Original Article

Ethnobotanical Survey of Medicinal Plants Used By the Marakwet Community in Cherangani Forest, Kenya

Mourine Mutai[*], **Ezekiel Mugendi Njeru**, **Regina Ntabo**

Department of Biochemistry, Microbiology and Biotechnology, School of Pure and Applied Sciences, Kenyatta University, Nairobi, Kenya

ARTICLE INFO

ABSTRACT

Since long time ago, humans have used medicinal plants. Currently, many of the contemporary drugs can be traced to plant origins. Human activities such as deforestation and farming risk the availability of medicinal plants of medical importance; therefore, there is a need to document knowledge and information on these plants. Structured questionnaires, which involved oral interviews and discussions, were used to gather information from the 35 selected herbalists. The information on every medicinal plant used in the treatment of human diseases was documented. A total of 26 medicinal plants were recorded with trees (38.5%), herbs (30.8%), shrubs (26.9%), and climbers (3.8%). The plant parts were either used singly or in combination. The mixture of leaves, roots, and barks were the most preferred combination by 77.1%, followed by barks and roots by 57.1%, and leaves and barks by 11.4%. The diseases treated were gastrointestinal ailments by 97.1%, while skin and respiratory were 80% each. Boiling was the most preferred method of preparation (58%), followed by burning to ashes (28%), boiling (12%), and raw (2%). Oral administration was the most preferred method (63%), followed by swabs (24%), and inhalation (13%). The medicinal plant's primary source was Cherangani forest (91.4%), although some herbalists had also domesticated some medicinal plants (8.6%). The study provides information on medicinal plants used by herbalists in the Marakwet community, which be used in investigating potential active compounds in the documented medicinal plants for the development of crude drugs.

GRAPHICAL ABSTRACT
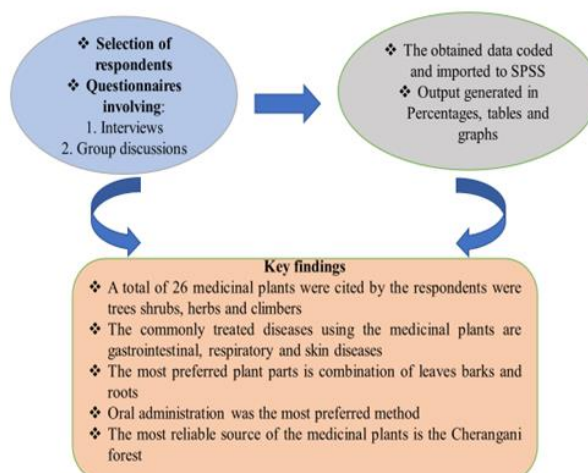
Introduction

Medicinal plants have been the source of significant curative and preventive medical therapy for humans from many parts of the world. World Health Organization (WHO) estimates that 80% of the world's population uses medicinal plants for their primary healthcare purposes, while some combine herbal and contemporary medicine [1]. Some people combine contemporary medicine and herbal medicine [2, 3]. In third world countries, 80% of the population uses herbal medicine because they are economical and naturally available in most remote areas [4]. In developing countries, contemporary medicine is not readily available because hospitals are in urban areas; hence patients have to travel and incur costs [5]. In developing countries, 40-90% of its population uses medicinal plants for their primary healthcare. The high demand for medicinal plants has made people settle in areas in which indigenous plants are found, including forests. The indigenous plant's usage has been increasing with time [6], thus risking the loss of these indigenous plants commonly used as herbal medicine.

In Africa, traditional medicine has been common since the 19th century, and it is known just as contemporary medicine [7]. Each region within the continent has unique traditional medicine. Information on conventional medicine usage trickles down to the tribal community, where they still preserve and value it [5]. There can be variations between communities in terms of the diseases they treat and the preparation method [8]. It is estimated that around 50% of natural products and their derivatives obtained from herbal medicine find their way to clinical settings used for diverse purposes [9].

Kenya is one of the countries in East Africa with diversified flora estimated at 7,000 plant species, putting it one of the richest in the region. The high flora diversity has led to the discovery of many medicinal plants in the country [10]. According to a study [11], 90 % of the Kenyan population have used herbal medicine at one point in their lives, while more than 70 % of the population uses homemade herbal preparations for their primary healthcare. The herbalists pass the ethnobotanical information to close family members. The knowledge is passed orally hence there is the possibility of loss of vital information on these medicinal plants [7].

Most populations have settled around the forest, using forest plants for food, firewood, and herbal medicine. As a result, there is a risk of losing the indigenous plant species in such forests due to deforestation [12]. The indigenous plant species may be vital for future use; therefore, there is a need to document the knowledge and protect the forest due to its rich flora diversity. According to a study [13], there is a need to recognize community knowledge, cultures, and their relationship with indigenous plant species. The utilization and conservation of the indigenous plant species can be achieved through it since other stakeholders have used it. In situations where regulation and legislation are required, local approaches that include traditional knowledge are used [14]. The convention on biological diversity reiterates that the goal of protecting indigenous plants incorporates the use of traditional knowledge [15].

Cherangani forest is one of the protected forests by the Government of Kenya. However, cases of encroachment for timber harvesting purposes and charcoal are still rampant [16]. Pastoralist communities such as the Pokot and Marakwet have settled around the forest, and used the forest as herding fields hence threatening its rich biodiversity [17].

This study aimed to document the medicinal plants used by the Marakwet herbalists in the Cherangani forest areas, Elgeyo-Marakwet County, Kenya. The objectives were to establish (1) the specific uses of the medicinal plants, (2) the common parts of the medicinal plants frequently used, recipe preparation methods and method of administration, (3) the source of the medicinal plants (4) and the possible side effects of the medicinal plants after use.

Material and methods

Site description

The study was carried out in areas surrounding Cherangani forest, Elgeyo-Marakwet County, Kenya. Cherangani forest borders three counties, namely Tranzoia, West Pokot, and Elgeyo-Marakwet, occupied by Luhya, Pokot, and Marakwet communities. The area lies between Latitude: 1° 14' 60.00" and N Longitude: 35° 26' 59.99" E. The forest covers about 1,200 square kilometers, of which 956 square kilometers are gazetted into forest reserves. The forest comprises of bushlands, grasslands, and croplands. The mountain parts of the forest are often rocky ad stony with shallow soils [18]. However, approximately 20% of the forest is rich in vegetation cover consisting of Kapkanyar, Kapolet, Kiptaberr, Kipkunur, Kerer, and Lelan blocks. The soils are deep with high organic matter content. Some forest regions, such as the North-Western region and the Northern part of the forest, have shallow soils prone to soil erosions. Additionally, the soil acidity varies in different areas of the forest. The forest is majorly composed of metamorphic, quartz, marble, and precambrian rocks.

The area receives an average rainfall of 1200mm annually and 1400-1500mm in the rainy seasons. The site receives an uneven distribution of rains, with April to May and August to November as the peak periods. The dry period is from December to February and an average temperature of 24 ^oC annually.
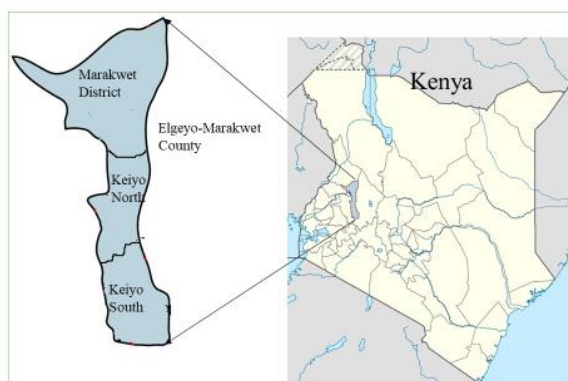

Figure 1: Map of the study area

Selection of respondents

Purposive and snowball types of sampling were used to select the respondents. Purposive sampling was used where herbalists helped pinpoint some of the herbal medicine practitioners in their residential areas. Snowball sampling was used where some known herbalists were willing to lead us to where other practicing herbalists were living. The selection was based on the herbalists' willingness to voluntarily give information on the medicinal plants that they were using for their daily practices.

Ethnobotanical data collection

The ethnobotanical data were collected in 2019 through face-to-face interviews with the herbalists who were willing to participate in the study. Structured questionnaires were used in the field. During the interview, the researchers recorded information on the medicinal plants' local names, the types of diseases treated, the recipes for preparing the medicinal plants, the mode of administration, the side effects of the medicinal plants, and the patient's response after use were documented. Information on parts of the plants frequently used was also noted. The sampling areas included Kapsowar, Cheptongei, and Kapcherop. Thirty-five herbalists were interviewed at the selected study site.

Data analyses

Qualitative and quantitative data were generated using the Statistical Package for Social Sciences (SPSS) version 22.0. The normality of the collected data was tested using the SPSS. The data was analyzed, and output generated in averages, percentages, figures, and tables.

Result and Dissection

Socio-demographic information

The majority of the respondents had formal education (48.6%), while 8.6% of them and 5.7% of them held secondary education and tertiary education, respectively. Also, 37.1% of the respondents had no formal education. The

practice duration ranged from less than ten years (40%), while most (60%) had been practicing for more than ten years. The majority of the respondents (90%) reported that herbal knowledge transfer was from close family members, while 10% learned it through careful observation (Table 1).

Table 1: Social demographic information of the respondents

Gender		Frequency	Percentage (%)
	Male	8	22.9
	Female	27	77.1
	Age bracket		
	31-40	5	14.3
	41-50	8	22.9
	51-60	13	37.1
	Above 60	9	25.7
	Level of education		
	N/A	13	37.1
	Primary	17	48.6
	Secondary	3	8.6
	Tertiary	2	5.7
	Duration of practice		
	0-10	14	40
	11-15	10	28.6
	Above 15	11	31.4

The respondents listed 26 medicinal plants used for diverse purposes. Table 2 summarizes information on the local names, common names, botanical names, and family names of the documented medicinal plants. The plants comprised of herbs, shrubs, trees, and climbers. However, their distribution differs. Trees had the highest percentage (38.5 %), followed by herbs (30.8%), shrubs (26.9%), and climbers (3.8%). Each documented plant has its preparation method and uses, as outlined in Table 2. Table 2 also summarizes the plant parts used.

Table 2: Plants used for herbal remedies by the Marakwet community in the areas surrounding Cherangani forest

	Local name (Marakwet)	Common name	Botanical name	Family name	Habit	Uses
1	Cheserya	Not found	*Zehneria scabra (L. f) Sond*	*Cucurbitaceae*	Climber	Stomachache and related complications Common cold and cough Oral thrush Sour throats and mouth ulcers Skin infections Cancer
2	Toboswo	Not found	*Croton macrostachyrus Hohst*	*Euphorbiaceae*	Tree	Skin related infections Respiratory infections such as chest congestion Allergies Purgative
3	Angurwo	Not found	*Plechrantus barbartus Andrews*	*Lamiaceae*	Herb	Skin rashes Soap Allergies

4	Remit	Wild olive	*Olea africana*	*Oleaceae*	Tree	Eye infections Itchy skin rushes
5	Chebokobil	Zanzibar plant	*Lippi javanica (Burn.f) spreng*	*Verbenaceae*	Herb	Amoebiasis Stomachache and stomach related complications
6	Sokwon	East African Green Wood	*Warburgia ugandensis*	*Canellaceae*	Tree	Stomachache Oral thrush Common cold and cough
7	Korniswo	Pricky Thorn Bonsai	*Acacia brevispica Harms*	*Mimosaceae*	Shrub	Itchy skin rashes Wounds
8	Churur	Whistling thorn	*Acacia hockii De Wild*	*Mimosaceae*	Tree	Abdominal pains Stomachache
9	Ngopkwo	Thorn tree	*Acacia nilotica(L) Delile*	*Mimosaceae*	Tree	Abdominal pains and stomach related complications
10	Kurelwo	Orange leave croton	*Croton dichogamous pak*	*Euphorbiaceae*	Shrub	Oral thrush and mouth ulcers Stomach related pains
11	Murgut	Yellow nutsedge	*Cyperus esculentus*	*Cyperaceae*	Herb	Stomachache Colic pains in children Abdominal pains
12	Kalobotwo	Thorn apple	*Solanum incanum*	*Solanaceae*	Herb	Abdominal pains Colic pains in children Wounds
13	Chepkendere two	Burnt plant	*Aloe spp*	*Oleaceae*	Herb	Wounds and wound-related infections
14	Mochontopo kot	Caralluma	*Carcelluma acutangula*	*Asclepiadaceae*	Herb	Respiratory infections such as chest congestion, especially wheezing, cough, and chest pains
15	Mororion	Stamperwood	*Ehretia cymose var*	*Boraginaceae*	Shrub	Stomach pains Colic pains in children
16	Korkowo	Corpse flower	*Erythrina abyssinica*	*Fabaceae*	Tree	Mumps and oral thrush
17	Sumeyon	Orange bird berry	*Hoslundia opposite valn*	*Lamiaceae*	Shrub	Abdominal pains Amoebiasis A colic pain in children
18	Sergellat	African indigo	*Indigofera arrecta*	*Fabaceae*	Herb	Amoebiasis/ stomach related complications
19	Chorwo	Brittle wood	*Nuxia congesta*	*Loganiaceae*	Tree	Stomachache Colic pains
20	Bryophyta		*Schefflera volkensii*	*Green moss*	Tree	Respiratory infections
21	Kibutkut		*Spilanthens mauritania*	*Asteraceae*	Herb	Oral thrushes Used during surgery
22	Koloswo	Mbarao(Swahili) in Kenya	*Terminalia brownie Fresen*	*Combretaceae*	Tree	Oral thrush Abdominal pains
23	Turkukai	Red cherry	*Withania somnifera*	*Solanaceae*	Shrub	Abdominal pains Respiratory infections Chronic skin ulcers Amoebiasis
24	Tilomwo	Christ thorn	*Ziziphus mauritania*	*Rhamnose*	Tree	Amoebiasis Abdominal pains

| 25 | Kochon | Knob wood | *Zanthoxylum chalybean* | *Rotaceae* | Shrub | Amoebiasis Stomachache Abdominal pains Colic pains |
| 26 | Kunyotwo | Yellow plum | *Ximenia americana* | *Oleaceae* | Shrub | Wounds |

Diseases treated by the respondents

The diseases described by the respondents were put into four groups: Gastrointestinal, respiratory, skin, and others such as immunological diseases. According to the respondents, the common ailment treated were gastrointestinal problems cited by 97.1% of the respondents, followed by respiratory and skin infections, each recording 80%. Some of the respondents (80%) had treated other diseases, such as immunological related (Figure 2).
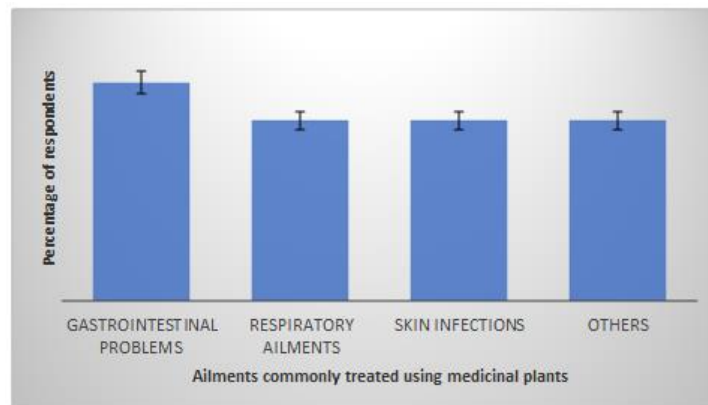

Figure 2: Common diseases treated by the herbalists using the medicinal plants

Genera and species of the medicinal plants

The respondents listed the use of different plants to treat various ailments. However, the use frequency of each plant species differed among the respondents (Figure 3). The first three are *Croton macrostachyrus,* which showed the highest frequency of respondents (94 %) using it in their daily practice, followed by *Zehneria scabra* (91%) and *Cyperus esculentus* (89 %), while *Solanum incanum* and *Bryophta spp* recorded the least use frequency of the respondents by 17.1% each.
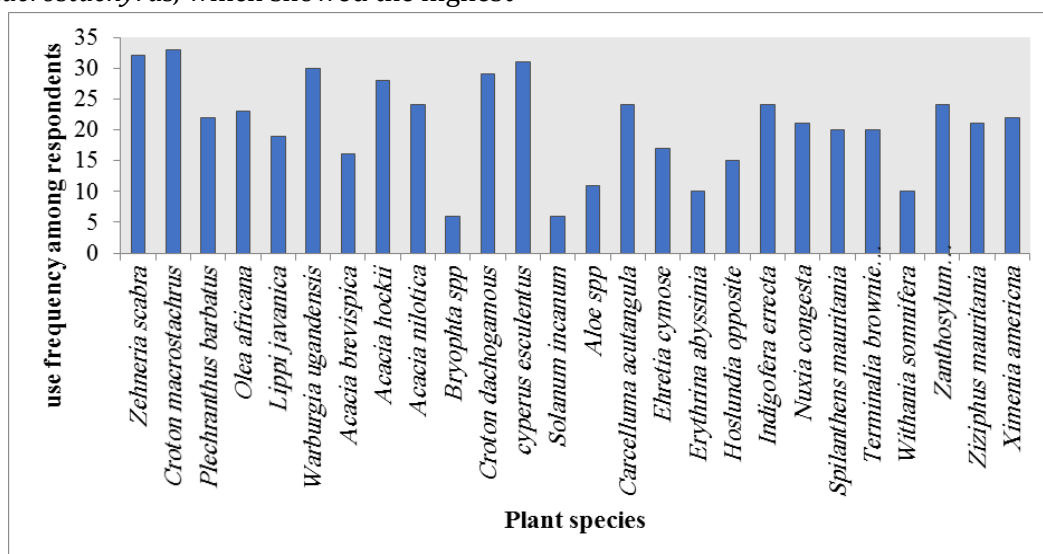

Figure 3: Species of medicinal plants used and the frequency used by the respondents

Plant parts used

The plant parts used were leaves, barks, roots, while other respondents used the plant parts in combination (Fig. 4). The use of leaves, barks, and roots had the highest percentage (77.1%) compared with barks and roots (57.1%) and leaves and barks (11.4%). Use of leaves alone showed the highest percentage (40%) compared with barks alone (5.7%) and roots alone (2.9%)
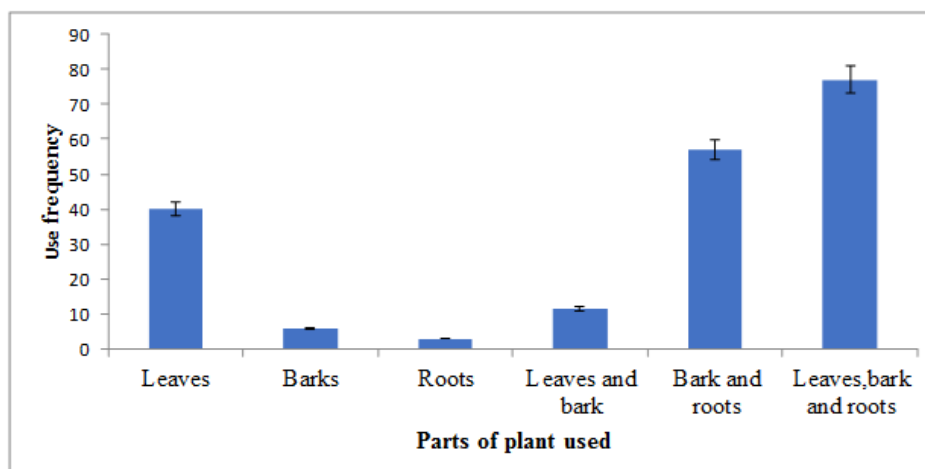

Figure 4: Parts of the medicinal plants used

Preparation method

The study reported that the respondents had diverse ways of preparing the medicinal plants to treat the ailments, including boiling, chewing while raw, burning it into ashes, and taking the ashes. However, some of the respondents said they prepared their medications by using more than one method of preparation. The most preferred way of preparing was boiling and raw consumption, by 58% followed by burning the plant parts into ashes (28%), boiling 12%, and chewing the plants while raw consumption (2%). The medicinal plants' prescription and dosage from one herbalist to another differed depending on the patient's age, the persistence of illness, the patient's physical fitness, and if the patient is pregnant.

Method of administration

The most preferred route of administration was oral by 63%, followed by swabs by 24% and inhalation by 13%. The mode of administration was dependent on the type of ailment. In treating gastrointestinal diseases, the herbalists recommended oral administration as the preferred method, while herbalists suggested inhalation and oral administration to treat respiratory infections. Herbalists recommended the use of swabs and oral administration when treating skin infections. The respondents reported that some medicinal plants were bitter; therefore, they recommend their patients to mix it with honey or milk. In all diseases, oral administration was common. Additionally, all the respondents reported giving additional verbal instructions to the patients. The majority of the respondents (97. 1%) instructed their patients to use the prescribed dosages once a day, especially in the morning, while 11.4% instructed twice a day.

Source of medicinal plants

All the respondents reported that the medicinal plant's primary source was the nearby forest (Cherangani forest). However, some of the respondents (8.6%) had domesticated some medicinal plants within their family farms. Additionally, 82.9% of the respondents reported that the medicinal plants that were scarce and rare were outsourced from places outside Elgeyo-Marakwet County. Some herbalists cooperated

with herbalists outside the county to help supply these rare species of medicinal plants.
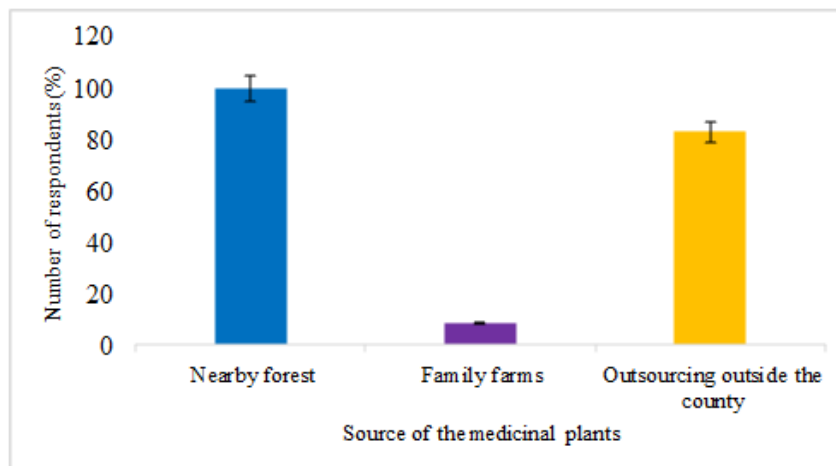

Figure 5: Source of the medicinal plants

Socio-demographic information

All the 35 participating herbalists had treated human diseases. The herbalists' ages ranged from 30 years to 76 years, with an average of 55 years. The finding could probably explain that it takes time to acquire knowledge from the older and experienced herbalists. Similarly, it has been shown that indicated that medicinal plants' knowledge is passed from the experienced and older generation to close relatives [18,19].

The majority of the respondents were women and practiced medicinal plants to treat diverse ailments at their homes. The respondents regularly sell their herbal products in the market places within the county (Elgeyo-Marakwet). The high percentage of women practicing medicinal plants to treat various ailments in the study area can be attributed to women's role in the family. The finding agrees with [20], where women were the majority of the practicing herbalist, and they were learning through their family roles. The women are often responsible for providing meals to the family, which in most cases, are plant-based recipes that are also responsible for family health [21].

Additionally, the respondent's duration of practice was directly proportional to the knowledge of medicinal plants. The older respondents cited many plants more than the younger respondents. Moreover, age was directly

proportional to education level where the younger respondents had formal education ranging from primary to tertiary learning institutions. In contrast, a majority of those who had not gone to school were the older specialists. The finding collaborates with a previous study by [21], who indicated that the experienced and older herbalists had no formal education

In the study area, herbal knowledge was mainly sourced from close relatives who had been practicing over time. The knowledge is shared from one generation to another. Those who get the privileged should keep the secrets, and they must be trusted members of the family. The finding collaborates with [22], [23] and [27], who established that herbal knowledge was shared with close family members only, and they ought to keep the secrets on the knowledge of the medicinal plants. However, some of the respondents indicated that they gained medicinal plant knowledge from careful observation and continuous practice. The finding collaborates with a previous study [24], suggesting that the source of herbal knowledge among herbalists was through careful observation.

Medicinal plants used by the Marakwet community

A total of 26 medicinal plants belonging to 18 families used for antimicrobial purposes were recorded in the study area. The growth forms of

these plants ranged from herbs, trees, shrubs, and climbers. The use of trees and herbs was high more than climbers and shrubs, and this is due to the trees and herbs availability in the study area. The respondents' socio-cultural beliefs and practices could have made them believe that the herbs and trees are efficient in treating human ailments. The finding is in contrast with other studies [24], where the use of trees and herbs more than shrubs or climbers is because of the active pharmacological compounds in the trees and herbs more than any other plant growth forms

The diseases treated by the respondents were grouped into four categories gastrointestinal, respiratory, skin infections. Gastrointestinal ailments had the highest percentage cited by the respondents in the study area, while respiratory and skin ailments were mentioned at equal proportions. The finding shows that the gastrointestinal tract has many infections compared with other body parts such as the respiratory system and skin. The result collaborates with a study by [24], and [25] who reported that the highest percentage of herbalists treating gastrointestinal diseases was due to many infections along the gastrointestinal tract.

Even though all plant parts are essential for medicinal purposes, the respondents had diverse views. The respondents were very definite in that some plant parts are used as a mixture while others singly. The use of leaves alone reported the highest percentage compared to roots and barks. The medicinal plant leaves can be picked more often than the barks and roots. The respondents also cited the need to protect the medicinal plants, and the use of roots and barks risk them losing the plants. Leaves are chewed while raw more easily compared with barks and roots. The finding agrees with a previous study [26], indicating that medicinal plant leaves use was high compared with any plant parts due to leaves' strategic location, thus allowing easy harvesting.

On the other hand, the respondents indicated that their treatment methods included using a mixture of different plant parts when preparing the herbal medicine. A mixture of leaves, barks, and roots recorded the highest percentage compared to barks and roots and leaves and barks. The combination of plant parts may increase the concentration of active ingredients essential for medication purposes. It could also be attributed to improving the efficiency of treatment hence; reducing the period in which the patient was supposed to use it.

The respondents indicated the use of different methods of herbal preparations. One of the common methods is soaking the medicinal plants then boiling them with water to make a decoction. The mixture is boiled until the amount of water is reduced to half or quarter of the boiling pots' initial water. According to the respondents, the preparation method is to concentrate the medication to increase its efficiency. Simultaneously, the respondents instructed their patients to chew some of the plant parts, especially the leaves.

Additionally, some plant parts were burnt, and the ashes licked. It should be noted that the respondents in the study area combined plant parts from different plant species. The finding is consistent with other studies done in the same region [11, 27], where a mixture of plant parts was used in the treatment of human and animal diseases. Mainly, combinations are used to increase efficiency. In some instances, the decoction can be bitter, and other plants can reduce the bitterness. Alternatively, milk or honey are added to the decoction, especially in children. Most respondents preferred decoction preparation because it is easier to prepare, administer, and be mixed with food, milk, honey, or tea. The is in agreement with previous studies [27], where decoction was more preferred because it is easier to prepare, administer, and mixed with milk or honey. In all medicinal plants' preparations in the study area, water is used as the solvent. The finding on water use as the universal solvent is in line with other studies by [28], where they established that water was used as a medium in all herbal preparations

While most of the respondents stated different administration methods, oral was common among all the respondents. Oral administration was also common in all the types of diseases that the respondents treated. The finding can be attributed to the number of infections and illnesses that occur along the gastrointestinal tract. Again, it is probably because the respondents had carefully observed that oral administration of their herbal preparations had positive impacts on the treatment of all diseases. The finding collaborates with a previous study by [10] , who maintained that herbalists recommend oral administration of the herbal remedies in all conditions treated. Swabs were common in the treatment of skin and skin-related infections. The respondents reported that the decoctions are swabbed in the affected areas in some cases. Some plant parts were ground into powder and applied to the affected areas, while in other instances, leaves were pound when fresh and applied to the skin-affected areas.

In the study area, the respondents indicated variations in dosages and prescriptions. The patient's dosage was determined by age, physical fitness of the patient based on the herbalist experience, the disease's persistence, and if the patient was pregnant. The respondents also indicated that they were careful not to overdose on their patients because they knew that excessive use of herbal preparations could negatively impact patient health. As a result, they recommend the amount and the number of times to use in a day. In most cases, the amounts of decoctions are measured using a glass of water, and they estimate it to quarter, half, or full glass. The majority of the respondents indicated that the best time to use is early in the morning before any meal. The prescription can be attributed to the need to monitor the body's reaction after using the herbal preparations. However, some had different herbal prescriptions, such as twice or once a day for a specified period. Lack of precision and standardization of herbal preparations have been discussed widely and are

a significant drawback of traditional medicine systems, as reported previously [29].

Most of the respondents reported that the patients' response was good, while a few were fair. However, there are side effects of herbal preparations. The common side effects are headache, diarrhea, fatigue, and vomiting. In some instances, the patient can experience more than two side effects. In other situations, the side effects such as diarrhea show the herbal preparations' effectiveness. The herbalists advise the patients to use enough water to rehydrate if the patient gets dehydrated. The cause of the side effects may be due to excessive or unquantified amounts of the herbal preparations; therefore, they become toxic to the body at some level. The study finding agrees with [30], who reported that medicinal plants used to treat human infections have side effects, although they are minimal.

The primary source of medicinal plants in the study area is the Cherangani forest. The forest location is near the respondent's residence. Although the government has strict measures to protect the forest from illegal encroachment, the respondents still find ways to pick the medicinal plants. This means that the herbalists have not cultivated most of these medicinal plants, and they rely on the wild medicinal plants. The medicinal plants' overdependence on wild habitats may risk these plants' availability in the future [9]. Despite relying on the forest, a majority of respondents cited that they had domesticated some medicinal plants in the family farms. The finding agrees with [31], who reported that some of the herbalists had domesticated the medicinal plants as a strategy of minimizing encroachment to the protected forests. Herbalists who have domesticated the medicinal plant supplement it with those from the forest. Also, these plants have other uses, such as firewood or fencing posts.

The medicinal plants grow in diverse habitats such as the highland, lowlands, and escapements. The medicinal plants that grow in lowlands are rare, and the herbalists outsource them from other places outside Elgeyo-Marakwet County.

The finding can be attributed to differences in climatic conditions and soils, hence some plants grow in lowlands, highland while a few grow in escapements [10]. The majority of the respondents (80%) outsourced them from West Pokot, Transzoia, and Baringo counties, respectively. The respondents indicated that they knew other practicing herbalists in the neighboring counties who could help collect medicinal plants and supply them at a negotiable cost.

Conclusion

The study revealed that the medicinal plants in Marakwet are from many plant families, and they have different growth forms, including trees, shrubs, herbs, and lianas. The commonly used plants are *Zehneria scabra, Croton macrostachyrus,* and *Cpyerus esculentus,* while the least used plants are *Bryophyta spp, Solanum incanum,* and *Erythrinia Abyssinia*. The medicinal plants are used to treat human diseases such as gastrointestinal, respiratory, and skin. The plant parts mainly used are roots, leaves, and barks. However, a mixture of the plant parts is also used. The primary source of medicinal plants is natural habitats such as forests. Continuous use of these plants can lead to risks of overexploitation and depletion of the medicinal plants; therefore, there is a need to document these plants and the forest, which is the primary source of these plants be protected. The study provides ethnobotanical information that can be utilized to investigate active compounds in medicinal plants, which can help in drug development.

Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose.

References

[1]. World Health Organization WHO. *WHO traditional medicine strategy: 2014-2023*. 2013 [PDF], [Google scholar],

[2]. Horrigan B., Le Tourneau M., *Altern. Ther. Health Med.,* 2003, **9**:21 [Google scholar], [Publisher]

Hussain M.S., Fareed S., Ansari S., Rahman M.A., Ahmad I.Z., Saeed M., *J. Pharm. Bioallied. Sci.,* 2012, **4**:10 [Crossref], [Google scholar], [Publisher]

[3]. Popović Z., Matić R., Bojović S., Stefanović M., Vidaković V., *J. Ethnopharmacol.,* 2016, **181**:182 [Crossref], [Google scholar], [Publisher]

[4]. Maroyi A., Cheikhyoussef A., *Indian j. tradit. knowl.,* 2015, **14**:401 [PDF], [Google scholar], [Publisher]

[5]. Jiang H., Zhang Y., Lü E., Wang C., *Veg. Hist. Archaeobot.,* 2015, **24**:165 [Crossref], [Google scholar], [Publisher]

[6]. Ozioma E.O.J., Chinwe O.A.N., *Herbal medicines in African traditional medicine. Herb. Med.,* 2019, **10**:191 [Google scholar], [Publisher]

[7]. Elujoba A.A., Odeleye O.M., Ogunyemi C.M., *African J. Tradit. Complement Altern. Med.,* 2005, **2**:46 [Google scholar], [Publisher]

[8]. Gurib-Fakim A., *Mol. Aspects Med.,* 2006, **27**:1 [Crossref], [Google scholar], [Publisher]

[9]. Kigen G., Kipkore W., Wanjohi B., Haruki B., Kemboi J., *Pharmacognosy Res.,* 2017, **9**:333 [Crossref], [Google scholar], [Publisher]

[10]. Kipkore W., Wanjohi B., Rono H., Kigen G., *J. Ethnobiol. Ethnomed.,* 2014, **10**:24 [Crossref], [Google scholar], [Publisher]

[11]. Moore C.D., *American Imperialism and the State*, 1893-1921. Cambridge University Press; 2017 [Google scholar], [Publisher]

[12]. Salako K.V., Moreira F., Gbedomon R.C., Tovissodé F., Assogbadjo A.E., Kakaï R.L.G., *J. Ethnobiol. Ethnomed.,* 2018, **14**:36 [Crossref], [Google scholar], [Publisher]

[13]. Potvin C., Revéret J.P., Patenaude G., Hutton J., *The role of indigenous peoples in conservation actions: a case study of cultural differences and conservation priorities. In: Governing Global Biodiversity*. Routledge: 2017 [Google scholar], [Publisher]

[14]. Lovren V.O., *Traditional and Indigenous Knowledge: Bridging Past and Future Sustainable Development.* 2019 [Crossref], [Publisher]

[15]. Akotsi E.F.N., Changes in forest cover in Kenya's five" water towers" 2003-2005. Kenya Forests Working Group; 2006 [Publisher]

[16]. Joana Gil-Chávez G., Villa J.A., Fernando Ayala-Zavala J., Basilio Heredia J., Sepulveda D., Yahia E.M., González-Aguilar G.A., *Compr. Rev. Food Sci. Food Saf.,* 2013, **12**:5 [Crossref], [Google scholar], [Publisher]

[17]. Forest C.H., *Strategic Ecosystem Management Plan 2015-2040*. 2015 [PDF], [Google scholar]

[18]. Minja M., Allport R., Njau P. *Tanzan Vet. J.,* 2001, **17**:186 [Google scholar], [Publisher]

[19]. Miara M.D., Bendif H., Hammou M.A., Teixidor-Toneu I., *J. Ethnopharmacol.,* 2018, **219**:248 [Crossref], [Google scholar], [Publisher]

[20]. Eddouks M., Ajebli M., Hebi M., *J. Ethnopharmacol.,* 2017, **198**:516 [Crossref], [Google scholar], [Publisher]

[21]. Bouasla A., Bouasla I., *Phytomedicine*, 2017, **36**:68 [Crossref], [Google scholar], [Publisher]

[22]. Beyene B., Beyene B., Deribe H., *J. Resour. Dev. Manag.,* 2016, **22**:33 [PDF], [Google scholar], [Publisher]

[23]. Kebebew M., Mohamed E., International J. Herb. Med., 2017, **5**:124 [PDF], [Google scholar], [Publisher]

[24]. Cadena-González A.L., Sørensen M., Theilade I., *J. Ethnobiol. Ethnomed.,* 2013, **9**:23 [Crossref], [Google scholar], [Publisher]

[25]. Umair M., Altaf M., Abbasi A.M., *PLoS One*., 2017, **12**:e0177912 [Crossref], [Google scholar], [Publisher]

[26]. Mbuni Y.M., Wang S., Mwangi B.N., Mbari N.J., Musili P.M., Walter N.O., Hu G., Zhou Y., Wang Q., *Plants*, 2020, **9**:331 [Crossref], [Google scholar], [Publisher]

[27]. Madani S., Amel B., Noui H., Djamel S., Hadjer H., *J. Intercult. Ethnopharmacol.*, 2017, **6**:311 [Crossref], [Google scholar], [Publisher]

[28]. Aadhan K., Anand S.P., *Int. J. Herb. Med.,* 2017, **5**:17 [PDF], [Google scholar], [Publisher]

[29]. Nafiu M.O., Hamid A.A., Muritala H.F., Adeyemi S.B., *Preparation, standardization, and quality control of medicinal plants in Africa. In: Medicinal Spices and Vegetables from Africa.* Elsevier; 2017. p. 171 [Crossref], [Google scholar], [Publisher]

[30]. Yatoo M.I., Saxena A., Gopalakris A., Alagawany M., Dhama K., *Int. J. Pharmacol.,* 2017, **13**:732 [Crossref], [Google scholar], [Publisher]

[31]. Ganie A.H., Tali B.A., Nawchoo I.A., Khuroo A.A., Reshi Z.A., Dar G.H., D*iversity in medicinal and aromatic flora of the Kashmir Himalaya. In: Biodiversity of the Himalaya: Jammu and Kashmir State.* Springer; 2020 [Crossref], [Google scholar], [Publisher]