

Ethnobotanical Survey of Medicinal Plants in Mwala Sub-County, Machakos County, Kenya

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Abstract: Studies on traditional use of medicinal plants can provide leads towards discovery of pharmaceutical drugs for treatment of both human and livestock diseases. This study sought to identify and document the use of medicinal plants by residents of Mwala Sub-county in Machakos County, Kenya. The research employed cross-sectional research design where simple random sampling was used to select the households to be sampled. A sample size of 61 households was used for the study and data collected by use of semi-structured questionnaires. Voucher specimens were collected, pressed, dried, mounted and identified at the Kenya Forestry Research Institute (KEFRI) Herbarium. Microsoft Excel Spreadsheet and Statistical Package for Social Sciences (SPSS) were used for data analysis and results presented in the form of tables and graphs. The study focused on identifying medicinal plants used, diseases treated, parts of the plant used, and methods of preparation and routes of administration. Research findings documented a total of 51 plants species from 31 families used to treat 38 different disease conditions in the study area. The commonly used plant species was *Aloe secundiflora* (11.1%) while Malaria (19.8%) was the most cited disease. The most used plant parts were the leaves (52.8%) and bark (19.4%). About 75.4% of the respondents acquired knowledge on medicinal plant use through apprenticeship from relatives. With the stocks of medicinal plants declining in the area, there is need for conservation, domestication and better management of key medicinal plants. Additionally, documentation of the indigenous knowledge is necessary to ensure intergenerational benefits from the herbal medicines.

Keywords: Bio Piracy, Indigenous Knowledge, Ethnobotany, Conservation

1. Introduction

Ethnobotany is the study of how people in a particular region or a given culture make use of their locally available native plants thus studies in ethnobotany and Traditional Ecological Knowledge (TEK) serves as a linkage between conservationists and local communities. Such studies shows how the locals interact with their environment thereby making a way for their participation in conservation [1] The World Health Organization [2] estimates that about 80% of the World's population in developing countries are still dependent on herbal medicine for their primary healthcare. About 95% of African drug needs comes from medicinal

plants and as many as 5,000 plant species in Africa are medicinally significant [3]. Most African communities lack access to modern health facilities and services and they are vulnerable to health challenges experienced in their respective areas. They have therefore adopted the use local and indigenous knowledge in order to come up with remedies to such adversities [4]. Medicinal plants serve as a reservoir of curative elements used by a large population of African local communities in the cure and management of various diseases such as malaria, diabetes, respiratory infections, skin diseases, diarrhea, hypertension and mental disorders and many others [5]. In many cultures globally, the use of medicinal plants is common while most advanced pharmaceutical drugs have been derived from these plants

[6]. Historical accounts and literature sources reveal that modern medicine has greatly benefited from traditional medicine particularly remedies derived from botanical medicinal plants [7]. Despite the dominance of traditional medicine in health provision globally there is, still very scanty documentation of the medicinal flora. There is an urgent need therefore to document these plants and the indigenous knowledge for future references [8]. Kenyans also have a hand in the use of medicinal plants. Over 70% of the population in Kenya relies on traditional medicine as their primary source of healthcare [9]. Traditional medicines play a major role in primary healthcare and upkeep of Kenyan rural communities and is preferred at the expense of modern drugs, since they are locally available, cheap, self-administered and apparently effective [10].

Increased demand for medicinal products in the recent past has led to increased utilization, thus threatening survival of these plants in their natural habitats [11]. Unsustainable utilization of wild medicinal flora has been majorly as a result of increased commercialization of herbal products [12]. Unmonitored trade of medicinal plant resources, habitat loss, overexploitation, destructive harvesting techniques and habitat change are other primary threats to medicinal plant resources in developing nations [13]. Sindiga, [14], blames lifestyle changes inclined towards western culture to the loss of Ethnobotanical knowledge while others Cox [15] cites lack of interest by the young generation in traditional knowledge and ancient way of life, as the root causes of decreased use of medicinal plants. Conservation of medicinal plant species is therefore vital for local health as well as

international drug development. Local knowledge an important tool in the conservation of natural resource and biodiversity [11, 16]. Traditional knowledge on natural resources management however becomes more useful when integrated with the modern conservation approaches [17]. Ethno botanical research plays an imperative role in highlighting the highly utilized and endangered plants for conservation and sustainable utilization [18]. Clear management strategies are essential to avoid extinction of threatened medicinal plant species. Public awareness is equally important for sustainable utilization and conservation of wild plant stocks in regards to ensuring conservation of medicinal plants in Kenya [11, 19-20].

Mwala region, Machakos County of Kenya has a rich diversity of plants, some of which the locals rely on as remedies to both human and livestock ailments. In this remote region, several diseases are common and the people rely on the highly respected traditional practitioners who prescribe cures for many of the diseases using herbs, roots, charms and sometimes even rituals [21-22]. The people together with the local traditional healers have accumulated indigenous knowledge and practices on the use and processing of these plants for medicinal purpose. Local and traditional healers possess enormous information on traditional medicine [23]. However, these information has not been documented a factor which informed the study. The study therefore sought to document the different medicinal plant species in Mwala sub-county, diseases and ailments treated, threats to medicinal plants and the current conservation practices carried out.

2. Description of Study Area and Methodology

2.1. Description of Study Area

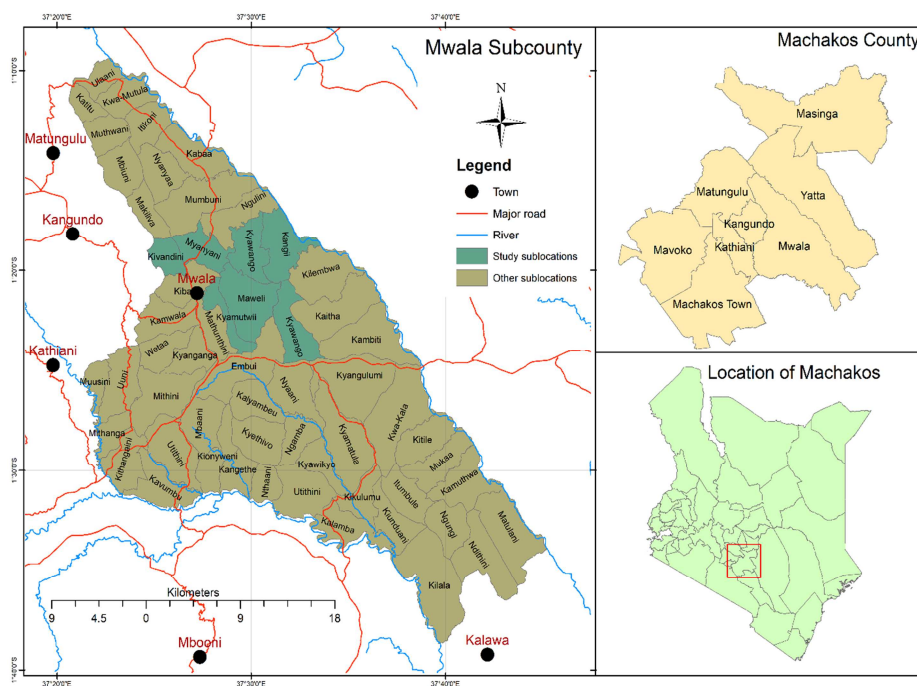


Figure 1. Map of the study area (Source: Author).

This study was conducted in Mwala sub county, Machakos County, Kenya. The sub county covers an area of approximately 1,018 km² and lies between 01°21'10.45" S, 37°27'10.35"E (Figure 1). The area has ecologically distinct climate characterized by low and erratic bimodal rainfall with two distinct rainy seasons (short and long rains). The short rains which occur from October to December are more reliable and evenly distributed in this region [24]. The mean annual rainfall is about 596.7mm and an altitude of 1186m (A. S. L) and the mean annual temperatures range between 21.3°C to 22°C [25]. The sub county has a population of about 163,032 people. Dominant vegetation includes fruit trees including *Mangifera indica*, *Citrus sinensis*, *Carica papaya*, Acacia and Euphorbia tree species.

2.2. Methodology

Cross-sectional research design was used for this study. This design aims at investigating personal information related to attitude, belief and opinion of the target population. This study targeted 100 people which included key informants (herbalists), the general population (other people in the community with knowledge on medicinal plants) and herbal medicine vendors in the market.

The survey was conducted between December, 2017 and January, 2018 using structured questionnaires, Key Informant Interviews (KII), group discussions, demonstrations and guided field walks. Knowledgeable key informants were selected based on recommendations from the local people and the local community leaders. Study subjects were selected using random sampling technique six Sub-locations namely Maweli, Kyawango, Kivandini, Kyamutwii, Kangii and Myanyani. Selection was made from all households within the distance of 0 to 500m along the Mwala-Kyawango road. From the sampled households, at least one member of the family was selected for the study regardless of age, education, sex and occupation as long as they were willing to participate in the study. Semi structured interviews were done for primary data collection. Interviews and group discussions were conducted in the local Kamba dialect and were complemented by field walks. Data collected revolved around socio economic characteristics of the respondents, local names of the plant species, medicinal uses, parts used, methods of preparation, and administration route were documented. Additional information on the conservation of the plants used as remedies to diseases was also noted down. Voucher specimens were collected, pressed, dried, mounted and identified in the Kenya Forestry Research Institute (KEFRI) herbarium and scientific names of collected species verified on Tropicos database [26]. The data collected was analyzed using SPSS and Microsoft excel 2013 and results presented in the form of tables, graphs and pie charts.

3. Results and Discussions

3.1. Socio-Economic Characteristics of Respondents

3.1.1. Gender of the Respondents

Majority of the respondents were males (54.1%) whereas females formed 45.9% of the respondents. Previous studies indicate that gender-based knowledge is not homogeneous as it varies in various parts of the world and even within individual countries depending on the respective gender's interaction with natural resources. Some studies indicate that women are more knowledgeable about medicinal plants, other studies indicate that men know more while a number of studies also reveal no difference between the genders in terms of medicinal plant knowledge [27]

3.1.2. Age of Respondents

Age was considered in this study in order to understand the relationship between knowledge on medicinal plants and age and determine how age influences herbal knowledge. Majority of the key informants were above 50 years old. They were followed by respondents aged between 36-50 years (27.9%), 19-35 years old (24.6%) and individuals who were less than 18 years old formed 14.8% of the respondents. These findings indicate that the elderly are more knowledgeable on medicinal plants than the young due to their lengthy interaction with the plant resources in their environment. This in itself poses a threat to indigenous knowledge continuity on herbal medicine from one generation to another if appropriate measures are not taken to ensure the young are trained on the same.

3.1.3. Level of Education

In order to fully understand the relationship between education and knowledge on medicinal plant processing, respondents were requested to indicate their levels of education. Majority 47.5% had primary school education while 41.0% had secondary school education. Only 4.9% of them had tertiary education. About 6.6% of the respondents had no formal education. Mwala sub-county residents with formal education were more likely to be influenced by the western culture to rely on modern medicine than plant medicine. Educated people tend to be more acculturated due to influence of modern education and lifestyle, they seek conventional medical treatment thus have less time with traditions compared to the less educated [28].

3.1.4. Household Size

Household size is one of the factors that can influence the reliance on traditional medicine and the rate of harvesting for treatment. Majority of the households (55.7%) had 4-6 members, followed by 2-3 members (19.7%). About 16.4% of the households had 7-9 members while 8.2% had only one family member. In most rural setups, households with many household members are more likely to rely on medicinal plants due to expenses associated with purchasing modern medicine

and seeking modern health services for all members.

3.1.5. Occupation of Respondents

The respondents comprised farmers (45.9%). Students 19.7%, business persons formed 8.2% of respondents and 6.6% were casual laborers. About 3.3% of the respondents were herbalists, 1.6% clergy, 1.6% Mechanics, 4.9% housewives, 3.2% civil servants, 3.3% craftsmen, and 1.6% Drivers. This means that most of the respondents interacted

with medicinal plants while farming thus might have knowledge on the important medicinal plants.

3.2. Medicinal Plant Species in Mwala Sub-County

Medicinal plant species in the study area were documented to provide a checklist for future reference. The Table below gives a summary of all the medicinal plant species identified during the study.

Table 1. Medicinal plants, part used, diseases treated and mode of administration.

S.NO	Botanical Name	Local Name	Family	Part Used	Therapeutic uses	Mode of administration
1	<i>Acacia brevispica</i>	Mukuswi	Mimosoideae	Leaf	Giddiness and Cough	Crushed and Infusion Orally administered
2	<i>Acacia mellifera</i>	Muthiia	Mimosoideae	Bark	Cough	Crushed and Infused Orally taken
3	<i>Acacia nilotica</i>	Musemei	Mimosoideae	Bark	Cough	Crushed, boiled and Infused orally
4	<i>Acacia tortilis</i>	Kilaa	Mimosoideae	Bark	Swollen abdomen and cough	Chewed or soaked and orally administered
5	<i>Erythrocephalu marginatum</i>	Kakunini	Compositae	Whole	Malaria	Boiled and Decoction Orally administered
6	<i>Agave sisalana</i>	Ikonge	Asparagaceae	Leaf	Cuts and Wounds	Sap squeezed and applied
7	<i>Aloe secundiflora</i>	Kiluma	Euphorbiaceae	Leaf	Malaria, Fatigue	Decoction or infusion Orally taken
8	<i>Altenanthera pungens</i>	Kakwasi	Amaranthaceae	Roots	Toothache	Pounded and infusion Orally taken
9	<i>Aspilia pluriseta</i>	Muti	Compositae	Leaf	Wounds and Snake bites	Sap squeezed and applied
10	<i>Azadirachta indica</i>	Mualuvaini	Meliaceae	Bark, Leaves	Malaria and Joint pains	Pounded or boiled and infusion orally taken
11	<i>Balanites aegyptiaca</i>	Kilului	Balanitaceae	Fruit	Headache	Chewed to remove pulp
12	<i>Barleria ventricosa</i>	Kailawimbu	Acanthaceae	Whole	Rheumatism	Crushed and Infusion Orally administered
13	<i>Bidens pilosa</i>	Munzee	Asteraceae	Leaf, seeds	Ear complications and Toothache	Pounded and infusion Orally taken
14	<i>Carica papaya</i>	Muvavai	Caricaceae	Stem, Fruit and Leaves	Toothache, Ulcers and Malaria	Sap applied, leaf boiled, Fruit eaten
15	<i>Carissa spinarum</i>	Mukawa	Apocynaceae	Roots	Joint Pains	Boiled and Infusion Orally taken
16	<i>Catha edulis</i>	Miraa	Celastraceae	Leaves	Fatigue	Chewed
17	<i>Citrus limon</i>	Kitimo	Rutaceae	Fruit	Skin Rashes and Cough	Fruit eaten
18	<i>Croton megalocarpus</i>	Kithulu	Euphorbiaceae	Bark, Leaves and Seeds	Kidney failure, lungs and Cough	Concoction, Crushed and Infusion orally administered
19	<i>Cynodon dactylon</i>	Ikoka	Poaceae	Leaves	Stomachache	Chewed
20	<i>Eucalyptus tereticornis</i>	Musanduku	Myrtaceae	Leaves	Small pox	Boiled and infusion Used for bathing
21	<i>Grewia similis</i>	Mutuva	Tiliaceae	Bark	Constipation	Chewed
22	<i>Jatropha curcas</i>	Kitanyuka-mwene	Euphorbiaceae	Roots	Mouth Blisters	Chewed
23	<i>Kleinia squarrosa</i>	King'endya Nthenge	Asteraceae	Bark, Leaves and Stem	Cholera, Thrombosis and Malaria	Concoction, Crushed and Infusion orally taken
24	<i>Lannea schweinfurthii</i>	Kyuasi	Anacardiaceae	Bark	Pneumonia	Boiled and infusion Orally administered
25	<i>Lantana camara</i>	Mukiti	Verbenaceae	Leaves	Wounds	Crushed and Infusion Taken orally
26	<i>Launaea cornuta</i>	Uthunga	Asteraceae	Leaves	Chest pain	Crushed and Infusion Taken orally
27	<i>Mangifera indica</i>	Kiembe	Anacardiaceae	Bark, Leaves and Roots	Toothache, Ringworms, Diarrhea	Boiled or Roasted and Grinded or pounded and infusion orally administered
28	<i>Moringa oleifera</i>	Muringa	Moringaceae	Flower, Leaf, Seeds and Roots	Malaria, Hypertension, toothache, Ulcers, Teeth-whitening	Chewed, Boiled and Infusion taken orally.
29	<i>Morus alba</i>	Kitae	Moraceae	Fruit	Blood Recharge	Chewed
30	<i>Ocimum kilimandscharicum</i>	Mutaa	Labiatae	Leaves and seeds	Constipation, Cough and Eye problems	Crushed and Infusion Orally taken or rubbed in the eye
31	<i>Ormocarpum trichocarpum</i>	Muthingii	Fabaceae	Leaves	Ulcers	Crushed and infusion Orally

S.NO	Botanical Name	Local Name	Family	Part Used	Therapeutic uses	Mode of administration
32	<i>Oxygonum sinuatum</i>	Musong'e	Polygonaceae	Leaves	Toothache	administered.
33	<i>Plectranthus barbatus</i>	Muvou	Lamiaceae	Leaves	Stomachache and Joint Pains	Chewed for sap.
34	<i>Psidium guajava</i>	Kivela	Myrtaceae	Leaves	Diarrhea and Stomachache	Chewed or Crushed and Infusion taken orally.
35	<i>Searsia natalensis</i>	Mutheu	Anacardiaceae	Leaves	Diarrhea and Stomachache	Crushed and infusion Orally administered
36	<i>Ricinus communis</i>	Kyaiki	Euphorbiaceae	Seeds	Constipation	Crushed, Soaked And infusion taken orally.
37	<i>Senna siamea</i>	Mukengeta	Caesalpiniodeae	Leaves, Stem	Malaria and Ulcers	Chewed.
38	<i>Senna spectabilis</i>	Mukengeta 2	Caesalpiniodeae	Leaves	Cramping	Roasted or boiled and Infusion orally taken.
39	<i>Solanum incanum</i>	Mukondu	Solanaceae	Leaves and Roots	Stomachache	Concoction.
40	<i>Solanum americanum</i>	Managu	Solanaceae	Leaves	Tonsils	Chewed or Crushed And Infusion orally taken.
41	<i>Steganotaenia araliacea</i>	Kivuavui	Apiaceae	Bark	Oedema	Chewed or cooked.
42	<i>Strychnos spinosa</i>	Muteta	Loganiaceae	Roots	Cold flu	Boiled and Infusion Orally administered.
43	<i>Euphorbia bicompecta</i>	Kyatha	Euphorbiaceae	Bark, Leaves and Branches	Tonsils and Ear complications	Boiled and Infusion Orally taken.
44	<i>Synadenium spp</i>	Kilembwa	Euphorbiaceae	Bark and Stem	Ulcers, Swollen abdomen and Toothache	Sap squeezed and applied
45	<i>Tamarindus indica</i>	Kithumula	Caesalpiniodeae	Fruit	Arthritis	Roasted, grinded and powder infused and orally taken.
46	<i>Terminalia brownii</i>	Muuku	Combretaceae	Bark and Leaves	Yellow Fever, ulcers	Soaked and Infusion Taken orally.
47	<i>Cascabela thevetia</i>	Ilaa	Apocynaceae	Fruit and Leaves	Lungs in Livestock and Wounds on Humans	Crushed, Boiled and Infusion taken orally.
48	<i>Tithonia diversifolia</i>	Ilaa 2	Asteraceae	Whole plant	Stomachache	Infusion taken orally or sap applied on wounds.
49	<i>Baccharoides lasiapus</i>	Muvatha	Compositae	Leaves	Stomachache and Lungs	Crushed and infusion Orally administered.
50	<i>Ximenia americana</i>	Mutula	Olaceaeae	Roots	Joint Pains	Crushed and Infusion Taken orally.
51	<i>Zanthocylum chalybeum</i>	Mukenea	Rutaceae	Bark and Leaves	Malaria, Ulcers and Cough	Boiled and Infusion Orally taken.
						Boiled and Infusion Orally administered.

A total of 51 plant species distributed across 31 families were recorded in the study area together with 5 vouchers. The top six medicinal plant species mentioned by respondents included *Aloe secundiflora* (locally known as Kiluma) which was the most popular, having been mentioned 28 times by the respondents. Other commonly used plant species were *Moringaoleifera* mentioned 22 times, *Terminalia brownii* 19 times, *Azadirachta indica* 18 times, *Solanum incanum* 17 times, *Psidium guajava* 11 times among others. Conservation efforts should therefore be geared towards the above mentioned species as they are important elements in the treatment of various diseases in the study area. Of the 51 plant species, 91.67% were used to treat

human diseases while only 7.94% are used treat livestock diseases. The remaining (0.39%) were used to treat both human and livestock ailments.

3.3. Diseases Treated and Plant Parts Used

A total of 38 disease conditions were mentioned. Malaria (19.84%) was the most common disease mentioned. This was followed by Stomachache (13.49%), coughing (9.52%), wounds and Lung complication (5.56%) among others. The diseases were further grouped into different categories and the number and percentage of the total species used for treatment summarized as shown in table 2 below

Table 2. Ailment categories treated by different plants as per International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)-WHO Version for; 2016.

(ICD-10)-WHO Version for; 2016	Ailment category	Specific condition	No. of species used (N=51)	% of total species
XI	Digestive disorders	Diarrhea, stomachache, constipation, ulcers, cholera, blotting	19	37.3
X	Diseases of the respiratory system	Cough, chest pains, pneumonia, lungs, cold	14	27.5
XII	Diseases of the skin and subcutaneous tissue	Wounds, skin rashes, smallpox, ringworms	8	15.7
III	Diseases of the blood and blood-forming organs and certain	Blood cleansing, thrombosis	2	4

(ICD-10)-WHO Version for; 2016	Ailment category	Specific condition	No. of species used (N=51)	% of total species
XIV	disorders involving the immune mechanism	Cramping, Kidney failure	2	4
XII	Diseases of the genitourinary system	Joint pains, rheumatism	6	12
I	Diseases of the musculoskeletal system and connective tissue	Malaria, yellow fever, mouth blisters	10	19.6
IX	Certain infectious and parasitic diseases	hypertension	1	2
XVIII	Diseases of the circulatory system	Migraines, headaches, fatigue	3	5.9
XIX	Headache and fatigue Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	Snake bites	1	2
	Injury, poisoning and certain other consequences of external causes			

Different plant parts were used for the treatment of different diseases and ailments. From all the citations made, the leaf (52.78%) was the most mentioned part, bark 19.44%, roots 10.32%, the whole plant (2.38%), seeds (4.76%), the stem (6.35%), fruit (3.17%), Branches and flowers (0.40%) each as shown in figure 2 below

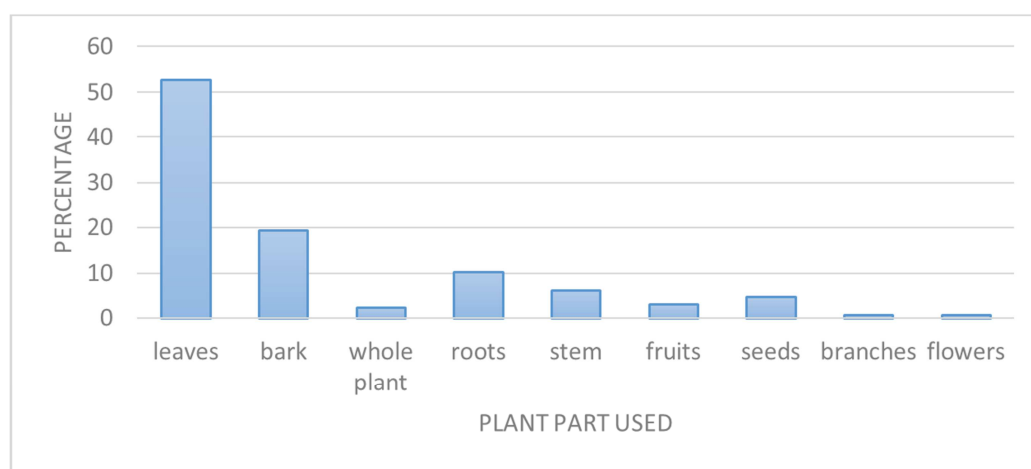


Figure 2. Plant parts used.

An estimate of the threat to medicinal plants can be made from the type of plant and the part used [29] Most remedy processing activities in the study area used the leafy parts of plants, and this could have an effect on photosynthesis process of plants. Studies conducted in Kenya, Ethiopia and in other parts of the world show that leaves are the most used plant parts for herbal medicine more than the other parts of a plant. This could pose a threat on plant species if unsustainably harvested. However according to Kalayu [18] harvesting of leaves compared roots in the study area has less negative influence on the survival and sustainability of medicinal plants in comparison to uprooting the whole plant or use of the roots. Bark harvesting also poses a threat to the plants since removal of the bark disrupts the translocation and exchange of food, water and nutrients between roots and leaves.

3.4. Mode of Preparation and Administration

The study results indicated that the methods of preparation employed primarily for single plant parts used were Decoction (22.22%), followed by Chewing (21.83%) and Pounding (9.13%) then infusing in hot or cold water to make hot and cold infusions respectively. Crushing (6.75%) and Pounding (7.54%) were other common modes of preparation. A decoction is prepared by boiling plant parts of single plant

species in water. Crushing and Pounding were done using two stones. One flat shaped and the other oval or spherical shaped to fit into the hands. The solvent was water.

Pounding also involved the use of a traditional mortar and pestle. Roasting took 2.38% and the most roasted species was *Synadenium species*. Once the plant was roasted, the resulting powder would be ground and applied topically on the affected part or infused in water mainly to treat a swollen abdomen. These remedies were prepared when required, thus most interviewees and the herbalists did not preserve the medicines. 7.94% of the modes of remedy preparation involved processing mainly as mixtures in the form of concoctions. To prepare a concoction, plant parts are obtained from more than one plant species and boiled together in water. Majority, 82.94% of the respondents said that they use oral method to administer the prepared medicine. Only 17.06% of them applied the prepared medicine through the topical application.

3.5. Reasons for Using Medicinal Plants

The researcher sought to find out the reasons behind the continued use and preference of herbal medicine even with the availability of conventional medicine.

Majority (34.4%) of the respondents indicated that they prefer medicinal plants for treatment of diseases due to their

efficiency. Other reasons mentioned included availability (27.9%), lack of side effects (24.6%), cheapness (8.2%) and

long distance to health centers (4.9%) as shown in figure 3 below.

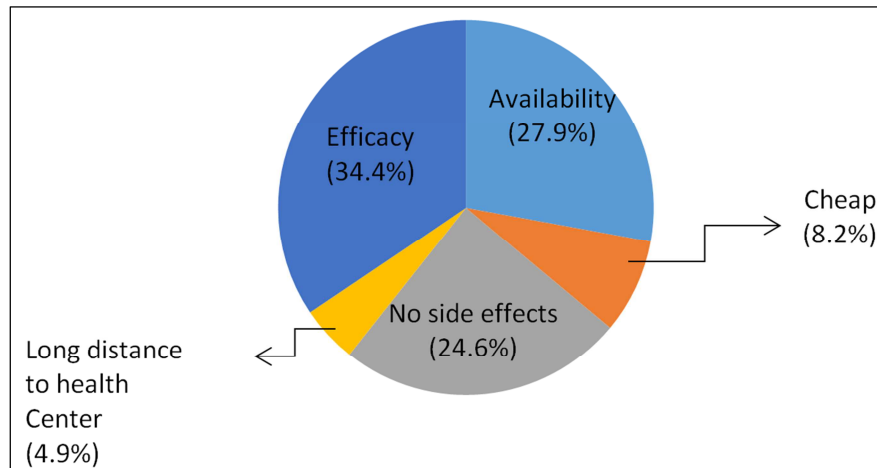


Figure 3. Reasons for use of medicinal plants.

A report by the World Health Organization of the United Nation [2] singles out the affordability and unavailability of modern health facilities as some of the reasons for preference of medicinal plants by rural households. Kaingu *et al.* [30] and Nagata *et al* [31], further cite the long distance to health centers, unreliable transport services and lack of financial resources are some of the reasons that make herbal medicine to be more reliable to people.

3.6. Conservation Practices

Table 3 below shows the current conservation efforts of medicinal plants carried out in the study area by the residents.

Table 3. Medicinal plants conservation measures.

Conservation measure	Frequency (N=61)	Percentage (%)
Domestication	34	55.7
Trainings on conservation	11	18.0
Protection by conservation groups	6	9.8
Others	3	4.9
None	3	4.9
Efforts by administrative officers	3	4.9
Community scouts	1	1.6
Total	61	100

Majority 55.7% of the respondents indicated that domestication of medicinal plants is a common practice of conserve plants in the area. 18% indicated that there are trainings carried out in the area to conserve and protect medicinal plants while 9.8% indicated that there are groups and Community Based Organizations (CBOs) that assist in conserving medicinal plants. 4.9% of the respondents indicated that the Local area chief takes efforts to encourage people to conserve medicinal plants, 4.9% others indicated that other conservation measures such as planting trees are undertaken while 4.9% others indicated that there are no measures that are being taken to conserve medicinal plants in the area. 1.6% indicated that scouts from the local institutions

at a particular time participate in medicinal plant conservation.

3.7. Respondents' Perception on the Threats to Medicinal Plants

Respondents were asked to list various threats to medicinal plants in Mwala. Table 4 below indicates perceived threats by the respondents to the medicinal plants.

Table 4. Threats to medicinal plants.

Threat	Frequency (N=61)	Percentage (%)
Overgrazing	15	24.6
Climate change	15	24.6
Charcoal burning	9	14.8
Clearing for cultivation	7	11.5
Overharvesting	6	9.8
Lack of awareness	5	8.2
Others	4	6.6
Total	61	100

The respondents indicated that medicinal plants in the area are perceived to face a number of threats. Majority (24.6%) indicated that Overgrazing and climate change were the main threats to conservation of medicinal plants each. Charcoal burning (14.8%), Overharvesting (9.8%) and clearing for cultivation (11.5%). A section of the respondents (6.6%) indicated that the threats to medicinal plants in the study area included cultural changes, habitat loss, urbanization and lack of potential candidates for training as most youth were not interested. A study by Maunguja [32] also listed Charcoal production, Climate change and drought and deforestation as some of the threats facing medicinal plants in Arabuko Sokoke Forest, Kilifi Kenya. Grazing management practices and proper stocking should be encouraged in the study area to reduce overgrazing. Cultivation of fast growing species for charcoal production and the promotion of alternative fuel energy sources would help reduce the pressure on medicinal plants.

3.8. Methods of Herbal Knowledge Acquisition

Respondents indicated several ways in which they gained herbal knowledge as summarized in figure 4 below. Majority (75.4%) of them indicated they gained knowledge through

apprenticeship from their relatives. Other methods of knowledge acquisition included induction from mobile practitioners (14.8%), Formal training (3.3%) and own observation (6.6%).

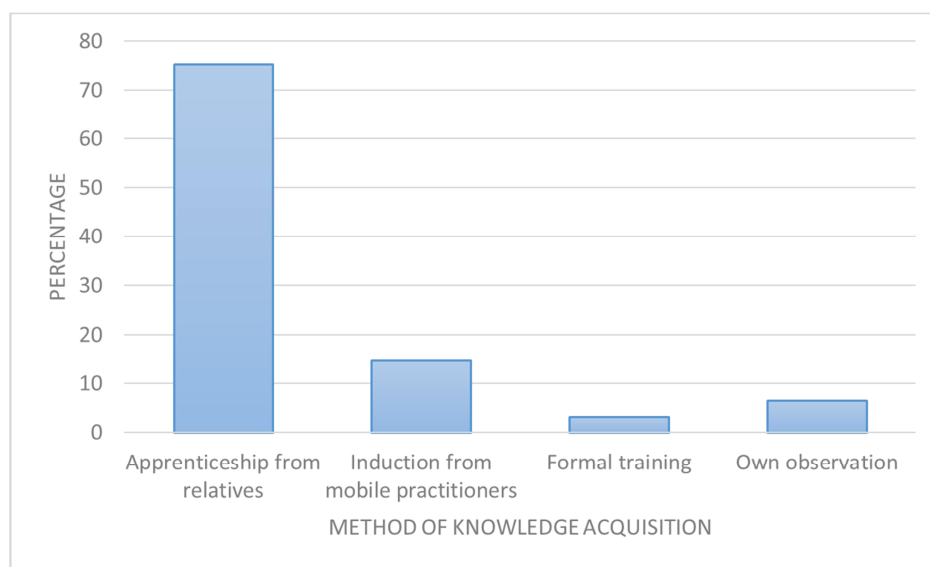


Figure 4. Method of herbal knowledge acquisition.

Apprenticeship from relatives therefore was the most effective way of passing herbal information. These findings match that by Kisangau *et al.* [33] conducted in Kitui County, Kenya, where he found out that majority of the respondents (89%) gained herbal knowledge through apprenticeship from experienced family relatives. Knowledge of traditional herbal medicine is passed from one generation to another by oral means, through training by knowledgeable individuals or through inheritance. Herbal knowledge is however susceptible to loss because due to a number of challenges facing apprenticeship including lack of interest by the young [20] and in some cases the old people do not have apprentices or prefer secrecy when collecting herbal products [34-35]. Ethnobotanical pharmacopoeia is importantly used in intervention of disease and need arises for documentation and preservation of tradition medicinal knowledge to boost the discovery of new drugs [36-37].

4. Conclusion

From the study, it is evident that there exists a diversity of medicinal plants in Mwala and the people in the study area have immense knowledge on use of plants for medicinal purposes hence patenting and documenting of these species is therefore necessary for safe custody. Relevant education institutions and government agencies within the area should therefore work towards documenting the indigenous knowledge to ensure the knowledge does not get lost or get buried with the elderly who act as custodians to the knowledge. Traditional healers should also be well trained on conservation to protect the disappearing species and knowledge base. A high proportion of households were

found to use medicinal plants for the treatment of various diseases with malaria being the most cited disease. The most used parts were leaves, bark and roots. Widespread utility of roots and bark accompanied by anthropogenic factors such as overgrazing, charcoal burning, and clearing forests for cultivation, deforestation and climate change contributed a considerable proportion of threat to medicinal plants in the area. Conservation and sustainable use of the valuable plant species is essential.

In order to minimize the drawbacks of traditional medicine and to upgrade the health services in Mwala Sub-county, local medicinal practitioners should be given technical support through the department of culture and social services through licensing for accountability and value addition support in processing, packaging and marketing of the herbal medicine.

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