

# Ethnobotanical relevance and conservation of medicinal plants used to treat human diseases in Ifedore, Ondo-State, Nigeria

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**Abstract.** Olanipekun MK. 2023. *Ethnobotanical relevance and conservation of medicinal plants used to treat human diseases in Ifedore, Ondo-State, Nigeria. Asian J Ethnobiol 6: 7-19.* An ethnobotanical study of medicinal plants used by the local people in Ifedore Local Government Area, Nigeria, was conducted to document indigenous knowledge of the importance of medicinal plants. Eighty-four respondents were selected randomly from four villages, and 20 key informants were selected with the help of local administrators, elders, and other community members. Semi-structured interviews, group discussions, and field observation were used for data collection. Descriptive statistics were used for ethnobotanical data analysis. In this study, 98 medicinal plant species belonging to 47 families were collected, identified, and documented. Asteraceae and Solanaceae were the highest families. Most plants were collected from the wild, and herbs were the most growth form. Leaf (63.2%) was the most frequently utilized part. The majority of the identified plants were herbs (55 species, 56%); followed by trees (36 species; 36.7%); climbers (4 species, 4%), and shrubs (3 species, 3%), respectively. The plants were not cultivated (70.4%). The most popular modes of preparation and route of administration were decoction and oral route, respectively. The medicinal plants were reportedly used mostly for treating respiratory tract infections 41 (41.8%). The local people believed that heart disease, liver disease, and urinary tract incontinence had no effective modern medication like herbal mixtures. *Ocimum basilicum* L. was highly effective in treating diarrhea. Agricultural expansion and building purposes, amongst others, were the most common factors for diminishing the number of medicinal plants. Training and supporting traditional healers with incentives increase their interest in conserving medicinal plants.

**Keywords:** Conservation, cultivated, ethnobotany, indigenous knowledge, medicinal plant

## INTRODUCTION

Medicinal plants are considered rich resources of ingredients that can be used in drug development and synthesis. Medicinal plants have been used in virtually all cultures as a source of medicine since times immemorial Togola et al. (2005), Etongo et al. (2017), Arowosegbe et al. (2018) and Olanipekun et al. (2020). Plants have been used traditionally as a source of medicine to control various ailments afflicting humans. In addition, traditional medicine has been used as an alternative medicine for thousands of years with great contributions made by practitioners to human health, particularly as primary health care providers at the community level, and has maintained its popularity worldwide. It was reported by Park et al. (2012) that about 60-85% of the population in every country of the developing world has to rely on traditional medicine. Unfortunately, despite the undoubted success of herbal treatment in the study area, the medicinal plants, knowledge, and experience of the traditional health practitioners have not been validated and well documented in the literatures.

The practice of traditional medicine is widespread in China, India, Japan, Pakistan, Sri Lanka, Thailand, and Korea. For example, in China, traditional medicine accounts for around 40% of all health care delivered and is used to treat roughly 200 million patients annually (WHO 1999). In many parts of Africa, herbal medicine still plays a

vital role in their inhabitants' health care, especially in remote places where clinics and hospitals are sparsely located (Etongo et al. 2017; Olanipekun et al. 2020). For example, plants have been used as a source of medicine from time immemorial to treat different ailments due to their long history of remarkable results in Ethiopia, and traditional medicine has become an integral part of the culture (Regassa et al. 2017). These traditional medical practices and remedies are recorded in oral tradition, early medico-religious manuscripts, and traditional pharmacopeias, which, according to some historians' estimates, date back to the 15th century AD (WHO 2001).

In rural areas, traditional health practitioners operate closer to the people, taking advantage of plant species' biodiversity to cure different types of diseases and ailments (Togola et al. 2005). Herbal medicine is well-established in many cultures and traditions in the study area. Unfortunately, information on herbal medicine in many rural communities of the world has been dominated by oral tradition rather than documentation of the traditional information for sustainability (Gouwakinnou et al. 2018). Considering the current rate of deforestation with the concurrent loss of biodiversity, there is an urgent need for accurate documentation of the knowledge and experience of traditional herbalists. It is necessary to make an effort to avoid erosion of this knowledge in the study area by conserving information on useful plants. This paper reported information gathered from traditional healers,

herbalists, and rural dwellers on plants used to treat human diseases.

## MATERIALS AND METHODS

### Ethical considerations

A supportive and introductory letter was obtained from the Department of Plant Science and Biotechnology, Ekiti State University, Nigeria, and submitted to leaders of the communities. The leaders discussed, agreed, and wrote a permission letter. The local communities were approached honestly, openly, and informed about the research objectives. They were told that the results were used for academic purposes and that no commercialization was involved.

### Study site and informant selection

The study was conducted in four villages in Ifedore Local Government Area, Ondo-State, using an ethnobotanical survey study design. The villages are Ilara-Mokin, Ero-Ibuj, Ibule, and Ijare. We selected 100 respondents, who were traditional practitioners, experts of plant science, and elders who were custodians of the information related to the distribution of available plants in the study area, consisting of 48 males and 52 females, randomly selected from the different villages in the study area. Also, 20 key or secondary informants who were expected to supply particularly relevant and detailed information were selected purposively with the help of local administrators, elders, and other community members, considering that these people had the potential to provide insight and understanding about traditional medicinal plants in the area.

### Ethnobotanical data collection

Ethnobotanical data were collected from March 2020 to June 2021. The techniques employed for the data collection were semi-structured interviews and field observations (Alexiades 1996). In addition, medicinal plant species identification, collection, and processing were made based on ethnobotanical information provided by the informants using basic botanical collecting tools (Vogl et al. 2004).

### Voucher specimen collection

The samples of the identified plants were collected and pressed to prepare the voucher specimens. First, however, preliminary identification was conducted in the field. Also, identifying unidentified specimens was done by comparison with authentic specimens in the herbarium, illustrations and taxonomic keys in Books of 'Flora of Nigeria and with the assistance of the curator from the Herbarium unit of the Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria. The plant specimens were collected, numbered, pressed, and dried using a plant press tool.

### Ethnobotanical data analysis

Software Package for the Social Science (SPSS 2010) version 20 was used to analyze the ethnobotanical data.

Descriptive statistics methods, namely percentage and frequency, were employed to summarize the data on medicinal plants used and the associated knowledge. Information on the knowledge of medicinal plants and the socioeconomic status of the respondents were determined. Direct matrix ranking was done for seven plants on the plant species' multipurpose use categories according to the informants' information (Ayyanar and Ignacimuthu 2011). The fidelity level specifies the informants claiming to use certain plant species for the same major purpose, which was calculated for the most frequently reported diseases or ailments using this formula:  $FL = N_p/N \times 100$ . Where  $N_p$  is the number of informants that claim to use a plant species to treat a particular disease, and  $N$  is the number of informants that use the plant as a medicine to treat any given disease.

### Intellectual property agreement statement

Before the interviews, a two-time visit was made to the study area where the Kings, the traditional rulers, and elders were duly informed about the objectives of the research work with a verbal agreement that the information gathered during the research shall be protected and that the research shall not be used for commercial purposes. Furthermore, the research was also used to train and enlighten the students on using medicinal plants to treat various diseases to conserve our heritage; thus, the interview was granted.

## RESULTS AND DISCUSSION

### Relationship between medicinal plant knowledge and age, gender, and level of education

The females had more knowledge and responded better than the male respondents during the survey (Table 1). This could be because women are closer to the family members' welfare than men. Schunko et al. (2016) also reported a similar result that in Grosses Walsertal, Vorarlberg, the western province of Austria, women knew more medicinal plants because they were in charge of food and medicine. Furthermore, in rural communities near Chapada Diamantina National Park in Bahia, Brasil, women also knew more medicinal plants than men (Voeks 2007).

**Table 1.** Medicinal plants knowledge among the respondents in the study area

	Variables	Number of respondents	% number of respondents
Gender:	Male	48	48
	Female	52	52
Age:	15-24	8	8
	25-35	22	22
	36-50	32	32
	50-90	38	38
Educational status:	Can not read and write	49	49
	Able to read and write	21	21
	Primary school	15	15
	Secondary school	8	8
	College and above	7	7

In Rejang Tribe, in Bengkulu, Indonesia, women significantly new plant names and uses than men (Wiryo et al. 2019a). However, some studies reported the opposite result, i.e., men knew more botanical knowledge than women. For example, in Zegie Peninsula, Northwestern Ethiopia, males had more medicinal plants than females because, in this community, the father passed the traditional knowledge to his first son (Teklehaymanot and Giday 2007). Similarly, De Melo et al. (2011) also reported that in the community of Fulni-ô in north-eastern Brazil, males knew more medicinal plants than females. In Semende Tribe, in Bengkulu, Indonesia, males had more botanical knowledge than females because males spent more time in the garden (Wiryo et al. 2019b).

The old people among the respondents in this study also had more knowledge than young ones because they have accumulated more experiences and knowledge with natural resources over time than younger respondents. Thus, the younger generation (22%) had lower knowledge of medicinal plants than the middle age (32%) and elders (38%) respondents, respectively. Young people's lack of traditional knowledge could be strongly influenced by several factors, such as age, civilization, disbelief, and lack of interest (Yineger and Yewhalaw 2007; Ayantunde et al. 2016). The decline of local botanical knowledge among young generations has been reported from the studies in rural communities in Mato Grosso, Brazil (Miguéis et al. 2019), in Garifuna, Nicaragua (Coe and Anderson 1996), in Western Himalaya (Uniyal et al. 2006), and Indonesia (Wiryo et al. 2017; Wiryo et al. 2019b). However, this

result was in contrast with the results provided by Yineger and Yewhalaw (2007), which showed no correlation between medicinal plant knowledge and the age of respondents.

Oral transmission of medicinal plant knowledge to both the elderly and the younger people is the most common way of transferring indigenous knowledge in the study area, though the system is not sustainable. Indigenous knowledge transfer through oral transmission could be eroded through generation unless it is written and documented. During this study, some informants said emphatically that “we used to know many medicinal plant recipes for various ailments before, but now we have forgotten most of them.” This might be a sign of losing indigenous knowledge of the use of medicinal plants.

### The plants used as medicine

In this study, ninety-eight plant species belonging to forty-eight families were used by the respondents in managing various human health problems in the study area. The identified plants' family names, common and local names, were documented. The family Asteraceae had the largest numbers of species, namely, *Acanthospermum hispidum*, *Ageratum conyzoides*, *Aspilia africana*, *Bidens pilosa*, *Chromolaena odorata*, *Helianthus annuus*, *Melanthera scandens*, *Tithonia diversifolia*, *Vernonia amygdalina* followed by the families Euphorbiaceae and Solanaceae, while several other families were represented by just one or few numbers of species each (Tables 2 and 3).

**Table 2.** List of plants used in managing various diseases in the study area

Botanical name (Auth.)	Family name	Local name	Common name
<i>Abrus precatorius</i> L.	Fabaceae	Oju ologbo	Crab's eye
<i>Adansonia digitata</i> L.	Bombaceae	Igi ose	African baobab
<i>Acanthus montanus</i> (Nees) T.Anderson	Acanthaceae	Ahon-ekun	White ginger/false thistle
<i>Acanthospermum hispidum</i> DC.	Asteraceae	Dagunro-gogoro	Bristle starbur
<i>Aframomum melegueta</i> (Roscoe)	Zingiberaceae	Atare	Grains of paradise
<i>Ageratum conyzoides</i> (Delile)	Asteraceae	Imi-Eshu	White Weed
<i>Albizia adianthifolia</i> (Schumach.) W.Wight	Fabaceae	Abo	Albizia
<i>Alchornea laxiflora</i> (Benth.) Pax & K.Hoffm.	Leguminosae	Ube	Counting sticks
<i>Aloe arborescens</i> (Mill)	Asphodelaceae	Alon erin	Torch aloe
<i>Aloe barteri</i> Baker	Liliaceae	Ida egun	Aloe
<i>Aloe vera</i> (L)	Liliaceae	Eti erin	Aloe
<i>Allium cepa</i> L.	Liliaceae	Alubasa	Onion
<i>Allium sativum</i> L.	Liliaceae	Garlic	Ayuu
<i>Alstonia boonei</i> (De.Wild.)	Apocynaceae	Ahun	Stool wood
<i>Amaranthus spinosus</i> (L)	Amaranthaceae	Tete elegun	Spiny amaranth
<i>Anacardium occidentale</i> (L.)	Anacardiaceae	Kasu	Cashew
<i>Ananas comosus</i> (L.)	Bromeliaceae	Ope oyinbo	Pineapples
<i>Aristolochia indica</i> L.	Aristolochiaceae	Ako-igun	Flower
<i>Aspilia africana</i> (Pers.) C.D.Adams	Asteraceae	Yunriyun	Heamorrhage plant
<i>Asystasia gangetica</i> L.	Acanthaceae	Lobiri	Chinese violet
<i>Azadirachta indica</i> (A.Juss)	Meliaceae	Dongoyaro	Neem Tree
<i>Bambusa vulgaris</i> (Schrad)	Poaceae	Opaarun	Bamboo
<i>Barleria buxifolia</i> L.	Acanthaceae		
<i>Bidens pilosa</i> L.	Asteraceae	Abere oloko	Blackjack
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Etupa elila	Hogweed
<i>Bridelia ferruginea</i> Benth.	Phyllanthaceae	Ira	
<i>Calotropis procera</i> (Aiton)	Apocynaceae	Bomubomu	Sodom apple
<i>Capsicum annuum</i> (L.)	Solanaceae	Ata wewe	Pepper

<i>Carica papaya</i> (L.)	Caricaceae	Ibepe	Pawpaw
<i>Cassia fistula</i> (DC.)	Fabaceae	Kasia	Golden Shower
<i>Celosia argentea</i> L.	Amaranthaceae	Celosia	Celosia
<i>Chasmanthera dependens</i> (PROTA)	Menispermaceae	Atoo	Chasmanthera
<i>Chromolaena odorata</i> (L.) R.M.King	Asteraceae	Akintola	Siam weed
<i>Citrus aurantifolia</i> (Christin)	Rutaceae	Osan Wewe	Lime
<i>Citrus aurantium</i> (L.)	Rutaceae	Osan Gaingain	Sour Orange
<i>Citrus sinensis</i> (L.)	Rutaceae	Osan	Orange
<i>Cocos nucifera</i> (L)	Euphorbiaceae	Agbon	Coconut palm
<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Gwanduwa	Little gourd
<i>Combretum periculatum</i> Vent.	Combretaceae	Ogan	fire vine
<i>Crinum jagus</i> (J. Thomps) Dandy	Amaryllidaceae	Ogede omimi	Crinum
<i>Curcuma longa</i> (L.)	Zingiberaceae	Ajo	Turmeric
<i>Cymbopogon citratus</i> L.	Poaceae	Ewe tea	Lemon grass
<i>Datura metel</i> L.	Solanaceae	Apikan	Devil's trumpet
<i>Elaeis guineensis</i> (L)	Arecaceae	Ope	Oil palm
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Emi-ile	Asthma weed
<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	Ifobia	Mexican fire plant
<i>Ficus exasperate</i> (Vahl.)	Moraceae	Eepin	Sand paper
<i>Flueggea virosa</i> (Roxb. Ex Willd)	Euphorbiaceae	Eyin eye	White-berry bush
<i>Garcinia kola</i> L.	Clusiaceae	Orogbo	Bitter kola
<i>Glyphaea brevis</i> (Spreng)	Tiliaceae	Atori	Masquerade stick
<i>Gossypium hirsutum</i> (L.)	Malvaceae	Igi-Owu	Cotton Wood
<i>Helianthus annuus</i> (L.)	Asteraceae	Fufulele	Sunflower
<i>Heliotropium indica</i> (L.)	Boraginaceae	Apari igun	Heliotropium
<i>Jatropha curcas</i> L.	Euphorbiaceae	Lapalapa pupa	
<i>Jatropha gossypifolia</i> (L)	Euphorbiaceae	Lapalapa funfun	
<i>Jatropha multifida</i> (L.)	Euphorbiaceae	Ogege	Coral plant
<i>Mangifera indica</i> L.	Anacardiaceae	Mangoro	Mango
<i>Melanthera scandens</i> (Schum. and Thonn)	Asteraceae	Agbugbo	Black-stamened-one
<i>Momordica charantia</i> L.	Curcubitaceae	Ejinrin were	Bitter gourd
<i>Morinda lucida</i> (Benth)	Rubiaceae	Ohio, Oruwo	Brimstone
<i>Moringa oleifera</i> (Lam.)	Moringaceae	Ewe igbale	Moringa
<i>Mucuna sloanei</i> (Fawc.)	Fabaceae	Yerepe	Horseeye bean
<i>Newbouldia laevis</i> (P. beauv)	Bignoniaceae	Akoko	African tulip
<i>Nicotiana tabacum</i> (L)	Solanaceae	Taba	Tobacco
<i>Ocimum gratissimum</i> (Forssk.)	Labiatae	Efinrin	Scent Leaf
<i>Parkia biglobosa</i> (Benth)	Fabaceae	IgiIru	African Locust Beans
<i>Parquetina nigrescens</i> (Wennberg) Bullock	Apocynaceae	Ogbo	Africa parquetina
<i>Pergularia daemia</i> (Forssk.) Chiov.	Ascepiadaceae	Atufa	Pergularia
<i>Phyllanthus amarus</i> (Schum. and Thonn.)	Phyllanthaceae	Ehinolubisowo	Black catnip
<i>Phyllanthus muellerianus</i> (Kuntze)	Phyllanthaceae	Egun-eja	Myrobalan
<i>Phyllanthus nummulariifolius</i> Schumach. &Thonn.	Phyllanthaceae	Iranje	Leaf-flower
<i>Piper guineense</i> (L.)	Piperaceae	Iyere	African black pepper
<i>Psidium guajava</i> (L.)	Myrtaceae	Gurofa	Guava
<i>Pycnanthus angolensis</i> (SIDA)	Myristiaceae	Akomu	African Nutmeg
<i>Raphia farinifera</i> Hyl.(Gaertn.)	Palmae	Oguro	Palm
<i>Saccharum officinarum</i> L.	Gramineae	Ireke	Sugarcane
<i>Senna alata</i> (L.) Roxb.	Fabaceae	Asunwon oyinbo	Ringworm bush
<i>Sida acuta</i> (Burn)	Malvaceae	Iseketu	Common wireweed
<i>Solanum americanum</i> (Mill.)	Solanaceae	Odu	Small-flower night shade
<i>Solanum nigrum</i> (L.)	Solanaceae	Efo-odu	Black-night shade
<i>Sorghum bicolor</i> (L.) Moench	Poaceae	Poroporo oka	Millet
<i>Spondias mombin</i> L.	Anacardiaceae	Okinkan	Hog mombin
<i>Syzygium aromaticum</i> L.	Myrtaceae	Kanafuru	Clove-tree
<i>Telfaria occidentalis</i> (Hook. F)	Cucurbitaceae	Agboroko	Fluted pumpkin
<i>Tithonia diversifolia</i> Hemsl.	Asteraceae	Tree marigold	Jogbo-agbale
<i>Trema orientalis</i> (L.)	Ulmaceae	Afele	charcoal tree
<i>Tribulus terrestris</i> L.	Zygophyllaceae	A small herb	Cat-head or devils weed.
<i>Tridax procumbens</i> (L)	Compositae	Sabaruma	Tridax
<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	Ito igbin	Burweed
<i>Vernonia amygdalina</i> (Delile)	Asteraceae	Ewuro	Bitter Leaf
<i>Vitellaria paradoxa</i> C.F.Gaertn.	Sapotaceae	Ori	Shea Butter
<i>Vitex agnus-castus</i> (L)	Lamiaceae	Efo oriri	Chase tree
<i>Vitis vinifera</i> (L)	Vitaceae	Girepu	Grape vine
<i>Xylopi aethiopica</i> (Dunal) A. Rich	Annonaceae	Arunje	Ethiopian pepper
<i>Xylopi quintasii</i> (Engl and Diels)	Annonaceae	Eru awonka	Negro pepper
<i>Zea mays</i> (L)	Poaceae	Agbado	Corn
<i>Zingiber officinale</i> (Roscoe)	Zingiberaceae	Atale	Ginger
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	Ekanesi-adie	Chinese-apple

**Table 3.** Frequency of occurrence of plant species within their families in the study area

Family name	Frequency	Percent	Plant species
Acanthaceae	3	3.1	<i>Acanthus montanus</i> , <i>Asystasia gangetica</i> , <i>Barleria buxifolia</i>
Amaranthaceae	2	2.0	<i>Amaranthus spinosus</i> , <i>Celosia argentea</i>
Amaryllidaceae	1	1	<i>Combretum periculatum</i>
Anacardiaceae	3	3.1	<i>Anacardium occidentale</i> , <i>Mangifera indica</i> , <i>Spondias mombin</i>
Annonaceae	2	2.0	<i>Xylopia aethiopica</i> , <i>Xylopia quintasii</i>
Apocynaceae	3	3.1	<i>Alstonia boonei</i> , <i>Calotropis procera</i> , <i>Parquetina nigrescens</i>
Arecaceae	1	1	<i>Elaiis guineensis</i>
Aristolochiaceae	1	1	<i>Aristolochia indica</i>
Ascepiadaceae	1	1	<i>Pergularia daemia</i>
Asteraceae	9	9.2	<i>Acanthospermum hispidum</i> , <i>Ageratum conyzoides</i> , <i>Aspilia africana</i> , <i>Bidens pilosa</i> , <i>Chromolaena odorata</i> , <i>Helianthus annuus</i> , <i>Melanthera scandens</i> , <i>Tithonia diversifolia</i> , <i>Vernonia amygdalina</i>
Bignoniaceae	1	1	<i>Newbouldia laevis</i>
Boraginaceae	1	1	<i>Heliotropium indica</i>
Bombaceae	1	1	<i>Adansonia digitata</i>
Bromeliaceae	1	1	<i>Ananas comosus</i>
Caricaceae	1	1	<i>Carica papaya</i>
Clusiaceae	1	1	<i>Garcinia kola</i> ,
Combretaceae	1	1	<i>Combretum periculatum</i> ,
Compositae	1	1	<i>Tridax procumbens</i>
Cucurbitaceae	1	1	<i>Coccinia grandis</i> , <i>Momordica charantia</i> , <i>Telfaria occidentalis</i>
Euphorbiaceae	7	7.1	<i>Cocos nucifera</i> , <i>Euphorbia hirta</i> , <i>Euphorbia heterophylla</i> , <i>Flueggea virosa</i> , <i>Jatropha curcas</i> , <i>Jatropha gossypifolia</i> , <i>Jatropha multifida</i>
Fabaceae	6	6.1	<i>Abrus precatorius</i> , <i>Albizia adantifolia</i> , <i>Cassia fistula</i> , <i>Mucuna sloanei</i> , <i>Parkia biglobosa</i> , <i>Senna alata</i>
Gramineae	1	1	<i>Saccharum officinarum</i>
Lamiaceae	2	2	<i>Ocimum gratissimum</i> , <i>Vitex agnus-</i>
Leguminosae	1	1	<i>Alchornea laxiflora</i>
Liliaceae	2	2	<i>Allium cepa</i> , <i>Allium sativum</i>
Malvaceae	2	2	<i>Gossypium hirsutum</i> , <i>Sida acuta</i>
Meliaceae	1	1	<i>Azadirachta indica</i> ,
Menispermaceae	1	1	<i>Chasmanthera dependens</i>
Moraceae	1	1	<i>Ficus exasperate</i>
Moringaceae	1	1	<i>Moringa oleifera</i>
Myrtaceae	2	2	<i>Psidium guajava</i> , <i>Syzygium aromaticum</i>
Myristicaceae	1	1	<i>Pycnanthus angolensis</i>
Nyctaginaceae	1	1	<i>Boerhavia diffusa</i>
Palmae	1	1	<i>Raphia farinifera</i>
Phyllanthaceae	4	4	<i>Bridelia ferruginea</i> , <i>Phyllanthus amarus</i> , <i>Phyllanthus muellerianus</i> , <i>Phyllanthus nummulariifolius</i>
Piperaceae	1	1	<i>Piper guineense</i>
Poaceae	4	4	<i>Bambusa vulgaris</i> , <i>Cymbopogon citratus</i> , <i>Sorghum bicolor</i> , <i>Zea mays</i> ,
Rhamnaceae	1	1	<i>Ziziphus mauritiana</i>
Rubiaceae	1	1	<i>Morinda lucida</i>
Rutaceae	3	3	<i>Citrus aurantifolia</i> , <i>Citrus aurantium</i> , <i>Citrus sinensis</i> ,
Sapotaceae	1	1	<i>Vitellaria paradoxa</i>
Solanaceae	5	5	<i>Capsicum annum</i> , <i>Datura metel</i> , <i>Nicotiana tabacum</i> , <i>Solanum americanum</i> , <i>Solanum nigrum</i>
Tiliaceae	2	2	<i>Glyphaea brevis</i> , <i>Triumfetta rhomboidea</i>
Ulmaceae	1	1	<i>Trema orientalis</i>
Vitaceae	1	1	<i>Vitis vinifera</i>
Xanthorrhoeaceae	3	3	<i>Aloe barteri</i> , <i>Aloe vera</i> , <i>Aloe aborescens</i>
Zingiberaceae	3	3	<i>Aframomum melegueta</i> , <i>Curcuma longa</i> , <i>Zingiber officinale</i>

### Diversity of growth forms and habitat of medicinal plants in the study area

Most of the identified plants were herbs in nature (55 species, 56%), followed by trees (36 species; 36.7%), climbers (4 species, 4%), and shrubs (3 specie, 3%) respectively (Figure 2). The use of herbs as the most mentioned plants might be because herbs are more effective and relatively more available than other plant growth forms in the study area (Lulekal et al. 2008; Megersa et al. 2013).

### Plant parts used to treat various diseases

People in the study area harvest different plant parts (i.e., leaf, seed, bark, latex, and fruit) to prepare herbal remedies (Figure 1). Leaf was the most harvested plant part, with 63 species (63.2%), followed by fruit, 13 species (12.2%), stem bark, 10 species (10%), seed, 6 species (6%), root, 2 species (2.4%), and latex, 4 species (4.3%), respectively (Figure 3, Table 4). Obviously, some tendencies contain more concentration of both micro and macronutrients of bioactive ingredients than the other

plants. In addition, many metabolic and photosynthetic activities usually occur on the leaves (Eddouks et al. 2002; El-Hilaly et al. 2003; Gidey et al. 2011; Olanipekun et al. 2020). However, the use of the leaf as the major plant part for the medicinal purpose than other plants parts is contrary to the findings of Hunde et al. (2006), in which the root (31.4%) was reported as the most widely used plant part followed by leaf (24.4%). Also, the study by Yineger and Yewhalaw (2007) showed that root constituted the major plant part (42%) used. Furthermore, Teklehaymanot and Giday (2007) also documented root as a major plant part (35.8%) used in treating human ailments.

**The method of preparation of the plants and ways of administration**

The methods of preparing the identified plants locally vary from herbalists to herb sellers, indigenous people, and others, and this could be generally classified into various categories, namely decoction, infusions, squeezing, cutting, pounding, and grinding (Figure 4, Table 4). The parts of plants used for the preparation were either fresh or dried materials, though the fresh materials were reportedly more effective and preferred to the dry specimens. This could be because the bioactive ingredients in dry specimens have

been reduced or volatilized due to exposure to the sun and air during drying (Regassa et al. 2017). Usually, two, three, or more species of plants were combined and used in more than one preparation method. This result confirms the synergistic effects of the plant preparation when combined (Mukazayire et al. 2008; Atul and Ray 2014; Khuankaew et al. 2014). The number of species used for herbal preparation by decoction and infusion, respectively, was 10 (23%) each. Other preparation methods were grinding (4 species, 9.3%) and concoction, squeezing, squeezing/decoction (3 species, 6.9% each). Other less frequently used methods were cutting, pounding, crushing, pounding/squeezing, crushing/pounding, squeezing/infusion, i.e., one species (2.3%) each (Figure 3). Respiratory tract infections, various skin diseases and conditions such as pains and inflammations, respectively, were the most commonly treated diseases and conditions by traditional medicine, as reported by the informants. Oral administration was the most frequently used herbal healing method (Table 4). Oral administration easily targets disease organisms to ensure a quick recovery and prevent disease attack (Mukazayire et al. 2008; Khuankaew et al. 2014; Woldeab et al. 2018).

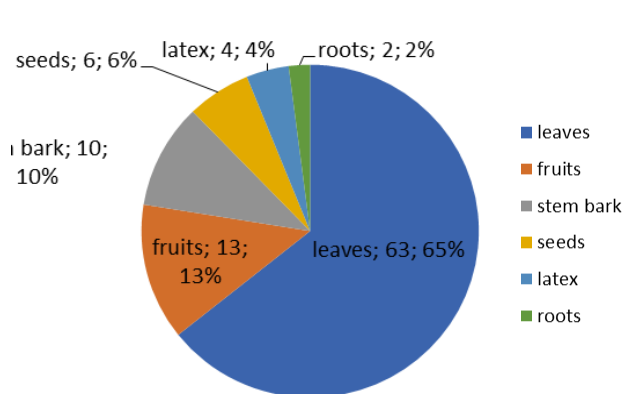


Figure 1. The plant parts of the identified plants

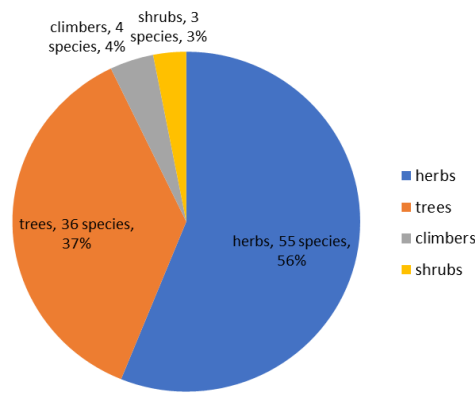


Figure 2. The plant forms of the identified plants

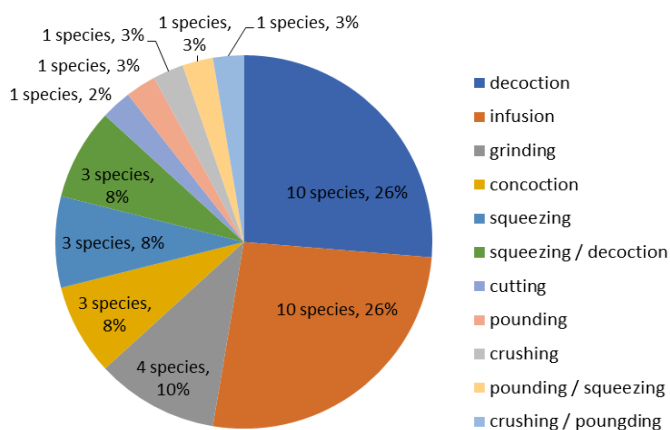


Figure 3. The methods of preparation of the identified plants

**Table 4.** List of the methods of preparation and mode of administration of the plants used in the management of various diseases in the study area

Species name	Plant form	Part used	Disease treated	Mode of preparation	Route of administration
<i>Abrus precatorius</i>	Climber	Leaf	Malaria	Decoction	Oral
<i>Adansonia digitata</i>	Tree	Leaf, stem bark	Malaria	Decoction	Oral
<i>Acanthus montanus</i>	Herb	Leaf	Respiratory tract infection	Infusion	Oral
<i>Acanthospermum hispidum</i>	Herb	Leaf	Bacterial and fungal, skin ailments, fever.	Infusion	Oral, dermal application
<i>Aframomum melegueta</i>	Herb	Seed	Respiratory tract infection	Grinding	Oral/inhaling
<i>Ageratum conyzoides</i>	Herb	Leaf	Cramps; Wounds, Skin rashes	Squeezing	Dermal, oral
<i>Albizia adianthifolia</i>	Tree	Leaf/bark	Cramps	Decoction	Oral
<i>Alchornea laxiflora</i>	Herb	Leaf	Pile, eczema, Respiratory tract infection	Grinding	Dermal, oral
<i>Aloe arborescens</i>	Herb	Leaf	Acne, burns	Squeezing	Dermal
<i>Aloe barteri</i>	Herb	Leaf	Burns	Infusion	Dermal
<i>Aloe vera</i>	Herb	Leaf	Acne, burns, acne pimples, eczema, scabies	Infusion	Dermal
<i>Allium cepa</i>	Herb	Leaf	Respiratory tract infection	Cutting	Inhaling
<i>Allium sativum</i>	Herb	Leaf	Respiratory tract infection	Pounding	Eating/inhaling
<i>Alstonia boonei</i>	Tree	Leaf/bark	Malaria, Respiratory tract infection; Dysentery	Decoction	Oral
<i>Amaranthus spinosus</i>	Herb	Leaf	Respiratory tract infection; Boils, eczema	Infusion	Inhaling
<i>Anacardium occidentale</i>	Tree	Leaf/bark	Malaria, respiratory tract infection	Decoction	Oral
<i>Ananas comosus</i>	Herb	Fruit	Respiratory tract infection	Concoction/ crushing	Oral
<i>Aristolochia indica</i>	Climber	Leaf	Cough, inflammation	Squeezing/ Infusion	Oral
<i>Aspilia africana</i>	Herb	Leaf	Wounds, itch, Rheumatic pains	Crushing/ pounding	Dermal
<i>Asystasia gangetica</i>	Herb	Leaf	Respiratory tract infection	Squeezing	Oral
<i>Azadirachta indica</i>	Tree	Leaf/seed	Malaria, Respiratory tract infection; Skin itching, eczema,	Decoction Infusion	Itching, eczema, ringworm
<i>Bambusa vulgaris</i>	Tree	Leaf	Diabetes; Rashes	Decoction/p ounding	Oral
<i>Barleria buxifolia</i>	Shrub	Leaf	Diabetes and respiratory diseases, anaemia, toothache and cough.	Concoction	Oral
<i>Bidens pilosa</i>	Herb	Leaf	Diarrhea/inflammation	Squeezing/ Decoction	Oral
<i>Boerhavia diffusa</i>	Herb	Leaf	Skin infection	Squeezing/ Decoction	Dermal
<i>Bridelia ferruginea</i>	Tree	Leaf/bark	Respiratory tract infection/malaria	Decoction	Oral
<i>Calotropis procera</i>	Herb	Leaf	Skin infection/inflammation	Squeezing/ Decoction	Oral/dermal
<i>Capsicum annuum</i>	Herb	Leaf/fruit	Respiratory tract infection/inflammation	Pounding	Oral
<i>Carica papaya</i>	Shrubs	Leaf/seed	Respiratory tract infection, constipation, pain	Pounding/ Squeezing	Oral
<i>Cassia fistula</i>	Tree	Leaf	Respiratory tract infection	Decoction	Oral
<i>Celosia argentea</i>	Herb	Leaf	Diarrhea, wounds and skin eruption, antidote for poison.	Pounding/ Squeezing	Oral/dermal
<i>Chasmanthera dependens</i>	Tree	Leaf	Respiratory tract infection	Pounding/ Squeezing	Oral
<i>Chromolaena odorata</i>	Herb	Leaf	Respiratory tract infection; Wounds, rashes	Decoction	Oral/dermal
<i>Citrus aurantifolia</i>	Tree	Leaf/fruit	Respiratory tract infection	Decoction/ Squeezing	Oral
<i>Citrus aurantium</i>	Tree	Fruit	Measles/inflammation	Decoction/ Squeezing	Dermal/oral
<i>Citrus sinensis</i>	Tree	Fruit	Respiratory tract infection; Ringworm	Decoction/ Squeezing	Oral
<i>Cocos nucifera</i>	Herb	Bark	Rheumatism, Eczema,	Concoction	Oral

<i>Coccinia grandis</i>	Climber	Leaf	Reduce high blood pressure and abscesses.	Infusion	Oral
<i>Combretum paniculatum</i>	Tree	Leaf	Respiratory tract infection; worms, skin spot	Decoction	Oral
<i>Crinum jagus</i>	Herb	Leaf	Respiratory tract infection/inflammation	Infusion	Oral
<i>Curcuma longa</i>	Herb	Leaf/root	Respiratory tract infection/inflammation	Grinding	Oral
<i>Cymbopogon citratus</i>	Herb	Leaf	Respiratory tract infection/inflammation	Infusion	Inhalation/oral
<i>Datura metel</i>	Herb	Leaf	Diabetes	Grinding	Oral
<i>Elaeis guineensis</i>	Tree	Fruit	Respiratory tract infection; skin infection	Decoction	Oral/dermal
<i>Euphorbia hirta</i>	Herb	Leaf	Eczema, wounds	Infusion	Dermal
<i>Euphorbia heterophylla</i>	Herb	Leaf	Skin problems, fungal diseases, and abscesses.	Infusion/ concoction	Dermal
<i>Ficus exasperata</i>	Tree	Leaf	Respiratory tract infection; Boils, ringworm	Pounding/ Decoction	Dermal
<i>Flueggea virosa</i>	Tree	Leaf	Respiratory tract infection	Pounding/ Decoction	Dermal
<i>Garcinia kola</i>	Tree	Seed	Respiratory tract infection	Pounding/ Decoction	Oral
<i>Glyphaea brevis</i>	Tree	Leaf	Cramp	Grinding	Oral
<i>Gossypium hirsutum</i>	Herb	Leave/seed	Respiratory tract infection; Skin rash	Pounding/ Decoction	Oral/dermal
<i>Helianthus annuus</i>	Herb	Leaf	Respiratory tract infection	Infusion	Oral
<i>Helitropium indicum</i>	Herb	Leaf	Respiratory tract infection, pains, Small pox, wounds	Concoction/ Infusion	Oral, dermal
<i>Jatropha curcas</i>	Herb	Leaf/latex	Skin spots/ diarrhea	Squeezing latex	Dermal/oral
<i>Jatropha gossypifolia</i>	Herb	Leaf/latex	Pile, Respiratory tract infection	concoction	Dermal/oral
<i>Jatropha multifida</i>	Herb	Leaf/latex	Pile, Respiratory tract infection	Squeezing latex	Oral
<i>Mangifera indica</i>	Tree	Fruit/leaf	Malaria, Respiratory tract infection; Bleeding, piles	Decoction	Oral
<i>Melanthera scandens</i>	Herb	Leaf	Skin infection, wounds	Decoction	Dermal
<i>Momordica charantia</i>	Herb	Leaf	Pile, indigestion, Respiratory tract infection; Rashes, sores	Concoction	Dermal/oral
<i>Morinda lucida</i>	Tree	Leaf	Fever, Respiratory tract infection/skin infection	Decoction	Oral/dermal
<i>Moringa oleifera</i>	Tree	Leaf	Respiratory tract infection; Skin infection, pain, insomnia	Concoction	Oral/dermal
<i>Mucuna sloanei</i>	Herb	Leaf	Itching/inflammation	Boiling	Dermal
<i>Newbouldia laevis</i>	Tree	Leaf	Respiratory tract infection	Boiling	Oral
<i>Nicotiana tabacum</i>	Herbs	Leaf	Rheumatic swelling, piles, heart diseases and depression	Infusion	
<i>Ocimum gratissimum</i>	Herb	Leaf	Pile, diarrhea, dysentery, Respiratory tract infection	Concoction	Oral
<i>Parkia biglobosa</i>	Tree	Seed	Fever, Respiratory tract infection	Decoction	Oral
<i>Parquetina nigrescens</i>	Herb	Leaf	Pile, Skin lesions Respiratory tract infection	Infusion	Dermal/oral
<i>Pergularia daemia</i>	Herb	Leaf	Pile/constipation	Concoction	Oral
<i>Phyllanthus amarus</i>	Herb	Leaf	Skin spot, dysentery, wounds	Squeezing	Dermal
<i>Phyllanthus muellerianus</i>	Herb	Leaf	Wound dressing, skin eruption, liver problem	Concoction	Dermal
<i>Phyllanthus nummularifolius</i>	Herb	Leaf	Respiratory tract infection, diabetes	Concoction	Oral
<i>Piper guineense</i>	Herb	Fruit/seed	Respiratory tract infection/inflammation	Concoction	Oral

<i>Psidium guajava</i>	Tree	Fruit/leaf	Respiratory tract infection	Cooking/ Squeezing	Oral
<i>Pycnanthus angolensis</i>	Tree	Leaf/seed	Respiratory tract infection	Cooking/ grinding	Oral
<i>Raphia farinifera</i>	Tree	Leaf	Respiratory tract infection/skin infection	Concoction	Oral
<i>Saccharum officinarum</i>	Herb	Leaf/fruit	Malaria/	Squeezing	Oral
<i>Senna alata</i>	Tree	Leaf	Cramp, Ringworm, scabies, eczema, craw-craw	Boiling	Dermal
<i>Sida acuta</i>	Herb	Leaf	Whitlow, liver, dysentery	Squeezing	Dermal/oral
<i>Solanum americanum</i>	Herb	Leaf	Malaria, stomachache	Squeezing	Oral
<i>Solanum nigrum</i>	Herb	Leaf	Respiratory tract infection	Concoction	Oral
<i>Sorghum bicolor</i>	Herb	Leaf	Diarrhea	Concoction	Oral
<i>Spondias mombin</i>	Tree	Leaf/fruit	Dysentery, malaria	Cooking	Oral
<i>Scyzgium aromaticum</i>	Herb	Clove	Respiratory tract infection/inflammation	Concoction	Oral
<i>Telfairia occidentalis</i>	Herbs	Leaf	Anaemia	Decoction	Oral
<i>Tithonia diversifolia</i>	Herb	Leaf	Malaria/pains	Concoction	Oral
<i>Trema orientalis</i>	Tree	Leaf	Respiratory tract infection	Infusion	Oral
<i>Tribulus terrestris</i>	Herb	Leaf	Urinary tract infection and swelling.	Concoction	Oral
<i>Tridax procumbens</i>	Herb	Leaf	Urinary tract infection and swelling, Skin spots, wound healing.	Concoction	Oral/dermal
<i>Triumfetta rhomboidea</i>	Herbs	Leaf	Urinary tract infection and swelling.	Decoction	Oral
<i>Vernonia amygdalina</i>	Tree	Leaf	Respiratory tract infection, pains, malaria, Ringworm, rashes and eczema, small pox, measles	Concoction	Oral/dermal
<i>Vitellaria paradoxa</i>	Tree	Leaf/bark	Respiratory tract infection	Decoction	Oral
<i>Vitex agnus- castus</i>	Tree	Leaf	Acne, burns, dry skin, eczema/ Depression	Concoction	Dermal
<i>Vitis vinifera</i>	Tree	Leaf	Small pox, inflammation, depression	Concoction/ Squeezing	Dermal/oral
<i>Xylopi aethiopica</i>	Herb	Leaf	Respiratory tract infection	Crushing	Oral
<i>Xylopi quintasii</i>	Herb	Leaf	Urinary tract infection and swelling.	Maceration	Oral
<i>Zea mays</i>	Herb	Fruit	Urinary tract infection and swelling.	Crushing	Oral
<i>Zingiber officinale</i>	Herb	Seed	Respiratory tract infection/ Inflammation	Pounding/ Powdering	Oral
<i>Ziziphus mauritiana</i>	tree	Leaf	Anticancer, antidote, expectorant.	Concoction	Oral

### The wild and cultivated plants species identified in the study area

A total of 98 plants species were collected and documented from the study area. The plants were mostly wild and not cultivated (70.4%), while few are cultivated and available (29.6%) in the study area (Table 5 ). Some cultivated plants were *Aframomum melegueta*, *Aloe arborescens*, *Aloe barteri*, *Aloe vera*, *Allium cepa*, *Allium sativum*, *Aristolochia indica*, *Anacardium occidentale*, *Ananas comosus*, *Capsicum annuum*, *Carica papaya*, and *Citrus aurantifolia*, while others were wild and not cultivated in the study area. These plants were noted for their effectiveness and disease resistance. However, it was difficult to get some of the uncultivated plants; unfortunately, many of them are eroded and yet to be documented in the study area.

### The plant species are frequently used for several purposes

Medicinal plants in this study area were not only used for medicinal value but also used for different purposes. The informants frequently used seven plant species in the multipurpose use categories other than medicinal purposes. The plants were used as firewood, furniture, food, charcoal, fencing, etc. *Adansonia digitata* was the most multipurpose plant, followed by *Alstonia boonei* (Table 6).

The local people harvested multipurpose species mostly for furniture, firewood, food, and fencing (Alemayehu et al. 2015). The diversity of the multipurpose plants was highly diversified in the study area. This could be because there was an intense plantation of different trees in the government forest reserve areas in the past ten years. Though, it was reported by Maydeu-Olivares and Bockenholt (2005) and Geng et al. (2016) that the plants

have decreased in number, becoming rare and needing attention before totally lost.

#### Users of and marketability of the medicinal plants

Most traditional medicinal plant users were community members with lower incomes. Even if there are modern medications, the inhabitants of the study area were not rich enough to afford the purchase of synthetic drugs. Besides, sometimes the native people preferred traditional medicine because they believed that they were affordable, effective, disease to micro-organisms, less toxic, and lasted longer than modern medication. For example, *Ocimum basilicum* was used as a fast curative for diarrhea, while *A. hispidum*, *A. conyzoides*, *A. africana*, *B. pilosa*, *C. odorata*, *H. annuus*, *M. scandens*, *T. diversifolia*, *V. amygdalina* were all herbs in the family Asteraceae used effectively for various diseases in the study area (Megersa et al. 2013). Seventy-eight point nine percent (78.9%) of informants reported that traditional medicine or herbal mixtures had no specific market, but they were found as an integral part of the main market of each of the study areas. Medicinal plants were also marketed in a local community

for food, and economic purposes as well for medical value based on cultural activity (Fandohan et al. 2010). For example, *Abrus precatorius*, *A. digitata*, and *A. boonei* were economic plants used for building purposes, furniture purposes and local canoe and bridge constructions, respectively. *Parkia biglobosa* serves as a condiment for soup preparation, while, *A. occidentale*, *A. comosus*, *C. papaya*, etc., were used as fruit as well as food.

#### Informant Consensus Factor (ICF)

The various diseases and the number of plant species used to manage them were documented in the study area (Table 7). This was further grouped into various categories based on the site of occurrence of the disease, condition of the disease, and treatment resemblance of the disease to the local people to determine their informant consensus. The informant consensus factors were calculated for each category where the highest ICF (0.94) value was obtained for diseases related to hypertension and the least one (0.64) was associated with Anaemia and Worms (Table 8).

**Table 5.** The list of the wild and cultivated plants species identified in the study area

Identified wild plants	Percentage
<i>Abrus precatorius</i> , <i>Adansonia digitata</i> , <i>Acanthus montanus</i> , <i>Acanthospermum hispidum</i> , <i>Ageratum conyzoides</i> , <i>Albizia adianthifolia</i> , <i>Alchornea laxiflora</i> , <i>Alstonia boonei</i> , <i>Amaranthus spinosus</i> , <i>Aspilia africana</i> , <i>Azadirachta indica</i> , <i>Bambusa vulgaris</i> , <i>Barleria buxifolia</i> , <i>Bidens pilosa</i> , <i>Boerhavia diffusa</i> , <i>Bridelia ferruginea</i> , <i>Calotropis procera</i> , <i>Cassia fistula</i> , <i>Celosia argentea</i> , <i>Chasmanthera dependens</i> , <i>Chromolaena odorata</i> , <i>Coccinia grandis</i> , <i>Combretum periculatum</i> , <i>Datura metel</i> , <i>Euphorbia hirta</i> , <i>Euphorbia heterophylla</i> , <i>Ficus exasperate</i> , <i>Flueggea virosa</i> , <i>Garcinia kola</i> , <i>Glyphaea brevis</i> , <i>Gossypium hirsutum</i> , <i>Helianthus annuus</i> , <i>Heliotropium indica</i> , <i>Jatropha gossypifolia</i> , <i>Jatropha multifida</i> , <i>Lactuna virosa</i> , <i>Momordica charantia</i> , <i>Morinda lucida</i> , <i>Moringa oleifera</i> , <i>Newbouldia laevis</i> , <i>Ocimum gratissimum</i> , <i>Parkia biglobosa</i> , <i>Parquetina nigrescens</i> , <i>Pergularia daemia</i> , <i>Peperomia pellucida</i> , <i>Phoenix dactylifera</i> , <i>Phyllanthus muellerianus</i> , <i>Piper guineense</i> , <i>Pycnanthus angolensis</i> , <i>Prunus dulcis</i> , <i>Raphia farinifera</i> , <i>Senna alata</i> , <i>Sida acuta</i> , <i>Spondias mombin</i> , <i>Scoparia dulcis</i> , <i>Sparganophorus sparganophora</i> , <i>Tithonia diversifolia</i> , <i>Trema orientalis</i> , <i>Tribulus terrestris</i> , <i>Tridax procumbens</i> , <i>Triumfetta rhomboidea</i> , <i>Tylophora glauca</i> , <i>Vitellaria paradoxa</i> , <i>Vitex agnus-castus</i> , <i>Vitis vinifera</i> , <i>Xylopiya aethiopica</i> , <i>Xylopiya quintasii</i> , <i>Ziziphus mauritiana</i>	70.4 %
<b>Identified cultivated plant species</b>	
<i>Aframomum melegueta</i> , <i>Aloe arborescens</i> , <i>Aloe barteri</i> , <i>Aloe vera</i> , <i>Allium cepa</i> , <i>Allium sativum</i> , <i>Aristolochia indica</i> , <i>Anacardium occidentale</i> , <i>Ananas comosus</i> , <i>Capsicum annum</i> , <i>Carica papaya</i> , <i>Citrus aurantifolia</i> , <i>Citrus aurantium</i> , <i>Citrus sinensis</i> , <i>Cocos nucifera</i> , <i>Crinum jagus</i> , <i>Curcuma longa</i> , <i>Cymbopogon citratus</i> , <i>Elaeis guineensis</i> , <i>Mangifera indica</i> , <i>Psidium guajava</i> , <i>Saccharum officinarum</i> , <i>Solanum erianthum</i> , <i>Sorghum bicolor</i> , <i>Syzygium aromaticum</i> , <i>Vernonia amygdalina</i> , <i>Zea mays</i> , <i>Zingiber officinale</i>	29.6 %

**Table 6.** Selected seven medicinal plant species used for several purposes

Plant species	Use categories							Total	Rank
	Firewood	Furniture	Food	Charcoal	Fencing	Medicine	Forage		
<i>Adansonia digitata</i>	5	5	5	5	1	5	3	29	1 <sup>st</sup>
<i>Alstonia boonei</i>	5	3	5	5	1	2	4	25	2 <sup>nd</sup>
<i>Anacardium occidentale</i>	4	2	5	2	4	4	3	24	3 <sup>rd</sup>
<i>Ananas cosmosus</i>	1	1	5	1	1	3	3	15	7 <sup>th</sup>
<i>Bridelia ferruginea</i>	3	3	2	4	2	5	3	22	5 <sup>th</sup>
<i>Spondia mombin</i>	4	2	2	4	4	5	2	23	4 <sup>th</sup>
<i>Vernonia amygdalina</i>	3	2	2	3	4	5	3	18	6 <sup>th</sup>

### Threats to medicinal plants and conservation practices in study area

The influences of humans on the natural habitat where plants grow seem to be very high and the effort to conserve medicinal plants in the study area was very little. Thus, there is a need to conserve medicinal plants and associated knowledge (Lulekal et al. 2008; Gouwakinnou et al. 2018). However, it was reported by some participants that they had started cultivating some medicinal plants at home gardens, though the efforts needed to be improved. About 29.6 % of the medicinal plants collected were reportedly found cultivated at home gardens, and these include plants like *A. melegueta*, *A. arborescens*, *A. barteri*, *A. vera*, *A. cepa*, *A. sativum*, *A. indica*, *A. occidentale*, *A. comosus*, *C. annum*, *C. papaya*, *C. aurantifolia*, *Citrus aurantium*, *Citrus sinensis*, *Cocos nucifera*, *Crinum jagus*, *Curcuma longa*, *Cymbopogon citratus*, *Elaies guineensis* *Mangifera indica*, *Psidium guajava*, *Saccharum officinarum*, *Solanum erianthum*, *Sorghum bicolor*, *Syzygium aromaticum*, *V. amygdalina*.

This observation supports the report of Okigbo et al. (2008) that the local people conserve some of the wild medicinal plants that were relatively difficult to survive in the study area when cultivated. Also, the result of (Schippmann et al. 2002) indicated that only 5.7% of medicinal plants were cultivated in home gardens, showing the minimal effort of medicinal plant conservation. An increase in conservation efforts could ensure the availability of the plants both for the present and future generations (Ceriaco et al. 2011). Also, agricultural officers reported various efforts to teach the community members about conservation consciousness and systematically planned to conserve plants by establishing an association that keeps the destruction of natural resources under check. Even though some medicinal plants are cultivated, still conservation efforts are gingered towards wild medicinal plants because their accessibility is decreasing yearly and they are in danger of extinction (Lulekal et al. 2008; Eshete et al. 2016). Some of the factors decreasing the accessibility of these medicinal plants were the destruction of their habitats, their conversion to agricultural expansion, various constructions, overgrazing, urbanization, and over-harvesting (Cunningham 1992; Roberson 2008). Therefore, conscious efforts and appropriate actions are needed. The full participation of societies and stakeholders involved in

the conservation, production, and management as well as the wise exploitation of medicinal plants are, needed to be improved. Conservation and sustainable use of medicinal plants need the involvement of various sectors and greater public support and public awareness (Schippmann et al. 2002; Megersa et al. 2013).

**Table 7.** Lists of health problems and number of medicinal plant species used for treatment

Disease treated	No. of plant species used
Respiratory tract infection	41
Skin diseases	19
Inflammation	12
Pains	9
Diarrhea	8
Malaria	8
Depression	6
Eczema	6
Pile	6
Urinary tract infection	6
Diabetes	4
Dysentery	4
Ringworm	4
Worms	4
Bleeding	3
Boil	3
Crams	3
Wounds	3
Acne	2
Anaemia	2
Burns	2
Cough	2
Hypertension	2
Itches	2
Liver problems	2
Measles	2
Poison	2
Rashes	2
Rheumatism	2
Fever	1
Heart disease	1
Insomnia	1
Pimples	1
Scabies	1

**Table 8.** Informant consensus factor by categories of diseases in the study area

Disease categories	No. of species	Use citation	ICF
Malaria, fever, insomnia, pains	8	54	0.87
Respiratory tract infection, cough, inflammation, urinary tract infection	17	61	0.73
Skin infection, crams, wounds, eczema, acne, burns, pimples, scabies, boil, itches, ringworm, pile	16	48	0.74
Anaemia, worms	11	29	0.64
Poison, measles, heart disease, liver problems, diabetes	13	38	0.73
Rheumatism	2	16	0.93
Hypertension	2	18	0.94
dysentery, diarrhea	12	38	0.70

In conclusion, the communities in the study area traditionally used various types of plants available as medicine for treating human diseases. Surprisingly, traditional medicine was believed to be highly effective when used to treat various diseases in the study area. The largest number of the plants encountered were used to manage respiratory tract infections. Besides their medicinal value, the identified medicinal plants were used for different functions such as food, shelter, construction and condiments in soup making. Elderly informants had more knowledge of medicinal plants than younger ones. Unfortunately, several plants were not found; if special and urgent attention is not given to the conservation of these plants under threat, they will be eroded due to high deforestation activities for various purposes.

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