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Ethnobotanical Survey of Medicinal Plants Used In The Management of Diabetes, Asthma And Hypertension In Zanzibar

Khamis Rashid Kheir[1*], Mayassa Salum Ally[1], Bilal Badrudin Khamis[1], Rashid George Rashid[1], Thani Ame Ali[1], Hassan Buda Juma[1], Ussi Makame Kombo[2], Farid Mzee Mpatani[2], Hamisi Masanja Malebo[3], Burhani Othman Simai[4], Joseph Nicolao Otieno[5], Samson Hilonga[5], Murthaina Yussuf Ali[6], Bariki Salum Juma[1]

1. **Zanzibar Health Research Institute (ZAHRI), P. O. BOX 375, Binguni, Zanzibar**
2. **Chief Government Chemistry Laboratory Agency (CGCLA), P.O. BOX 759, Maruhubi, Zanzibar**
3. **UNESCO National Commission of the United Republic of Tanzania, P.O. Box 20384, Dar es Salaam, Tanzania.**
4. **Zanzibar Food and Drug Agency (ZFDA). P.O. BOX 3595, Changu Road Mombasa area.**
5. **Institute of Traditional Medicine, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar es Salaam-Tanzania.**
6. **Department of Natural Sciences, the State University of Zanzibar (SUZA), Tanzania.**

Corresponding author email: khamiskheir9@gmail.com

Abstract

The current therapeutic use of medicinal plants mostly relies on indigenous knowledge, a system of knowledge that has been orally transmitted successively from generations to generation. Indigenous knowledge is being lost at a rapid pace as it still relies on oral transmission and that traditions such as story-telling are disappearing, which makes their documentation particularly crucial. In a similar vein, elders, parents, traditional health practitioners and herbalists have long transmitted orally from generation to generations their expertise of locally using herbs to treat various ailments. This repository of information, developed over millennia, needs to be documented and stored to allow integration into the official health systems. On this background, there is an urgent need for researchers to conduct studies and document on plants uses in the management of diseases, including non-communicable diseases. In Zanzibar, people have a tradition of using medicinal plants for their primary healthcare needs. The study aimed to collect information on medicinal plants used in the management of diabetes, asthma, and hypertension in Zanzibar. An ethnobotanical survey was conducted using a purposive sampling method, 24 traditional healers across 12 shehias/villages in all districts of Unguja and Pemba were interviewed. The study identified 24 plant species used for asthma management, 15 for hypertension, and 20 for diabetes. These findings highlight the continued importance of medicinal plants in disease management in Zanzibar and provide a foundation for further pharmacological and phytochemical research. Thus, the data revealed that, in Zanzibar, people still depend on medicinal plants for management of different diseases. The basic information on the medicinal plants identified will serve as a platform for

ethnobotanists and pharmacologists to conduct further research regarding the pharmacological and phytochemical screening of plant species.

Keywords: *Ethnobotany, Medicinal plant, Asthma, Hypertension, Diabetes.*

1 Introduction

The use of medicinal plants for treating human diseases has been a global practice throughout history (Jamshidi et al. 2018). Thus, indigenous knowledge of traditional medicinal plants concerns the names, collection, preparation and uses as orally documented by the local and or indigenous people of a given area. Plants serve as primary sources of healthcare and have contributed significantly to the development of modern medicine by providing potential synthetic compounds (Ojah 2020). The relationship between humans and medicinal plants dates back to ancient times, with plants being used for medicinal purposes and as fuel, clothing, shelter, and food (Beyene et al. 2016). Zanzibar, an archipelago off the coast of East Africa, is recognized for its rich diversity of medicinal plant species. The use of plants for medicinal purposes in Zanzibar has been documented long back before the arrival of westerners. However, the sustainability of these resources is threatened by deforestation and inadequate conservation efforts (Nahashon, 2013). Over 95% of the population of Zanzibar, both in rural and urban areas, use traditional medicines for their primary healthcare needs,based on the fact that the cultural acceptability of traditional medicine is high since it applies a holistic approach to treatment (WHO2008).

Natural resource conservation is one of the ways the regulation needs to take the best consideration in protecting the community's use of traditional medicine in Zanzibar (Madeweya, 2004). The entire Zanzibar population is ethnically diverse, with people of African, Arab, Persian, and Indian descent (Giles, 1999). This diversity is lent to by the fact that these different cultures brought with them a great effect on the mixed approaches taken to healing about the traditional medicine of Zanzibar (Elizabeth, 2008). Zanzibar contains a wealth of botanical diversity, which includes many species of medicinal plants. Medicinal and aromatic plants play a significant role in disease management such as tuberculosis (TB), skin diseases, respiratory diseases like asthma, diabetes, and cardiovascular diseases like hypertension. Those plant species contain medicinally active compounds such as alkaloids, phenols, tannins, cryogenics, glycosides, and terpeniods with medicinal properties (Akinyemi 2018). Hypertension (6%) and diabetes (3.5%) were reported to be among the ten most common causes of hospitalization for all ages in Zanzibar in 2018. The disease was reported to have consistently high prevalence in 2016, 2017, and 2018 (ZHB 2018). Thus, this study aimed to collect information on medicinal plants used by Zanzibar populations in the management of non-communicable diseases, specifically asthma, hypertension, and diabetes.

2 Methods

2.1 Study area

The study was conducted in the Zanzibar Archipelago, located off the coast of Tanzania in East Africa. Zanzibar, comprising the islands of Unguja and Pemba, is part of the United Republic of Tanzania. According to the 2022 population and housing census, Tanzania's total population is 67,438,106, with 1,889,773 residing in Zanzibar (NBS 2022). The archipelago is recognized as a biodiversity hotspot with over 1,400 endemic species (Jessica et al. 2015). The survey covered all eleven districts in both Unguja and Pemba, with 12 Shehias purposely selected for the study.

2.2 Data collection

The ethnobotanical survey was carried out from April 2022 to June 2022, during which 24 interviews were conducted in twelve (12) Districts of Unguja and Pemba. Data were collected through semi-structured and structured interviews with people who knew traditional medicine and traditional healers living in villages around Zanzibar. The people interviewed were either born or had been living in the region for the past more than 15 years. The vernacular names were identified with the help of local traditional healers. The plants were tabulated with the botanical names, family names, vernacular names, plant parts used, uses, methods of preparation, and route of administration. The comparison between field data and literature entries was based on the scientific names of the species, using qualified and experienced botanists with relevant references.

2.3 Data management and analysis

To ensure data security and storage, the research team managed all collected information. Data from traditional healers were collected electronically using the Kobo program and stored securely, accessible only to authorized users. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) and Origin 8.5.1 software. Data were managed by the research team to ensure security and storage.

3 Results

3.1 Proportion of study participants

As presented in Figure 1, our study revealed that male traditional healers in Zanzibar contributed 72% of the collected information on the ethnobotanical use of medicinal plants, compared to 28% from female respondents. Male traditional healers from Zanzibar contribute 72% of male collected information of ethnobotanical use of medicinal plants compared to 28% coming from female respondents. Figure 1

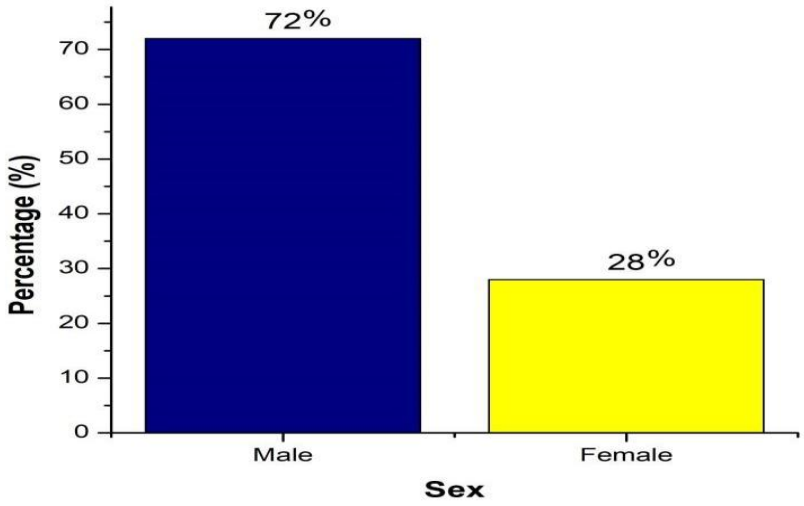

Figure 1: Proportion of study participants

3.2 Participants distribution by gender and age group

The age distribution of participants showed that no respondents were in the 18-40 age group, while the 41-60 age group had 56% male and 25% female respondents. Interestingly, in the 61-80 age group, female respondents (75%) outnumbered males (25%). Only 6% of male respondents were over 100 years old.

The number of female respondents was higher as compared to male interviewed. Figure 2 shows the age categories of respondents that were interviewed.

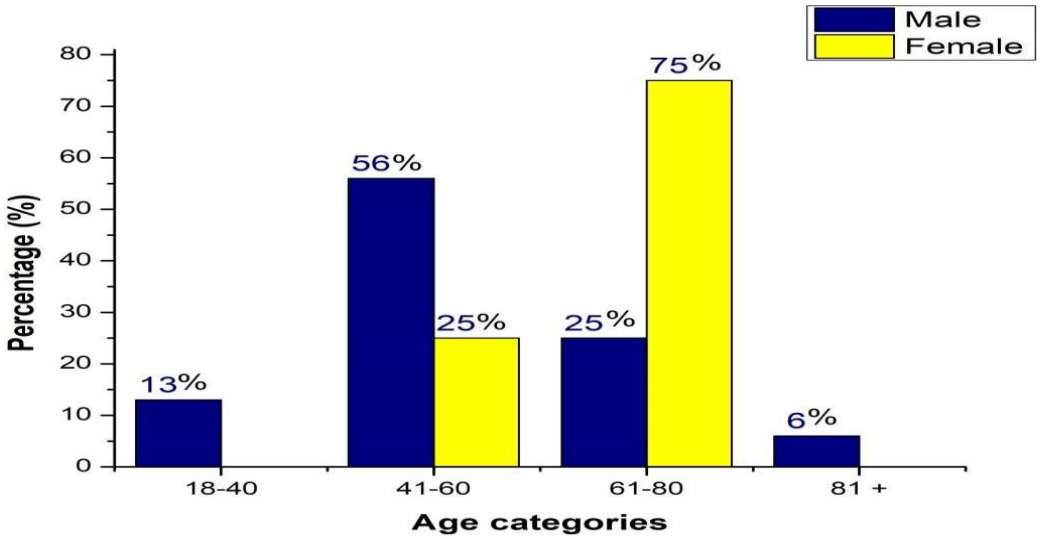

Figure 2: Age categories of traditional healers

3.3 Education status of Traditional healers

As presented in Figure 3, the levels of education for the interviewed traditional healers were depicted as percentages in four categories for secondary level (55%), primary level (5%), Quran School (35%), and University level (5%).

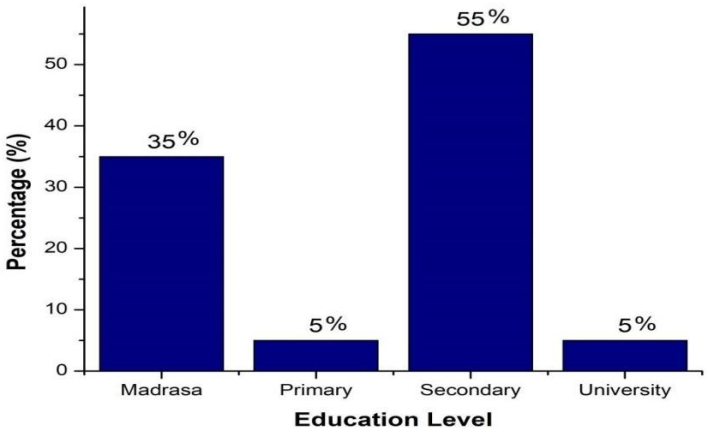

Figure 3: Education level of traditional healers

3.4 Working experience

Regarding experience, most traditional healers (9) had 21-40 years of experience, followed by 7 healers with 0-20 years and 4 healers with 41-60+ years of experience. Most of the Traditional healers fall between 21 - 40 years' categories of experience in their field which contributed 9 traditional healers followed by 0-20 years of categories which contributed of 7 traditional healers and finally 41 - 60+ years of categories which contributed by only 4 healers traditional (Figure 4).

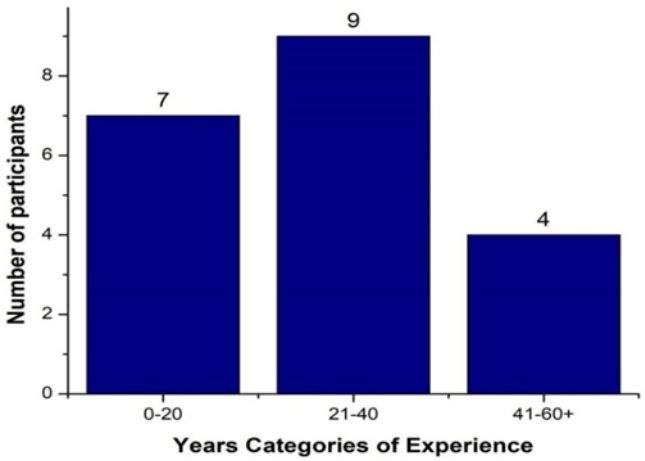

Figure 4: Healing carrier experience of traditional healers

3.5 Capacity of respondents to manage disease

Traditional healers showed varying capacities to manage different diseases. Asthma management had the highest positive response (83%), followed by diabetes (78%) and hypertension (72%). Figure 5 below provides the positive and negative responses of Traditional healers on disease management. Asthma was the leading disease showing a positive response against a negative response (asthma; 83% positive and 17% negative) followed by diabetes, showing that 78% had a positive response against 22% with a negative response) Finally, hypertension had a 72% positive response against 28% negative response.

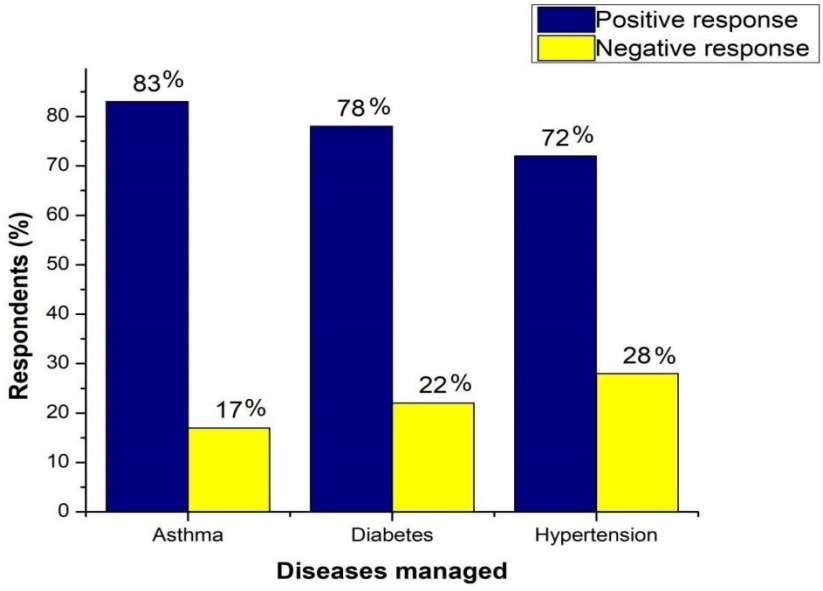

Figure 5: Capacity of Respondents to Manage Diseases

3.6 Number and types of Medicinal Plants used in Disease Management

The study identified a total of 24 plant species used for asthma management, 20 for diabetes, and 15 for hypertension. Some of the key plants mentioned for asthma treatment included *Tragia brevipes, Casuarina equisitufolia*, and *Cocos nucifera*. For hypertension, commonly used plants were *Ocimum americanum, Urena lobata, and Moringa oleifera*. Diabetes management often involved plants such as *Moringa oleifera, Mimosa pudica,* and *Carica papaya*. Figure 6 below provides the number of medicinal plants mentioned by traditional healers that they use to treat different diseases. Three (3) diseases have been recorded in this study, whereby by large number of medicinal plants are mentioned to treat asthma (25). Appendix 1 of the present study shows the list of plant species, their respective families, and their medicinal uses.

3.6.1 Asthma

From this study a total number of twenty-four (23) plants reported to manage asthma which were; *Tragia brevipes, Casuarina equisitufolia, Cocos nucifera, Ficus exasperata, Abrus precatorius, D. fastuosa, Guilandina bonduc, Toddalia asiatica, Tamarindus indica, Acalypha fruticosa, Allium sativum, Croton Sylvaticus, Msumusumu, Gloriosa superba, Solanum lycopersicum, Euphorbia tirucalli, Phyllanthus niruri, M. japonica, Manihot esculenta, Diospyros consolatae, Ageratum conyzoides, Euphorbia tirucalli, Pisum sativum.* The most reported plant families were Fabaceae, Euphobeceae, and Rutaceae. The collected data resembled the data reported by Holaly et al. 2017 in his study on Ethnobotanical study of plants used to Treat Asthma in the Maritime Region in Togo, where by mostly of the plant families reported were Lugumenaceae, followed by Euphorbiaceae and Rutaceae.

3.6.2 Hypertension

A total of 15 plant species belonging were reportedly used in herbal preparations for the traditional treatment of hypertension which were; *Ocimum americanum, Urena lobate, Stahytarpheta jamaicensis, Cocos nucifera, Moringa oleifera, Carica papaya, Cajanus cajan, Ziziphus mucronata, Psidium guajava, Azadirachta indica, Tectona grandis, Murraya koenigii, Spondias dulcis, Citrus aurantifolia, Averrhoa bilimbi.* The data resemble those reported by Holaly et al. 2018, where the families including Fabaceae and Rutacea were reported to be mentioned by traditional healers from Togo as same as from Zanzibar for the management of hypertension.

3.6.3 Diabetes

A total of 20 plants species were reported to manage diabetes during the survey which were; *Moringa oleifera*, *Mimosa pudica*, *Carica papaya, Syzygium cuminii, Musa paradisiaca*, *Launaea cornuta, Ziziphus mucronata, Mwangwi, Leonotis nepetifolia, Guilandina bonduc, Strychnos innocua, Opuntia vulgaris, Croton sylvaticus, Uvaria acuminata, Mangifera indica, Rapanea melanophloeos, Spondias dulcis, Euphorbia hirta, Phyllanthus sp, Citrus limonia.* The most represented family was Anacardiaceae and followed by Asteraceae. The findings revealed that most of the plants used to manage diabetes in Zanzibar were unique as those reported by some scholars, including Sonia Verma et al. 2018, Messaoud et al. 2022 Behzad et al. 2018. Therefore, Traditional healers from Zanzibar use the plants based on inherited knowledge from their ancestors, based on accumulated traditional medicine wisdom with time-tested and refined healing knowledge and skills. The identified medicine plants deserve further scientific attention for the isolation and identification of medicinally important chemical entities needed for drug discovery

and the development of new and needed therapeutic agents.

3.7 Informant Consensus Factor (ICF) Calculation

Formula:

ICF= (Nu−Nt) / (Nu−1)

Where:

- Nu: Total use reports for a specific disease.
- Nt: Number of plant species used for that disease.

Data:

1. ***Asthma***:
    - Nu=83 (Positive responses, % converted to total healers)
    - Nt=24 (Plant species)
2. **Diabetes**:
    - Nu=78
    - Nt=20
3. ***Hypertension***:
    - Nu=72
    - Nt=15

Calculation for Asthma:

ICF for Asthma (83−24) / (83−1)

ICF for Asthma ≈0.72I

Similarly:

- ICF for diabetes (78−20) / (78−1)
- ICF for Diabetes ≈0.75I

Simalarly:

- ICF for Hypertension (72−15) / (72−1)
- ICF for Hypertension ≈0.80I

Regarding the use of plants to treat particular illnesses, traditional healers strongly agree, according to the Informant Consensus Factor (ICF) values. The trustworthiness of the plant species chosen for treatment based on common ethnobotanical knowledge was demonstrated by the greatest ICF (0.80) for hypertension, which was followed by diabetes (0.75) and asthma (0.72).

4 Discussion

The gender distribution of traditional healers in our study, with 72% male and 28% female participants, aligns with findings from other studies. For instance, Magwede et al. (2014) reported a higher number of male traditional healers compared to females.

The age distribution of traditional healers in our study, with a majority falling in the 61-80 age group, is consistent with findings by Gessler (1995), who reported that most traditional healers were around 50 years old. This trend could be explained by the fact that older individuals are more likely to have accumulated traditional medicinal knowledge through prolonged interaction with elders.

Our findings on disease management capacity among traditional healers show a high positive response for asthma (83%), diabetes (78%), and hypertension (72%). These results are comparable to those reported

by Hughes et al. (2015) in urban South Africa, where traditional medicines were commonly used to manage non-communicable diseases, with hypertension being a frequently treated condition.

The diversity of medicinal plants used for treating asthma, hypertension, and diabetes in Zanzibar demonstrates the rich ethnobotanical knowledge in the region. For asthma management, our study identified 24 plant species, with Fabaceae, Euphorbiaceae, and Rutaceae being the most represented families. This finding is similar to the study by Holaly et al. (2017) in Togo, where Leguminosae, Euphorbiaceae, and Rutaceae were commonly reported for asthma treatment.

For hypertension, 15 plant species were identified, with similarities to findings by Holaly et al. (2018) in Togo, particularly in the use of plants from the Fabaceae and Rutaceae families. The 20 plant species reported for diabetes management in Zanzibar, however, showed unique characteristics compared to studies by Verma et al. (2018), Messaoud et al. (2022), and Behzad et al. (2018). This uniqueness suggests that Zanzibari traditional healers may be using plants inherited from their ancestors, which warrant further investigation through laboratory analysis to reveal their medicinal properties. Also, the traditions and customs that have been inherited from the ancestors have played a paramount role in affecting the spatial labor distribution through marital conducts in Zanzibar. These findings are consistent with the study reported by Magwede et al. 2014showing that male Traditional healers were reported in higher numbers as compared to female. Also, the study showed that male respondents have more knowledge (understanding) of traditional medicine practices as compared to female respondents (Magwedeet al. 2014).

4.1 Plants and disease management

According to the Informant Consensus Factor (ICF), the data gathered for this study show that traditional healers strongly agree about the use of medicinal plants for treating non-communicable diseases. The most dependable plant species selection was demonstrated by hypertension, which had the greatest ICF (0.80), followed by diabetes (ICF = 0.75) and asthma (ICF = 0.72). Furthermore, there were 15 species of medicinal plants used for hypertension, 20 for diabetes, and 24 for asthma, which matched the ICF values of the disorders.

The results are almost similar to those reported by Hughes et al. (2015 where traditional medicines reported to manage non-communicable diseases were 61%, and hypertension was a common disease reported to be managed by the Traditional healers in Urban South Africa **(**Hughes et al. 2015**).** Another finding reported from Uganda by Kakudidi et al. 2016 collated 42 medicinal plants from literature used in the treatment of NCDs, of which 20 (47.6%) are used in the management of hypertension, an indicator of its prevalence. Seven priority species were also identified for various NCDs by TMPs (Kakudidi et al. 2016). Therefore, Traditional healers from Zanzibar use the plants based on inherited knowledge from their ancestors, based on accumulated traditional medicine wisdom with time-tested and refined healing knowledge and skills. The identified medicine plants deserve further scientific attention for the isolation and identification of medicinally important chemical entities needed for drug discovery and development of new and needed therapeutic agents.

5 Conclusion and Recommendations

5.1 Conclusion

This study highlights the continued importance of traditional medicine and medicinal plants in healthcare management in Zanzibar. The identification of numerous plant species used for treating asthma, diabetes,

and hypertension provides a valuable foundation for future ethnobotanical, pharmacological, and phytochemical research. To build upon these findings, in Zanzibar, both Unguja and Pemba, where data have been collected, traditional medicine still plays an important role in improving health care, where most medicinal plant species are widely used to treat different diseases, including asthma, diabetes, and hypertension. Thus, the data revealed that in Zanzibar, people still depend on medicinal plants for their primary healthcare needs, which play a role in the management of different diseases. The Basic information of medicinal plants identified Medicinal uses in South Unguja will serve as a platform for ethnobotanists and pharmacologists to further research regarding pharmacological and phytochemical screening of the plant species.

5.2 Recommendations

The findings of this study have shown significant information on various medicinal plants that are usually used by traditional healers in Zanzibar. Although there has been some known information obtained in this study, however, for future studies, the following recommendations should be mostly considered by the researchers:

- **i.** Phytochemical screening and other biological studies of medicinal plants identified from this survey should be conducted so as to know the bioactivity and active compounds of the claimed medicinal plant species, together with the safety of the plants.
- **ii.** More education should be provided to the society on plants conservation for future generations and hence improving community welfare.

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APPENDIX 1.

Here is the list of plant species, their respective families, and their medicinal uses:

Plant Species	Family	Medicinal Use
Tragia brevipes	Fabaceae	Asthma
Casuarina equisitufolia	Casuarinaceae	Asthma
Cocos nucifera	Arecaceae	Asthma, Hypertension
Ficus exasperata	Moraceae	Asthma
Abrus precatorius	Fabaceae	Asthma
D. fastuosa	Fabaceae	Asthma
Guilandina bunduc	Fabaceae	Asthma, Diabetes
Toddalia asiatica	Rutaceae	Asthma
Tamarindus indica	Fabaceae	Asthma
Acalypha fruitcosa	Euphorbiaceae	Asthma
Allium sativum	Amaryllidaceae	Asthma
Croton sylvaticus	Euphorbiaceae	Asthma, Diabetes
Gloriosa superba	Colchicaceae	Asthma
Solanum lycopersicum	Solanaceae	Asthma
Euphorbia tirucalli	Euphorbiaceae	Asthma
Phyllanthus niruri	Phyllanthaceae	Asthma
Manihot esculenta	Euphorbiaceae	Asthma
Diospyros consolatae	Ebenaceae	Asthma
Ageratum conyzoides	Asteraceae	Asthma
Pisum sativum	Fabaceae	Asthma
Ocimum americanum	Lamiaceae	Hypertension
Urena lobata	Malvaceae	Hypertension
Stachytarpheta jamaicensis	Verbenaceae	Hypertension
Moringa oleifera	Moringaceae	Hypertension, Diabetes
Carica papaya	Caricaceae	Hypertension, Diabetes

Cajanus cajan	Fabaceae	Hypertension
Ziziphus mucronata	Rhamnaceae	Hypertension, Diabetes
Psidium guajava	Myrtaceae	Hypertension
Azadirachta indica	Meliaceae	Hypertension
Tectona grandis	Lamiaceae	Hypertension
Murraya koenigii	Rutaceae	Hypertension
Spondias dulcis	Anacardiaceae	Hypertension, Diabetes
Citrus aurantifolia	Rutaceae	Hypertension
Averrhoa bilimbi	Oxalidaceae	Hypertension
Mimosa pudica	Fabaceae	Diabetes
Syzygium cuminii	Myrtaceae	Diabetes
Musa paradisiaca	Musaceae	Diabetes
Launaea cornuta	Asteraceae	Diabetes
Leonotis nepetifolia	Lamiaceae	Diabetes
Strychnos innocua	Loganiaceae	Diabetes
Opuntia vulgaris	Cactaceae	Diabetes
Uvaria acuminata	Annonaceae	Diabetes
Mangifera indica	Anacardiaceae	Diabetes
Rapanea melanophloeos	Primulaceae	Diabetes
Euphorbia hirta	Euphorbiaceae	Diabetes
Phyllanthus sp.	Phyllanthaceae	Diabetes
Citrus limon	Rutaceae	Diabetes