines to treat the diabetes. Despite not using Western medications, the patient would return to the Western medicine provider for follow-up for their health problem, such as lab monitoring. The herbalist did not use Western medicines because she felt they were heavy on the body, and many treatments for chronic conditions became lifelong therapies. Additionally, she felt those who started on Western medicines began by taking one but then subsequently took multiple medications with a snowball-like effect. In contrast, she thought herbal medicines were not lifelong therapies but instead used for a while until the condition improved or resolved.

When asked how herbal medicines were dosed, the herbalist discussed how people react differently to the same dose. The herbalist described what dose had worked for her or other patients and the side effects to be aware of if the dose becomes too high. Herbal medicines, with unknown doses, were started at small amounts and slowly titrated up to where the patient benefits from the remedy but does not have too many side effects. If the side effects could not be tolerated for an effective dose, they had several plants with similar purposes to use instead.

These different medicinal purposes were based on how the plant was prepared. There were numerous ways other herbal medicines in Longo Mai were prepared. For oral preparations, leaves were used to make tea, various ingredients were combined to create an elixir, and plants could be ground and oxidized to produce an infused drink. For topical preparations, components were ground up to make a paste or scrub, juices were squeezed out of plants to put on wounds, and roots were grated and then put through a filter to make a paste. Leaves were also placed on one's head like a hat to help resolve headaches.

In contrast, herbal medicine preparation could also be rather complex. For instance, an aromatherapy for respiratory illnesses was created using the fruit *Solanum mammosum*. It was made by injecting alcohol into the fruit. After that, it was placed in a bag to be buried in the ground for one month. Then, it was dug from the soil and put into a glass jar to be opened to smell for sinus infections.

The herbalist was asked about the four plants evaluated in the literature review: *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania species* (Guaco), and *Neurolaena lobata* (Gavilana). The herbalist used *Annona muricata* for both gastrointestinal illnesses and cancer. The plant's fruit was consumed regularly by those with chronic gastrointestinal discomfort, such as gas. However, the leaves were dehydrated and made into a tea or oral infusion for intestinal parasites. In contrast, the fresh green leaves of the plant were made into tea for those with cancer. When asked about *Uncaria tomentosa*, she said it grew in Longo Mai, and she was familiar with it. However, their community did not commonly utilize it as an herbal medicine.

Regarding the *Mikania species*, the leaves were made into an infusion for joint pain, coughs, and fevers. This herbalist used *Neurolaena lobata* in Costa Rica for gastrointestinal

illnesses. For instance, the stems were eaten to help resolve stomach aches. On the other hand, the leaves of *Neurolaena lobata* were made into an oral infusion for parasitic illnesses. Seven leaves of the plant had been made into an oral infusion to be drunk daily for seven days for those infected with worms.

Founder Perspective

Another perspective on herbal medicine used in Costa Rica was taken from one of the founders of Longo Mai. She discussed how they initially had to be careful in determining which plants and herbs found in their community were good for humans and had medicinal properties compared to harmful ones. She stated how the freshness of the plants and herbs in her community made them the best medicines. Immersing in nature with the surrounding plants made her feel physically and mentally sound, which added to this perspective. Herbal medicines have been used throughout the community as public health tools. For instance, during the depths of the COVID-19 pandemic, hot tea with lemon grass was consumed by the entire Longo Mai community. The founder believed drinking the tea boosted their immune health as a preventative measure for the virus.

Medicinal plants and herbs were the first-line treatments for conditions such as headaches and stomachaches, and they were even used during birth. However, citizens of Longo Mai had been willing to seek out Western medicine, such as going to the hospital, if the herbal medicines were insufficient to treat the condition. When asked about the future of the community and its practices, the founder stated that while many children leave for university, some have come back to Longo Mai and continued the traditions of their parents and grandparents. While a doctor visited the town three times a month, prescribed Western medicines, and monitored health conditions, this founder only sometimes followed the doctor's prescribed regimens. For instance,

the founder stated that she did not take the anti-hypertensives prescribed by Western medicine when she felt well. Instead, she utilized plant and herbal medicines to maintain her blood pressure. These herbal anti-hypertensives included tea made with *Annona muricata*, coconut water, Carambola (star fruit), or grapefruit juice.

Citizen Perspective

A third perspective of herbal medicines was captured from a citizen of Longo Mai. She stated she had never gone to the hospital or needed "chemical" medications, as she referred to Western medicine, due to her use of herbal remedies. She added herbs to her food and drinks for their health benefits. For instance, she drank water with a small quantity of sugar and chia seeds, which she calls chan. The drink had been consumed daily to help improve digestion and kidney health. In addition, she cooked turmeric into her meals, such as in pasta sauce, since she stated it is good for the entire body's health. The benefits she described include but are not limited to strengthening the immune system and improving one's hair and skin.

The citizen also stated that many people only use herbal medications because "chemical" medications are expensive. In addition, she believed herbal medicines were superior to "chemical" medications in their efficacy. For example, the citizen told the story of one of her friends with uncontrolled rheumatoid arthritis. Her friend tried multiple "chemical" medications through the hospital, but nothing seemed to help. However, when the friend started drinking turmeric in their tea, the problems were resolved. The citizen also followed the beliefs of her friend. Despite some herbal medications' poor taste, she believed it was worth fixing health problems rather than using "chemical" medications that might have better or no flavor. For instance, this citizen preferred tomatillo leaves in tea, which tastes very bitter for menstrual cramps, over ibuprofen.

Case Study: Implications and Lessons Learned

Overall, herbal medicines have been essential to Costa Rican healthcare, history, and culture. The knowledge is passed on through each generation, and tourists disseminate it as much as possible to preserve it. The citizens of Longo Mai appreciated their proximity to fresh plants and herbs, which they believed made them ideal medicines. For instance, the people of Longo Mai used herbal medicines daily as preventative measures in their food and drinks. They also thought that the closer one was to these herbal medicines in terms of proximity, the more herbal medicine had been implemented. However, they believed everyone in Costa Rica had some connection to herbal medicines and knew at least a few family remedies.

There were many ways to prepare and dispense herbal medicines, both simple and complex. Doses were titrated and tapered down to reduce adverse reactions. *Annona muricata* and *Neurolaena lobata* were used for gastrointestinal illnesses. *Mikania* species were utilized for orthopedic and respiratory complaints. *Uncaria tomentosa* was found in Longo Mai but was not commonly used as a medicinal herb. Herbal medicines that appeared to be prominent in Longo Mai included *Annona muricata*, Caramobola, chia seeds, and turmeric.

Discussion

The literature review and case study described the significance herbal medicine played in the health and culture of Costa Ricans. It emphasized that more than just Western medicine had been practiced worldwide.¹ Supporting the safe use of herbal medicines is critical to patient care. After providers learn more about how these herbs are utilized, proper support can be given to patients practicing herbal medicine. Not only had herbal medicines been found safe and effective, but they also played a vital role in a patient's culture.^{2,3,6} With a more robust understanding of herbal medicine's use and cultural significance, better patient care could be

given, and the role of a shared decision-making process would be more respected and supported. This practice could improve patient outcomes and compliance with whatever practice of medicine they choose to prevent and treat diseases and illnesses.²⁷ It also would help empower patients to take their health into their own hands. Furthermore, it would help maintain a collaborative relationship between herbal and Western medicine, as seen in Longo Mai's people.

The literature review and case study supported the first major theme driving herbal medicine use in Costa Rica: its environment with robust and immense biodiversity.⁶ The literature evaluation and case study showed that herbal medicines allowed a person to be closer to nature and healing.³ The people of Longo Mai felt that fresh plants and herbs made them ideal medicines. In contrast, Western medicines were seen as more harmful. This idea was supported by how the herbalist described Western medicines as heavy on the body, and the citizen called Western medicine "chemical" medicine. In addition, there was a collective thought among the people of Longo Mai that living surrounded by herbal medicines provided their culture richness and was a gift from god. They implemented these medications in their daily lives as preventative measures, such as the citizen utilizing chia seeds and turmeric in her food and drink. She believed she never needed to use "chemical" medicine or go to the hospital due to the strong presence of medicinal herbs in her daily life. Furthermore, as discussed in the literature review, herbal medicine was a common link for all living in Central America due to its natural environment and ethnobotanical healing traditions.¹⁰ The case study supported this idea by describing how those who lived more rurally surrounded by herbs and plants used herbal medicine much more frequently than those who lived in urban areas with much less greenery.

The second major theme driving herbal medicine use in Costa Rica was its accessibility and affordability. One article reviewed found herbal medicines were more accessible and

affordable than Western medicine, especially in resource-limited areas.¹² However, the answer was more complex with how herbal medicines are used in everyday practice. While a medical provider traveled to Longo Mai three times a month and dispensed medications, the citizens chose herbs over Western medicines. For instance, the founder used herbs despite having been prescribed and dispensed Western medications for her hypertension. Therefore, despite the access to Western medicine, herbal medicines were preferred. However, a citizen of Longo Mai might have had more access to herbal medicine than those in the literature studied since plants and herbs surround Longo Mai. However, the case for herbal medicines preferred use due to their affordability was supported when a citizen of Longo Mai stated that she saw Western medicines as more expensive and less effective. For instance, the citizen's friend with uncontrolled rheumatoid arthritis initially used Western medicine, which included expensive specialty medications that did not appear to work for him. However, he finally found relief when the friend stopped taking Western medications and started taking herbal remedies that naturally grew in their town.

The third major theme driving herbal medicine use in Costa Rica was its strong cultural traditions and persistence to continue to preserve and extend the reach of herbal medicine knowledge. Both forms of research emphasized the long history and importance of the generational transfer of information to protect the wisdom of herbal medicine. The literature review described how the practice of herbal medicine in Costa Rica originally began with an emphasis on faith, herbs, and magic with the Bribri and Cabecar people, who honored maintaining a healing culture.^{7,8} Continuing this tradition, the herbalist from Longo Mai described how her mother and grandmother taught her herbal medicine from a young age and how she is now teaching her son, the community, and tourists this information to ensure its

continued use in future generations. The transfer of knowledge is essential to the herbalist since people in the Longo Mai community have used herbal medicine as a primary source of medical care. At the same time, while herbal medicine's prominence in Costa Rica varied considerably based on nearness to nature, its citizens, who mainly relied on Western medicine, still honored tradition by knowing at least a few herbal remedies for common ailments.

Beyond the main reasons for herbal medicine use, another central theme in the research is the overlap in how herbal medicines were prepared, strategically prescribed to reduce the risk of side effects, and utilized. In terms of preparation, both forms of research showed boiling, fermenting, and macerating as common ways to prepare herbal medicines.^{1,3} However, unique and complex preparation methods were discovered in the case study. For example, the herbalist had a sinus infection herbal medicine that took a month to prepare with an intensive multistep preparation process to inhale the scents from the jar containing the final product. While this was a unique dosage form, the most common dosage form encountered between the literature review and the case study was using plant leaves to make teas. The teas were very versatile in their indications, ranging from cancer to parasites to headaches.^{16,18,24}

Regarding safety, the main idea was that herbal medicines were generally safe if taken in appropriate doses and for short durations.^{2,3,6} The Longo Mai herbalist further supported that dosing is crucial to safety. She described how she was very cautious and used her previous experience to ensure herbal medicines were prescribed in safe and effective doses. The dosing included a caveat to taper and titrate doses based on side effects and efficacy. A unique point in the literature to prevent the overuse of an individual herbal medicine and its subsequent side effects was to rotate between different herbs with the same indication regularly.³ However,

while the herbalist had not mentioned this strategy, she had emphasized that multiple herbal medicines had the same indication and that they be switched if one was not tolerated.

In addition to multiple herbal medicines having the same indication, there was a common theme in the literature evaluation and case study of a singular herbal medication having numerous purposes. These indications were specific to the part of the herb or plant used. For instance, the *Mikania* species syrup was used for upper respiratory infections, but its juices were extracted from leaves to stop a patient from hemorrhaging.^{11,21} In the case study, the herbalist used *Annona muricata*'s fruit for chronic gastrointestinal discomfort, such as gas. Yet, the leaves were dehydrated and made into a tea or oral infusion for intestinal parasites.

Regarding the herbal medications found to be the most researched and subsequently evaluated in the literature review, *Annona muricata* was the most discussed in the case study compared to the others. While the literature evaluation showed over ten uses for it, there was overlap with the three most common indications in the case study: gastrointestinal illnesses, cancer, and parasites. Both showed that fruit was used for gastrointestinal discomfort and leaves for cancer. On the other hand, for parasitic infections, the literature evaluation showed that the seeds of the plants were used, while the case study showed that the leaves of the plants were used.^{16,17}

The *Mikania* species in the literature evaluation showed the leaves primarily used for various conditions, which included dermal eruptions, snake bites, and pruritus. Its syrup was used for hoarseness, asthmatic bronchitis, and cough.²¹ Contrasting, leaves were used for cough in Longo Mai. Beyond these conditions, there was an overlap with the case study utilizing the *Mikania* species for its anti-inflammatory and antipyretic properties.²¹ For *Neurolaena lobata*, the parts of the plants utilized varied slightly. While both used its leaves for indications, such as

parasitic infections, Longo Mai was unique in that the stems of the plant were chewed on to help relieve stomach aches.²⁴

The most significant difference between the literature evaluation and the case study was *Uncaria tomentosa*. The literature evaluation showed it being used in various conditions in Central America, including urinary tract infections, arthritis, cancer, and gastric ulcers. In contrast, the people of Longo Mai stated that the plant grew in the area but was not commonly used as an herbal medicine. However, it was necessary to remember that the case study focused on one area of Costa Rica and could not be generalized to the rest of the country and Central America. Therefore, the literature evaluation might have been better reflected in other regions of the area. Future research should focus on a broader investigation into how herbal medicines are used in all areas of Costa Rica.

In conclusion, the literature review showed more indications for each of the four herbal medicines selected than in the case study. The case study showed that each medication, except for *Uncaria tomentosa*, had a few primary purposes. One potential reason for this was that many plants and herbs in herbal medicine have the same indication. In addition, how the herbs are utilized could be based off how their ancestors utilized these herbal medications in a specific manner. Another reason for the difference could be the ease with which a specific plant was collected or prepared for a particular condition. Despite this, there tended to be an overlap between how the literature evaluation and case study described the preparation and prescribing of these specific herbal medicines. It was important to note that this case study reflected only a tiny area in Costa Rica. Herbal medicine might have been practiced differently based on the location's biodiversity and cultural practices. Therefore, future case studies should be completed to understand better herbal medicine use in urban areas outside the tropical rainforests.

Conclusion

Herbal medicines are essential to Costa Ricans' way of life for their health and cultural ties, mainly due to Costa Rica's robust and immense biodiversity, accessibility, affordability, and generational traditions.^{1,3,6} Both the literature review and case study overlapped in how medications were prepared, prescribed strategically to reduce the risk of side effects, and utilized. *Annona muricata* (Soursop), *Uncaria tomentosa* (Cat's Claw), *Mikania* species (Guaco), and *Neurolaena lobata* (Gavilana) were found to be the most commonly studied herbal medicines in Central America based on a PubMed literature search; however, the differences found might be due case study focusing on a singular, rural community in Costa Rica.^{16,20,21} These findings call attention to the significance of maintaining and supporting herbal medicine use in its physical and cultural benefits as a medical provider, which could improve the quality and outcomes of patient care.

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