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ETHNOPHARMACOLOGICAL INFORMATION ON TRADITIONAL USE OF MEDICINAL PLANTS IN FREETOWN, SIERRA LEONE.

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ABSTRACT

Background: The use of herbal medicinal products has greatly increased over the years, with less than 80% of people worldwide depending on some of their primary health care services. Safety, lack of enough resources and improper monitoring among others remain important issues with the use of herbal medicines and the impact of their harvest on the environment. When compared with studies from other parts of the world, this study and some others which were conducted earlier conducted in Sierra Leone indicates promising potentials and effectiveness of herbs in the treatment of some diseases.

Methods: Twenty respondents who regularly practice and deal in traditional herbal medicine provided information on the constituents which make up the recipes of their products, the sources of raw material, and types of health conditions treated with the plants.

Results: A total of 92 species of medicinal plants from 41 flowering families have been used by traditional herbalists to produce herbal medicines that are indicated for the treatment of 10 different medical conditions. Diseases with the highest treatment included malaria, gonorrhea, dysentery and toothache. The most cited species out of 92 mentioned, was Newbouldia laevis, while the most cited family of medicinal plants was Fabaceae with the highest value of family importance (75%).

Conclusion: As established by the traditional healers, the mode of extraction of these plants from their sources for medicinal purposes is considered sustainable with minimal damage to the study area; therefore, sustainable use can be encouraged or enforced in conjunction with special medicinal plants cultivation.

Keywords: Traditional Herbal Medicine Practitioner (THMP), medicinal, ethnobotanical, Sierra Leone.

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INTRODUCTION

Biodiversity is instrumental to the health and growth of economies, societies and individuals, through the provision of services such as the provision of food, raw materials, medicine, and water; regulating the climate; contributing to air and water quantity and quality; and mitigating natural hazards, all through the ecosystem (Ogunkunle, et al., 2019). Traditional medicines are substances which contain vitamins, minerals, or other materials and that can be eaten or drunk. They are also plants or plant parts used for various purposes including therapeutic, flavour ornamental etc (Mamtani et al., 2015). The use of plants and plant extracts as medicine by traditional medicine practitioners and other specialists was the primary method for treating various diseases before western medicine was introduced (Si-Yuan et al., 2014) because they are affordable, accessible, available, effective and have high cultural and religious preference (Million et al., 2022). This is especially true in developing countries where, for example, 70% to 80% of people use traditional medicine and about 85% of traditional medicines are obtained from plant extracts (El-Dahiyat et al., 2020). Medicinal plants can be defined as plants commonly used for treatment and prevention of specific diseases (Oladeji, 2016). Traditional healers are found in almost every rural village setting as well as in urban areas. Despite their contributions, the traditional healers have not received worthy credit. In many parts of the world, policy makers, health professionals and the general public are concerned about safety, efficacy, quality, storage and proper disposal of these drugs (WHO, 2000).

Many African countries are combating with various health challenges which seem insurmountable for many years. Making the case worse is the global issue of antimicrobial resistance to conventional drugs. The study of herbal medicine is a solution to these, as it leads to the discovery of new ways to combat some of the health challenges in Africa. According to CDC (2022), malaria tops the list of prevailing health problems in Sierra Leone, and it is a major cause of death among Sierra Leonean residents. Other common diseases that have been reported especially among adults in recent times include; toothache, abdominal disorder, fever, gastrointestinal disorder, different degrees of pain and gonorrhea to mention a few (Augustin et al., 2018).

African herbal medicine is a form of holistic health care system organized into three specialist levels, including divination, spiritualism, and herbalism, although they may overlap in some situations. The total number of African plant species with medicinal uses is estimated between 5,400 (Van, 2015) and 5,917 (Jusu and Sanchez, 2014). Like in most countries in Africa, a number of medicinal plants are recognized in Sierra Leone, as the use of herbal medicine is widespread nationwide, with a large number of the population using it to treat various health conditions (Jusu and Sanchez, 2014).

A traditional medicine practitioner / healer is someone who provides medical care to the community in which he lives, using herbs, minerals, animal parts and some facilities. However, the Traditional Medicine Practitioner (TMP) appears to be a modern designation accepted by the Scientific Technical and

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Research Commission (STRC) of the Organization of African Unity, now the African Union (AU) (Ozioma and Chinwe, 2019). Some traditional practitioners participate in primary health care programs (WHO, 2001). Others focus on reproductive health, female infertility, Ebola survivors, high blood pressure patients and students (James et al., 2016, 2018, 2019 and 2020). Common reasons given for use of traditional herbal are; pregnant and lactating women (availability and accessibility and also low cost, their effectiveness, the frequently inadequate provision of modern medicine, and cultural and religious preferences (Sheldon et al., 1997).

Various traditional healers use different practices and approaches to treat the same ailment. Dosage is often uncertain and drugs are prepared under unhygienic conditions. In addition, dosage is always a topic where herbalists advise on dosage as imprecise as in allopathic medicine (Macfoy, 2013). Herbal medicine comes with some risks but reports from various traditional medicine practices have supplied us with important formulas on how to correctly select, prepare and apply herbs. This will in turn influence clinical and scientific implementation to ascertain safe and effective alternatives to conventional drugs (Ekor, 2014).

Knowledge of most of these curative properties was accumulated over time from evidence-based observations. Studies have also been done focusing on the prevalence, determinants and pattern of herbal medicine use among hypertensive patients and other disease conditions such as malaria (Ranasinghe et al., 2015) and among Ebola survivors (James et al., 2019), pneumonia and diarrhoea (Diaz et al., 2013), Lebbie (1995) and Kanteh and Norman (2015). Among the few ethnobotanical and folk medicinal research conducted on medicinal plants in Sierra Leone, Macfoy (2014) in his book (Medicinal Plants and Traditional Plants in Sierra Leone), discussed over 200 medicinal plants used to treat various diseases and illnesses in relation to their socio-cultural, chemistry and biological activity testing. He also delved into the potential to develop new drugs and integration with western medicine and conservation issues pertaining to the medicinal plants. In total, very few number of authors have published but a few data on plants of Sierra Leone with their curative values (Macfoy, 2013, Turay, 1997). For example, Moringa is loaded with vitamins, bio-nutrients, protein and is used to treat and prevent about 300 diseases. Graviola tree (Annona municata) is loaded with vitamin C, B1 and B, commonly called soursop is used for treating viral and parasitic infections. Carica papaya seeds for intestinal parasites, Garcinia kola seeds for pain and inflammation, and Aloe vera for skin diseases among others. The same is also true for plants from other African countries (Macfoy, 2013).

These previously-reported data, though they contain vital information about some medicinal plants, they seem to be getting old already. Thus, there is a need to carry out an updated study, especially in locations not previously covered by previous studies in order to capture a wider scope of the country's medicinal plants potential in the future. In the context, this study was aimed to botanically characterize herbal medicinal plants that are commonly-used in Sierra Leone and publish vital information

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about the plants (and their parts) which are used in preparing formulations for treating ailments by THMPs.

METHODS

Study Design

Description and disease demography of study area

The study was conducted in Freetown, the capital city of Sierra Leone which is located around latitude 8.484'N and longitude -13.22994'W with a population of 1,055,964 according to Population and Housing Census (2015). Freetown comprises the western-located urban area and the eastern-located rural area. The target group for this study were the Traditional Medicine Practitioners from the study area who provided healing services through herbal medicine preparations. Twenty traditional herbal medicine practitioners were selected, ten from the Western Urban Area (Eastern, Central and Western) and ten from the Western Rural Area including Waterloo, Goderich, Hastings and Leciester (Figure 1). Majority of the active herbal medicine practitioners live within and around to the urban regions of the nation, with the mind of getting closer to a host of customers who especially could afford the cost of their services.

Figure 1: (a) The pictorial illustration of the study area (b) The pictorial illustration of the study area districts highlighted in red. (Sources: worldatlas.com and unocha.org respectively)

Data Collection and Sampling Techniques

Questionnaire method of data sampling was employed in this study, involving two separate sections: Section A focused on the THMPs socio-demographic information, while Section B contained inquiries on the kinds of home-grown medication they delivered, parts of the plants utilized, the diseases they were intended to treat, and details of preparation of the herbal medicine. In the assessment of data about the wellsprings of the crude materials, the THMPs were provided with a rundown of potential sources (i.e., purchase, sourcing from the wild, private cultivation, and so on). Even though some THMPs refused to explain details of their herbal medicines, some others did not mind giving out the requested information for free, while some others responded to all questions in exchange for cash.

Due to diversity of responses because of the low level of education, exposure and understanding of majority of the THMPs, semi-structured interviews and field observations were carried out along with some THMPs, as additional techniques to enhance data collection process. Interviews and discussions were based on a pre-prepared checklist of questions in English Language, which was translated into krio (Sierra Leonean local language) by an interpreter, for face-to-face interviews. Data on medicinal plants, their local names, part(s) used, methods of preparation and preservation, diseases treated with, route of application were collected using a data recorder. Plant samples were collected from the field and photographs were taken to aid identification. Other relevant information were gathered by conducting repeated inquiries at different times with the same informants to

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ensure the accuracy of the information originally obtained and recorded. Identification was accomplished at the FBC International Herbarium, located at Norman Cole Building, Department Biological Sciences, Fourah Bay College. The given local names were cross-referenced with those on the vernacular botanic list of the Flora of Sierra Leone. Some individual local names differed, therefore the plants had to be physically identified in order to be properly reported. The plant specimens were collected, pressed, and dried in preparation for final deposition at the mentioned Herbarium.

Data Processing and Analysis

The resulting data of the study are presented in tables, graphs, and percentages. The Relative Frequency of Citation (RFC) was calculated as the total number of times a species was mentioned/the total number of times that all species were mentioned x 100 and presented. The percentage of occurrence of various growth habits, part and method of preparation of the plant species are also presented.

RESULTS

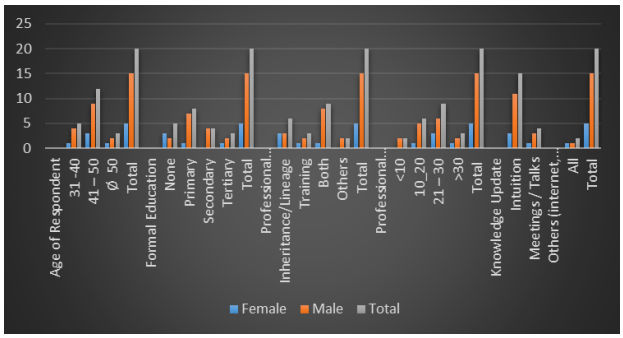

Figure 2: The socio- demographic status of the respondents

As observable in Fig 2, of the twenty THMPs engaged in this study, 15 (75%) were men and 5 (25%) were women. All of the respondents were matured men and women and were above 30 years of age, 15 of them (75%) being over 40 years of age. There were only three respondents (one female and two males) that were over 50 years old. Most of the respondents have some form of formal education. The majority of the healers (60%) had only primary and/or secondary education, while 3 of them had tertiary education and 5 do not have any formal education at all. The fact that some traditional healers have tertiary education shows that the profession is developing and attracting highly educated people, unlike in older times when only unlearned people practiced alternative medicine as a profession. With respect to experience, up to 60% of them had practiced the profession for more than 20 years. Most of the respondents came into the profession by inheritance (30%, being their family trade), or by training or both, while a few were through natural gifts or talents (10%). The THMPs updated their knowledge of medical practice through a wide range of choices, such as by intuition (70%), attendance at health talks or meetings (20%) and, while 10% of them adopted various forms of a combination of these and other choices. All 20 of the THMPs denied having experienced misidentification of plant species in the past because of their vast knowledge and experience. However, some of them confirmed misidentification by some of their assistants who were undergoing training at some time, and in such situations, measures like proper supervision are ensured, to avoid and control this problem. In the case of hygiene measures taken during preparation, all of the

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THMPs reported that proper hygiene has always been observed and maintained at the highest possible level.

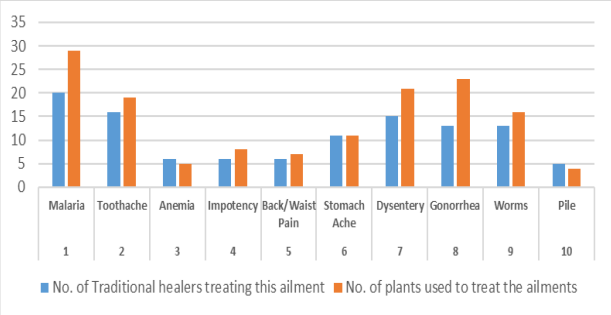

Figure 3: Various ailments that are treated using Traditional Herbal Medicine in Freetown.

Figure 3 is an illustration of the traditional healers and the type of disease that they treat. From this we could observe that malaria top the list both in the ailment treated by these traditional healers and also in the number of plants used to treat it (28, 20). Gonorrhea was next with 15 traditional healers having the knowledge of the treatment and naming 20 different plants used for the treatment. In this study, not many traditional healers are involved in the treatment of anaemia and pile with a few number of plants have been named for the treatment (5, 4).

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Table 1: Names of Plants Used in Formulation of Traditional Herbal Medicine for Treatment of Malaria.

No.	Plant Species	Family Name	Local Name	Part/s Used/ Growth habit	Preparation and Administration by the respondent indicated
1	*Aframomum melegueta*	Zingiberaceae	Aligata pepe (K)	Seeds/Herbs	Boiling of seed and decoction taken orally and steam bath
2	*Alstonia boonei*	Apocynaceae	Patan wood (K)	Stem,Root/Tree	Stem or root decoction drunk
3	*Ananas comosus*	Bromeliaceae	Pineapul (K)	Fruit/Tree	Fruit peel decoction drunk
4	*Cassia siberiana*	Fabaceae	Gbangba (K)	Root/Shrub	Stem is soaked in water for days/boiled and drunk
5	*Cassia siamea*	Fabaceae	ShekuTuray (K)	Stem/leaves/ Tree	Root is macerated and decoction made for drinking
6	*Carapa procera*	Meliaceae	Kayut (Te)	Leaves/Tree	Infusion of leaves is drunk
7	*Citrus aurantifolia*	Rutaceae	Lem (K)	Leaves/Shrub	Infusion of leaves is drunk
8	*Craterisperum laurinum*	Bignoniaceae	Amfori (Te)	Bark/Shrub	Inner bark of stem is boiled and decoction is drunk
9	*Dialium guineense*	Rutaceae	Black tombla(K)	Leaves/Tree	Leaves is grounded with lime, squeezed and juice is drunk
10	*Erythrococca anomala*	Euphorbiaceae	Bush lem (K)	Leaves/Shrub	Powdered leaves mixed with clay and applied as a lotion
11	*Harungana madagascariensis*	Hypericaceae	Pamayn tik (K)	Bark/Tree	Bark decoction is either mixed with leaves of *Manniphyton fulvum* or drunk directly
12	*Lantana camara*	Verbernaceae	Kru man popo (K)	Root/Shrub	Decoction is combined with the leaves of *Cymbopogon citratus* or taken directly
13	*Mangifera indica*	Anacardiaceae	Mangro (K)	Bark/Tree	Bark of stem slashed at East and West sides of the tree and boiled with ashes, used for washing with native soap
14	*Morinda germinate*	Rubiaceae	Brumston (K)	Leaves/Shrub	Semi-dried leaves are boiled and drunk
15	*Morinda morindoides*	Rubiaceae	Ojuologbo (K)	Leaves/Shrub	Boiled decoction with lime (*Citrus aurantofolia*) is drunk
16	*Mitragyna stipulosa*	Rubiaceae	Boe (Me)	Bark/Tree	Bark of stem is soaked in water for days/ boiled and drunk.
17	*Momordica charantia*	Cucurbitaceae	Spodila (K)	Leaves/Herb	An infusion/decoction is drunk directly or together with *Morinda germinate*

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18	*Musa sapientum*	Musaceae	Banana (K)	Leaves/Shrub	Young leaves are boiled and decoction is taken
19	*Newbouldia laevis*	Bignoniaceae	Kundinakara(K)	Leaves/ Shrub	Dried leaves decoction is drunk
20	*Persea Americana*	Lauraceae	Piya (K)	Seeds/Tree	Seeds are pounded, soaked in water, filtered and drunk
21	*Spondias mombin*	Anacardiaceae	Fix Plum (K)	Leaves/Tree	Leaves infusion with that of *Carica papaya* is used for bathing
22	*Momordica charantia*	Loganiaceae	Simiji (K)	Leaves and fruit/Shrub	Leaves crushed and rub on the body and fruits eaten
23	*Uvaria chamae*	Annonaceae	Finga (K)	Leaves/Shrub	Infusion or decoction of dried leaves plus *Sterculia tragacantha* is used for bathing
24	*Vernonia amygdalina*	Asteraceae	Somant (Te)	Leaves/ Herb	Dried leaves decoction with salt is drunk
25	*Xylopia aethiopica*	Annonaceae	Guinea pepe (K)	Fruits and Seeds/Tree	Both are grounded with ginger (*Zingiber oficinale*) and rubbed over the body Fruit pods infusion is also drunk

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

Table 2: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Toothache

No.	Plant Species	Family Name	Local Name	Part/s Used/ Growth habit	Preparation and Administration by the respondent indicated
1	*Acacia pennata*	Fabaceae	An-thanjani (Te)	Leaves/Tree	Young leaves are boiled and decoction is held in mouth
2	*Aframomum* melegueta	Zingiberaceae	Aligata pepe(K)	Seeds/Herb	Grounded, put into cotton wool and applied to affected tooth
3	*Anacardium occidentale*	Anacardiaceae	Kushu(K)	Leaves/Tree	Grounded and applied to the affected tooth
4	*Alchornea cordifolia*	Euphorbiaceae	Krimaslif(K)	Leaves/Shrub	Dried, boiled and juice is held in mouth
5	*Bertiera spicata*	Rubiaceae	Kafa (Me)	Bark/Shrub	Bark of the stem is boiled and juice is held in mouth
6	*Citrus sinensis*	Rutaceae	Orinch(K)	Bark/Tree	Inner bark of stem is boiled with salt and decoction held in mouth

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7	*Citrus aurantifolia*	Rutaceae	Lem(K)	Root/Shrub	Root bark is boiled and decoction is held in mouth or whole fruit is squashed and juice is held in mouth
8	*Carica papaya*	Caricaceae	Popo(K)	Root/Herb	Grounded and applied to affected tooth or boiled and juice is held in mouth
9	*Lygodium microphyllum*	Lygodiaceae	Yolo (Me)	Leaves/Tree	Boiled and decoction held in mouth
10	*Mangifera indica*	Anacardiaceae	Mangro(K)	Bark/Tree	Bark of stem boiled and juice held in mouth
11	*Manihot esculenta*	Euphorbiaceae	Casada(K)	Leaves/Shrub	Boiled with salt and juice is held in mouth or drunk without salt
12	*Musanga cecropicoides*	Urticaceae	An-fekan (Te)	Bark/Tree	Bark of stem is boiled and decoction is used as a gargle
13	*Newbouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Leaves/Shrub	Leaves are grounded and put-on affected tooth
14	*Phyllantus discoideus*	Phyllanthaceae	Tijo (Me)	Stem and Leaves/Tree	Bark slashed and cooked or young leaves boiled and juice held in mouth
15	*Spondias mombin*	Anacardiaceae	Fix-plum(K)	Leaves/Tree	Leaves boiled and juice held in mouth
16	*Samanea dinklagei*	Fabaceae	Ngonjgo (Me)	Leaves/Herb	Leaves boiled and juice held in mouth
17	*Uncaria Africana*	Rubiaceae	Kooka (Me)	Leaves/Shrub	Boiled/squashed juice kept in mouth
18	*Voacanga thouarsii*	Apocynaceae	Gbonu (Me)	Latex/Tree	Latex found in bark of stem is put into cotton wool and applied into affected tooth. Stem is also macerated and applied

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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Table 3: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Anaemia

No.	Plant Species	Family Name	Local Name	Parts Used	Preparation and Administration by the respondent indicated
1	*Alchornea cordifolia*	Euphorbiaceae	Krismaslif(K)	Leaves/Shrub	Boiled or squashed and juice is drunk
2	*Bidens Pilosa*	Asteraceae	Nidullif(K)	Leaves/Herb	Crushed and infusion is drunk
3	*Ficus capensis*	Moraceae	Waytewata(K)	Bark/Tree	Inner bark of stem tissue is removed and boiled until a bright red liquid is obtained and drunk
4	*Ipomoea batatas*	Convolvulaceae	Petetelif(K)	Leaves/Shrub	Young leaves are crushed and juice is drunk

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

Table 4: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Impotency

No	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Alchornea cordifolia*	Euphorbiaceae	Krimaslif(K)	Stem/Shrub	Fresh leafy stems are chewed
2	*Aframomum melegueta*	Zingiberaceae	Aligata pepe(K)	Fruits/Herb	Boiled and decoction is drunk
3	*Carpodinus dulcis*	Apocynaceae	Malory (Te)	Leaves/Shrub	Soaked for four hours and boiled, decoction is drunk
4	*Fagara macrophylla*	Rutaceae	Ambek (Te)	Leaves/Tree	Decoction is boiled and drunk
5	*Ficus capensis*	Moraceae	Waytewata(K)	Leaves/Tree	Decoction is drunk
6	*Hibiscus sabdariffa*	Malvaceae	Sawasawa(K)	Leaves/Shrub	Decoction is drunk or fresh leaves are chewed
7	*Landolphia dulcis*	Apocynaceae	Malombo(K)	Bark/Shrub	Decoction of the trunk-bark is drunk
8	*Mezoneurum benthamianum*	Fabaceae	Am-bandebrup (Te)	Root, Bark, Leaves/Shrub	Decoction is drunk
9	*Newboouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Leaves/Shrub	Decoction is boiled and drunk

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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Table 5: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Back/Waist Pain

No.	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Dialium guineense*	Rutaceae	Blaktombla(K)	Leaves, Fruits/Tree	Grounded, heated and tied to waist or fruit is soaked and juice is drunk with garlic
2	*Newboulda laevis*	Bignoniaceae	Kundinakara (Ma)	Leaves/Shrub	Boiled and decoction is used for washing
3	*Psidium guajava*	Myrtaceae	Gueva(K)	Leaves/Tree	Grounded with *Elaeis guineensis,* heated and tied on the back or whole fruits chewed
4	*Spondias mombin*	Anarcardiaceae	Fix plum(K)	Stem, Flowers/Tree	Grounded, heated and applied on the back
5	*Musanga cecropicoides*	Urticaceae	An-fekan (Te)	Root/Tree	Boiled and applied as a wash

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

Table 6: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Stomach Ache .

No.	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Aframomum melegueta*	Zingiberaceae	Aligata pepe(K)	Seed/Herb	Grounded, soaked, filtered and juice is drank
2	*Fagara macrophylla*	Rutaceae	Am-bek (Te)	Stem/Tree	Bark is grounded in a mortar, boiled and drunk
3	*Harungana madagascariensis*	Hypericaceae	Palm oil tik(K)	Sap/Tree	Inner bark is put in water and drunk
4	*Mitragyna stipulosa*	Rubiaceae	Boe (Me)	Bark/Tree	Bark of mature stem with the ripe fruit of *Xylopia aethiopica* are pounded and boiled, decoction is taken
5	*Musa sapientum*	Musaceae	Banana(K)	Fruit/Herb	Peel of ripe fruit is boiled or. dried with salt and soaked, juice is drunk
6	*Newbouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Root/Shrub	Boiled and juice is drunk
7	*Ocimum viride*	Lamiaceae	Tea bush(K)	Leaves/Herb	Boiled with honey and drunk
8	*Piper guineense*	Piperaceae	Am-pent (Te)	Stem/Shrub	Mature stem of creeper boiled and juice drunk
9	*Secamone afzelii*	Asclepiadaceae	A-lilarokant (Te)	Leaves/Shrub	Boiled and decoction is taken
10	*Spondias mombin*	Anarcardiaceae	Fix plum	Leaves/Tree	Boiled and taken orally

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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Table 7: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Dysentery

No.	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Anthonotha macrophylla*	Fabaceae	Roswod(K)	Leaves/Shrub	Boiled and taken orally
2	*Amphimas pterocarpoides*	Fabaceae	Ka-thanjka (Te)	Bark/Tree	Boiled and taken orally
3	*Cnestis ferruginea*	Connaraceae	Nyamawa (Me)	Stem/Shrub	Settled in water for some time and is drunk
4	*Diospyros thomasii*	Ebenaceae	Ka-bupkasi (Te)	Leaves/Tree	Leaves cooked and taken orally
5	*Gossypium hirsutum*	Malvaceae	Kotin(K)	Leaves/Tree	Boiled and taken orally or grounded, soaked and drunk
6	*Harungana madagascariensis*	Hypericaceae	Palm oil tik	Leaves/Tree	Young leaves together with *Solanum melongena*
7	*Manniophyton fulvum*	Euphorbiaceae	Njolo (Me)	Leaves/Shrub	Boiled and decoction is drunk (N, S)
8	*Microdesmis puberula*	Euphorbiaceae	Nikilf (Me)	Leaves/Shrub	Cooked with *Solanum melongena* and juice/decoction is drunk
9	*Musa paradisiaca*	Musaceae	Plantin(K)	Fruit/Herb	Pounded and eaten with salt
10	*Newbouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Leaves/Shrub	Roasted with beni-seeds, pounded in a mortar and powder is eaten
11	*Ocimum gratissimum*	Lamiaceae	Tea bush(K)	Leaves/Herb	Boiled with honey, salt or garlic and drunk
12	*Psidium guajava*	Myrtaceae	Gueva(K)	Leaves/Tree	Boiled/macerated, infused and drunk
13	*Parinari excels*	Rosaceae	Rof skin plom(K)	Fruit/Tree	Infusion of fruit is drunk
14	*Phyllantus muellerianus*	Euporbiaceae	Furuka (Ma)	Leaves/Shrub	Infusion of young shoot is drunk
15	*Sesamum indicum*	Padaliaceae	Beni(K)	Seeds/Shrub	Pounded with young leaves of *Manniophyton fulvum* and infusion is drunk
16	*Smeathmannia pubescens*	Passifloraceae	Ndovota (Me)	Bark/Tree	Pounded and soaked and juice/decoction is drunk
17	*Tetracera alnifolia*	Dilleniaceae	Katanta (Me)	Leaves/Shrub	Boiled with leaves from *Alchornea hirtella* and fruit from *Solanum melongena* and drunk
18	*Tetracera potatoria*	Dilleniaceae	Kondo tail(K)	Leaves/Shrub	Leaves boiled and decoction is drunk

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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Table 8: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Gonorrhea

No.	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Ageratum conyzoides*	Asteraceae	Wet ed lif(K)	Leaves/Herb	Pounded with leaves from *Xylopia aethiopica*, infuse in water and drunk
2	*Alchornea cordifolia*	Euphorbiaceae	Krismaslif(K)	Stem/Shrub	Pounded with stem from *Ananas comosus*, water and *Citrus aurantifolia* juice is added, mixed and filtered. Warmed in the sun/boiled and decoction is drunk
3	*Albizia adianthifolia*	Fabaceae	Ka-pun (Te)	Bark/Tree	Pounded and palm wine or bamboo wine is added and kept for some hours. Liquid is drunk or Infused with *Allium sativum*
4	*Arachis hypogaea*	Fabaceae	Granat(K)	Nut/Shrub	Soaked and liquid is drunk
5	*Craterispermum laurinum*	Rubiaceae	Alem-bak(K)	Stem/Shrub	Pounded with bark of *Citrus aurantifolia* and juice boiled, filtered and taken orally
6	*Dialium guineense*	Rutaceae	Blaktombla(K)	Leaves/Tree	Boiled and decoction is drunk
7	*Ficus exasperate*	Moraceae	Gono (Me)	Leaves/Tree	Boiled with fruit and leaves from *Citrus aurantifolia*, filtered and juice is stored in bottles to be taken orally
8	*Lophira lanceolata*	Ochnaceae	Ayen wood(K)	Leaves/Tree	Decoction of red young leaves is drunk
9	*Macaranga heterophylla*	Euphorbiaceae	Ka-fep (Te)	Leaves/Tree	Boiled and decoction is drunk
10	*Marsdenia latifolia*	Asclepiadaceae	Rope Quiah(K)	Bark/shrub	Outer bark scraped, cut into small pieces and boiled. Juice is drunk
11	*Mezoneurum benthamianum*	Fabaceae	Sangba (Me)	Leaves/Shrub	Boiled and decoction is drunk
12	*Nauclea latifolia*	Rubiaceae	Igbesi(K)	Leaves/Tree	Boiled and decoction is drunk
13	*Newbouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Root/Shrub	Decoction is drunk
14	*Phyllantus muellerianus*	Phyllanthaceae	Eg-bele (Te)	Bark/Shrub	Root bark decoction is drunk
15	*Scorparia dulcis*	Plantaginaceae	Tri lif(K)	Leaves/Herb	Boiled and decoction is drunk Taken with honey
16	*Saccharum officinarum*	Poaceae	Likala (Ma)	Stem/Shrub	Boiled with stem from *Costus afer* and fruit of *Citrus aurantifoila* and juice is drunk
17	*Secamone afzelii*	Apocynaceae	An-thoth-an-thi (Te)	Leaves/Shrub	Macerated and macerate is drunk
18	*Spondias mombin*	Anarcardiaceae	Fix plum(K)	Bark/Tree	Boiled and decoction is drunk
19	*Voacanga africana*	Apocynaceae	Gbonu (Me)	Sap/Tree	Infusion is drunk

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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Table 9: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Worms

No.	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Alstonia boonei*	Apocynaceae	Patan wud(K)	Bark/Tree	Bark of mature stem boiled and drunk
2	*Anchomanes difformis*	Araceae	Kipono (Me)	Sap/Shrub	Leaves can either be soaked or infused before drinking
3	*Aspilia latifolia*	Asteraceae	Fidanwanyane (Ma)	Leaves/Shrub	Boiled and decoction is drunk
4	*Bersama abyssinica*	Francoaceae	Jondoba (Me)	Bark/Tree	Inner back is dried, soaked/cooked and juice is taken orally
5	*Carica papaya*	Caricaceae	Popo(K)	Seeds/Herb	Leaves can be chewed raw
6	*Ficus exasperate*	Moraceae	Gono (Me)	Bark/Tree	Boiled and decoction is drunk
7	*Citrus aurantium*	Rutaceae	Awayato(K)	Fruit/Tree	Juice from ripe fruit is soaked with cold ashes
8	*Dichrostacys glomerata*		Am-pent-kali (Te)	Bark/Tree	Bark fibre of stem is soaked and drunk
9	*Hyptis suaveolens*	Lamiaceae	Bush tea(K)	Leaves, Stem/Herb	Leaves and stem are beaten in mortar with *Citrus aurantifolia* and salt. The juice is taken orally.
10	*Harungana madagascariensis*	Hypericaceae	Palm oil tik(K)	Bark/Tree	Decoction is drunk
11	*Newbouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Leaves/Shrub	Boiled and decoction is drunk
12	*Ocimum viride*	Lamiaceae	Tea bush(K)	Leaves/Shrub	Boiled and decoction is drunk
13	*Ocimum gratissimum*	Lamiaceae	Tea bush(K)	Leaves/Herb	Boiled and decoction is drunk
14	*Ipomoea involucrata*	Convolvulaceae	Sewane (Ma)	Leaves/Herb	Macerated and filtered and juice is drunk
15	*Scoparia dulcis*	Plantaginaceae	Ma-bong (Me)	Leaves/Herb	Chewed raw (P)
16	*Vernonia amygdalina*	Asteraceae	Bitter lif(K)	Leaves/Shrub	Macerated with salt and drunk (R)

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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Table 10: Names of Plants Used in the Formulation of Herbal Medicine for the Treatment of Pile

No.	Plant Species	Family Name	Local Name	Part/s Used/Growth habit	Preparation and Administration by the respondent indicated
1	*Ocimum bacillum*	Lamiaceae	Tea bush(K)	Leaves/Herb	Decoction is drunk
2	*Mimosa pudica*	Mimosaceae	Tie yulapa(K)	Root/Herb	Leaves decoction is drunk
3	*Newbouldia laevis*	Bignoniaceae	Kundinakara (Ma)	Leaves/Shrub	Leaves are squashed and juice is drunk
4	*Psidium guajava*	Myrtaceae	Gueva(K)	Leaves/Shrub	Leaves can be chewed directly or decoction made for drinking

Note: K: Krio, Me: Mende, Te: Temne, Ma: Madingo.

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An aggregate of 92 plants species spread across 41 families were referenced by respondents as solutions for 10 common health challenges as documented in Tables 1-10 above. These plants are utilized either independently or in combination with various other plants or substances. Different pieces of similar plants or different plants may be utilized, while a few arrangements are regulated alongside added substances like nectar, sugar, kojo, earth (soil), zest, etc. The Fabaceae family had the highest number of plant species (10) across the ten tables, trailed by Euphorbiaceae/Rutaceae and Rubiaceae with 9 and 8 species respectively. Seven species were listed from the family Apocynaceae while Lamiaceae and Asteraceae families were represented by 6 and 5 species respectively. Other families were represented by less than 3 species or less across the tables.

The determined RFC showed ranges from RFC = 1.05 (*Newbouldia laevis*), to RFC = 0.54 (*Citrus aurantifolia*), to RFC=0.40 (*Carica papaya*), to RFC = 0.35 (*Zingiber officinale*), to RFC = 0.35 (*Alchornea cordifolia*), to RFC = 0.30 (*Aframomum melegueta*), then RFC = 0.30 (*Cassia siberiana*) and RFC = 0.30 *Spondias mombin*). Among the mostly-utilized medicinal plant species. *Newbouldia laevis* has the highest Use Value (UV) of 1.05, demonstrating its significance in home grown clinical fix. The plant family most referred to was Fabaceae, and the Family Importance Value was most noteworthy in Fabaceae (75%) in the treatment of the sicknesses under study. According to the respondents, the mentioned plants were obtained both from the wild (90.0%) and by intentional and purposeful cultivation (10.0%). Notwithstanding, more prominent levels of therapeutic plants from wild sources demonstrated higher species variety in the investigation territory.

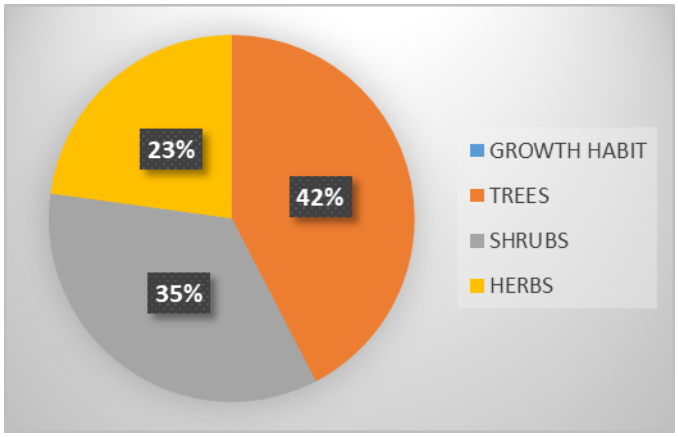

Figure 4: Growth habits of the plants used for different ailments in Freetown, Sierra Leone

As illustrated in Fig. 4, trees were the most common growth form of the plants used in medicinal preparation for remedies. 39 (42.4%) of the plants used are trees species, 32 (34.8%) shrubs and 21 (22.8%) herbs.

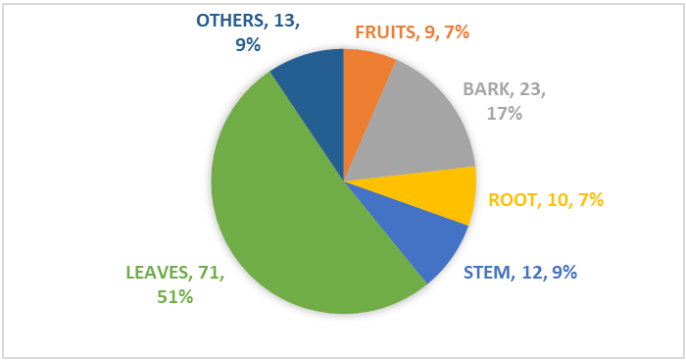

Figure 5: Percentage of Plant Parts Used in the Treatment of Ailments in the study area.

Fig. 5 indicates that the plant parts mostly used in the preparation of recipes were leaves, stem, flowers, fruits, seeds, bark, latex and so on. Leaves (77%) were the most frequently used plant part, followed by bark (25%), then stem (13%), root (10.8%), fruits (9.7%), and others such as seeds, latex, gum, flowers (14.1%). Most of the time the plant parts are used in combination.

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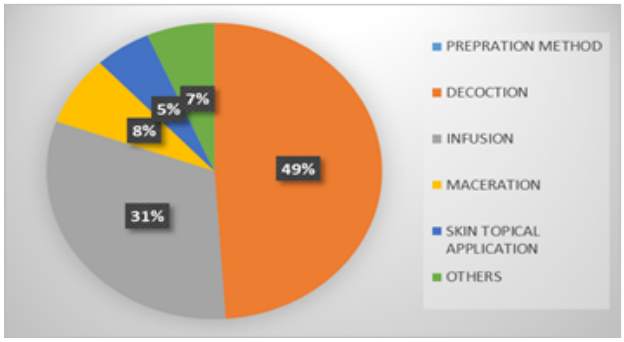

Figure 6: Percentage of Different Preparation Methods in the Treatment of Ailments in the study area.

The investigation as revealed in Fig. 6 discovered a few strategies for preparing the natural medication. They include decoction (48.9%), infusion (31.5%), maceration (7.6%), applied to skin (5.4%) and other methods reported in the figure above (6.5%).

DISCUSSION

Overall, in this study, 92 plant species have been explored across 41 families. The fabaceae family tops the list as the most mentioned, followed by Euphorbiaceae/Rutaceae and Rubiaceae with 9 and 8 species respectively. While the Apocynaceae were represented by 7 species, 6 species by Lamiaceae and 5 species by Asteraceae. The other families were represented by less than 5 species and 8 species. Different plant parts with various growth habits were reported in this study. Such parts ranged from leaves to seeds, stem, bark, flowers etc. While leaves were the most utilized plant parts, fruits were the least utilized. Trees were reported to be the most common while the least category of plants were herbs. Among the preparation procedures reported, decoction method was the most employed by respondents while direct use, especially by application on the skin was the least employed procedure for the treatment of various ailments. The predominant plants utilized or their families would rely upon the species structure and distribution of the zone as indicated by Sofowora (2013). The examination shows that malaria is the most predominant in the study area. Million *et al*. (2022) reported over 200 million incidents and over 600,000 deaths through malaria in 2020.

Information accrued on the different plant parts utilized showed that leaves are significantly more utilized than the other parts, followed by the stem. Past reports have also revealed that leaves were the most utilized parts of the plant in treating various medical issues (Aziz *et al*., 2018). Given that the most elevated plant part utilized for restorative purposes were the leaves, the investigation on the exposure of the zone to the danger of annihilation through harvest of therapeutic plants could be regarded as insignificant. Regardless, high dangers to the mother plant can occur by accompanied utilization of root, evacuation of bark and verdant stem harvests from the same plant stand. Therefore, there is need for the establishment of policies to guide the conservation and sustainable use of medicinal plants. Both in-situ and ex-situ methods of conservation and sustainability have been proposed by Chen *et al*. (2016), to resolve such conservation issues which may evolve in the future.

As indicated by the sources, most of the plant parts for therapeutic uses are either utilized independently or in combination with different plants or plant parts. Substances like sugar, table salt, nectar, alcohol, kojo etc may be added to the herbal formulations, purposefully, such as to expand the recuperating potential, improve the taste or diminish antagonistic impacts etc as the cases may require (Macfoy, 2013). For example, a customary medication applied to treat basic viral infection is set up by decoction of the leaves of *Cymbopogon citratus* with substances like nectar and alcoholic added (Lebbie and Raymond, 1995). Crushed pepper

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was also reported to be added to boiled leaves of either *Spilanthes calva* or *Commelina paludosa*, in the bid to enhance its palatability during consumption (Shofowora *et al*., 2013).

As presented above, the customary home-grown medications created in Freetown, is an impression of the commonness of jungle fever, gonorrhea, looseness of the bowels (dysentry) and toothache among the inhabitants of the city. There is enough proof to show that malaria is a significant general medical issue in Sierra Leone (CDC (2022), representing a larger number of cases and passings than most nations on the planet. The transcendence of traditional medications against malaria among the customary healers in the investigation zone is an affirmation that the illness is pervasive in the examination territory. This investigation also shows that the most noteworthy level of therapeutic plants are obtained from the wild (90%) while the rest (10%) developed on purpose. In concurrence with this investigation, comparable level of therapeutic plant species recorded from various nations have been reported by Macfoy, 2013, Sofowora *et al*., 2013, Ekor, 2014, Chen *et al*, 2016, Aziz, 2018, James *et al*., 2019, El-Dahiyat *et al* 2020.

Different methods of herbal preparation were reported in this study. A plant or a piece of the plant part can be bubbled (decoction) while infusion is obtained by absorbing the plant material cold or heated water for a while. Based on the findings of this examination, different strategies for administration of herbs include taking orally, by inhalation or applied as treatment (rubbed on the surface). Overall, the most commonly utilized method of administration of homegrown drugs was oral admission. This has corroborated the report of Hussain *et al*. (2018). The preservation status and populace elements of each plant was checked against the IUCN red rundown of compromised plants (IUCN Biodiversity Report, 2017), and none of the plants in this study was listed as being compromised or helpless. Be that as it may, two of the plants, (*Carica papaya* and *Mangifera indica*) are recorded in the "Information Deficient" categories.

The study revealed that a portion of the THMPs gather crude materials all by themselves from the wild while others buy them from sellers, whose source of harvesting of the parts were unknown (Salimova, 2020). Since the entirety of the plant species utilized for disease remedies in this investigation area are not compromised, it is sensible to assume from available information through this study and data in the red rundown of IUCN (2017), that all things being equal, the creation of forest reserves in the investigation zone may practically have no considerable adverse effects on the climate. Likewise, the activities of these conventional healers do not currently seem to pose any danger to the number of inhabitants in these territories. Endeavors made by certain THMPs in developing a portion of the spices and bushes they use is praiseworthy, yet there is opportunity to get better. There is a rich hold of native information on restorative plants because of an enormous number of specialists of conventional medication; notwithstanding, the logical approval of these customary cases is still at its outset.

CONCLUSION

Freetown has a rich wellspring of restorative plants and an enormous part of the populace actually depend on customary plant drugs which is widely and promptly accessible, practical, and accepted as being potent. Native information on the cures have been moving from one age then onto the next through conventional healers, proficient older folks, or common individuals, generally with no supporting documentation.

The significance of ethnobotanical and conservation research has been expanding,

since likely wellsprings of medications could vanish later on because of the fast loss of biodiversity. This study however zeroed in on the investigation region which will make some commitment in the safeguarding of the conventional frameworks of medication by appropriate recognizable proof, documentation, and harmonization of restorative information. Consequently, ethnobotanical contemplates and ensuing protection measures are direly needed to forestall the deficiency of important native information on restorative plants.

Also, from this investigation, there is a requirement for coordination of customary healers in the country, so as to lessen uncoordinated solutions involving various botanicals, and disparities in fixings among conventional healers. The significant employment of restorative plants for treatment of various sicknesses have been discovered, but these cures should be affirmed through logical experimentations to distinguish those that may give options in contrast to contemporary medications. There is need for proper training of THMPs and their understudies to forestall lapses in the area of dosage, hygiene, biodiversity protection and documentation.

CONFLICT OF INTERESTS

The writers declare that there is no conflict of interests pertaining to this study.

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