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ISSN: 2641-3094 DOI: https://dx.doi.org/10.17352/gje

Research Article

An ethno-botanical study of medicinal plants in Dilla Zuria Woreda of Gedo Zone, Southern Ethiopia

Tadeyos Mesfin[1]* and Wendawek Abebe[2]

[1]Dilla University, College of Natural and Computational Science, Department of biology, P.O. Box: 419, Dilla, Ethiopia

[2]Hawassa University, Department of biology, Hawassa, Ethiopia

Received: 23 April, 2022
Accepted: 10 May, 2022
Published: 12 May, 2022

***Corresponding author:** Tadeyos Mesfin, Dilla University, College of Natural and Computational Science, Department of biology, P.O. Box: 419, Dilla, Ethiopia, E-mail: tadibos18@gmail.com

Keywords: Dilla Zuria Woreda; Ethnobotany; Medicinal plants; Indigenous knowledge; Study

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Abstract

The present study was carried out to investigate the diversity and use of medicinal plants, and to document the indigenous knowledge of the local community. The typical ethnobotanical methodologies were applied during the study. Eighty-one informants were selected by the preferential sampling of which 61 were males and 20 were females. The selected individuals were considered knowledgeable in their view of medicinal plants. Data were collected using semi-structured interviews, field observation, group discussion, and specimen collection. Informant consensus, preference ranking, direct matrix ranking, and informant consensus factor were computed. A total of 105 plant species were identified belonging to 105 genera and 52 families. Of the total plants, 70 plant species have medicinal values and are recorded from the study area. Based on the study, the family Asteraceae was found to be the most prominent family with 8 species under 8 genera followed by Fabaceae which comprise 6 species under 6 genera. Of medicinal plants collected in the area, 79.66% were used to treat human ailments, 17.79% were used to treat both human and livestock ailments, and 2.54 % were used to treat livestock ailments. Of the total medicinal plants, herbs were the dominant making 45 (47.5%) followed by shrubs 35(29.46%), trees 15(15.75%), and climbers 10(7.35%). Leaf (41%) was the most frequently utilized medicinal plant part followed by root which is (18%). About 44 different kinds of diseases in the local community were identified and have been treated by existing and identified medicinal plants. The most widely used method of preparation was in the form of crushing (44%) followed by boiling (17%) and powdering (10%). The majority of preparations used fresh parts (53.63%) more than the dried forms (36.81%). Oral (50%) and dermal (30.92%) applications were the common routes of administration. Agricultural expansion, overgrazing, over-harvesting of plants for different household utensils, and other human-induced problems were the major threats to natural habitats in general and medicinal plants in particular. Therefore, it is recommended that awareness creation through training and education with the participation of government and non-governmental organizations on sustainable use and conservation of plant resources should be encouraged.

Introduction

Background and justification

Ethnobotany is a broad term referring to the study of the direct interrelation between humans and plants [1,2]. It is also defined as local people's interaction with their natural environment: how they classify, manage and use plants available around them [1]. Indigenous people have lived close to the natural environment depending on its products for their requirements as sources of food, medicine, and construction. Traditional societies throughout the world possess a wealth of traditional knowledge that they have accumulated during extended interactions with the natural world which remains fundamental to their physical, spiritual, and social wellbeing [3].

Plants have traditionally been used as a source of medicine in Ethiopia for many centuries to contest various human and livestock ailments. Traditional medicine has become a crucial part of the culture in the country due to its long history. Traditional medical practice has been in existence before the growth of modern medicine and continues to be widely accepted and used in the prevention and treatment of ailments [4,5]. The indigenous people of different localities in the country have developed their specific knowledge of the use, management, and conservation of plant resources [6]. The geographical diversity of Ethiopia has higher different habitats

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and vegetation types, and medicinal plants are also components of these. This geographical diversity coupled with a multiplicity of ethnic groups with multifaceted cultural diversity, makes the country home to the high diversity of traditional knowledge, practice, and uses of traditional medicine [4,7,8].

Ethnobotanical studies on medicinal plants in the country are limited when one considers the multiethnic and cultural diversity of the people, the diverse flora of the country, and the vital role played by traditional medicinal plants in the primary healthcare [7-16]. Likewise, the ethnobotanical studies of medicinal plants in the Dilla Zuria district have remained unexplored and no previous studies were conducted in the area. Furthermore, the area is facing habitat loss and vegetation destruction due to human-induced factors. Therefore, this study is conducted to examine and document the traditional medicinal plants used by indigenous people to treat both human and livestock ailments. In addition, it aims to identify plant parts used for medicinal purposes, methods of preparation, ways of administration, and challenges related to medicinal plants in the study area.

Methodology

Description of the study area

Dilla Zuria Woreda is located between6º15'05'' N 6º26'35''N latitude and 38º 15' 55'' - 38º 24' 02'' E longitudes. Woreda is the second-lowest administrative unit in current Ethiopia. It is bounded by Oromia Region in the South and the West, Bule Woreda in the East, and Sidama Region in the North (Figure 1). It is divided into 19 kebeles (lowest administrative units). The altitudinal range of the Woreda ranges from 1350m to 2550m with a slope between 39.4% and 51.5%. The mean monthly rainfall of the study area ranges from 83.7mm-310mm with an average RF of 172.9mm. The Rainfall is bimodally occurring between March up to June and September to October with the highest amount of rainfall occurring between May and September and the lower between October and February. The mean monthly temperature ranges from 15.4°C -to 17.9°C. January and February are the hottest months of the year with the maximum temperature record.

Population and livelihood

According to the 2007 G.C planning report of the agricultural development office of Dilla Zuria, the total population of the Woreda is 110, 939 with a total household of 22,837, among these-53945 were males and 56994 were females. The average family size consisted of 5 persons per HH (DZWAO, 2018). The livelihood of the people in the Woreda depends on agriculture, trade, handicraft, casual coffee processing employment, and labor work. Agricultural activities practiced by communities are based on agroforestry components such as trees, coffee, enset, fruits, crops (both annual crops and perennials crops), and livestock (DZWAO, 2018).

Sampling techniques

Out of the 19 kebeles in the study area, the study was conducted in 12 kebeles from February 26, 2018, to October 23, 2018. The sites were selected purposively based on the information collected on the availability of practitioners, users, and medicinal plants available with the help of the local

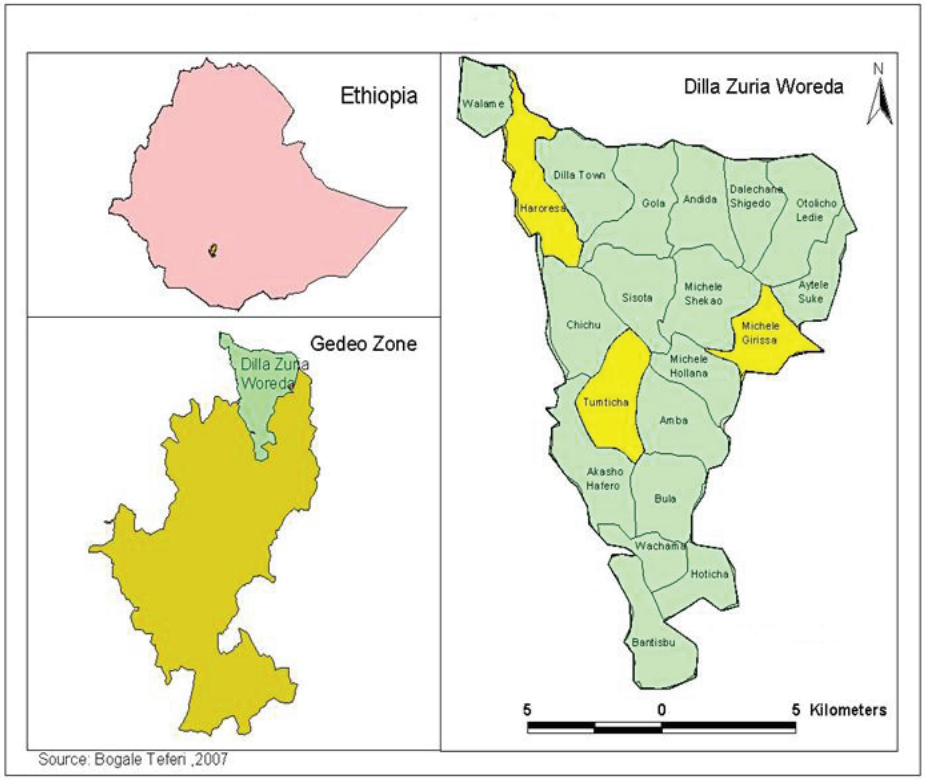

Figure 1: Location of the study area.

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community, development agents, and local elders. A total of 81 respondents from 12 kebeles (districts) (12 from Candida, 6 from Shigeo, 7 from Otolicho, 6 from Suke, 6 from Michele, 6 from Gola, 7 from Sisota, 6 from Tumticha, 6 from Chichu, 6 from Wachama, 6 from Amba, and 7 from Holland) were selected for this study. The respondents from the study sites were selected based on knowledge of traditional medicinal plants, age, and their role as traditional healers. The selection of respondents was taken place with the support of local administrative bodies, local elders, etc.

Methods of data collection

Two round field surveys were made within the 12 sampled Kebeles in the study Woreda. This was followed by field observation and collections of herbal plants from the natural vegetation and home gardens. Semi-structured interviews and group discussions were also employed in the data collection process. Field observations for the medicinal plants, which were used by the healers and households, were made during the study period to identify the availability and existence of medicinal plants in the study area. All relevant information including plant parts used, modes of preparation and routes of administration, and diseases to be treated as medicinal plants were collected during field observation. Voucher specimens of Medicinal plants reported twice or more during informant visits were collected. Preliminary identification was done in the field and reconfirmed at Dilla University with the support of professionals. Unidentified plant specifies were further taken to the National Herbarium of Addis Ababa University for more clarification and identification. At last, they were confirmed with the help of taxonomic experts from Addis Ababa University.

Semi-structured and systematic interviews can give us good ideas of the ways people describe their lives and their natural surroundings [1]. A semi-structured questionnaire was prepared and translated into the local language (Gediffa). Then, it was delivered to the respondents to identify the type of medicinal plants, and diseases treated with medicinal plants, to distinguish the way of preparation and route of administration of medicinal plants in the area. Interviews were also done with respondents to have more information about indigenous knowledge and traditional medicinal plant use in the area. Similarly, group discussions were made with key informants in 5 randomly sampled kebeles out of the 12 kebeles (Figure 2). The key informants selected were traditional healers with adequate knowledge of medicinal plants in the area. Group discussions with key informants were employed for cross-checking and confirming the validity of the data that has been gathered through semi-structured questionnaires and interviews. The group discussions were undertaken using the local language and the response was recorded using a Sony sound recorder. Later on, information obtained from the discussion was translated to English by the researcher for further use. The places and times for discussion were arranged based on the interest of the informants.

Ethnobotanical data analysis

Ethnobotanical data were analyzed both qualitatively and quantitatively. Qualitatively, it was analyzed in the form of description while quantitatively it was analyzed using descriptive statistics such as a percentage. During the analysis of the data, determination of multipurpose uses, proportions of different variables like habits, plant families, and, plant parts used, disease treatment, and methods of preparation were described by Informant consensus, Preference ranking, Direct matrix ranking, and Paired comparison.

Figure 2: Ethnobotanical Group discussion in the study area (Photo: by Tadeyos Mesfin, 2018).

Informant consensus

Informant consensus values indicate a particular species that serve as a remedy for a particular health problem or is used for several health problems. So that the ethnobotanical information obtained from the interviewed informants during the study was evaluated after two times visits of the same idea to check the validity of the information recorded. The visits were done without planned appointments with the informants. Unmatched or contradicting ideas were considered unreliable ideas and rejected. Informant consensus factor (ICF) was used to see the agreement of informants for a plant species in treating a particular disease and calculated for each category to identify the agreements of the informants on the reported remedies for the group of ailments. Moreover, it was used to see the distribution and incidences of disease categories in the study area. The ICF were calculated as the number of use citation in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one [17]. The factor provides a range of 0 to 1, where high a value acts as a good indicator for a high rate of informant consensus. ICF = nur-nt / nur-1.Where: ICF: Informant consensus Factor, Nur: number of use citations, and Nt: number of species used.

Preference ranking

Preference ranking was conducted following Martin [1] for the six most important species of medicinal plants used in treating a wound, as traditional healers treat it usually. Ten informants were selected to identify the best preferred medicinal plant species for the treatment of wounds. Each

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informant was provided with six medicinal plants reported to cure wounds and asked to assign the highest value (6) for the most preferred species, against this illness and the lowest value (1) for the least preferred plant by their order for the remaining ones. The value of each species was summed up and the rank for each species was determined based on the total score. This helped to indicate the rank order of the most effective medicinal plants used by the community to treat wounds.

Direct matrix ranking

Direct matrix ranking was conducted following Martin [1] and Cotton [3] . This was conducted considering several attributes of medicinal plants such as their use as food, medicine, firewood, building, charcoal, and forage. These were uses of medicinal plants commonly reported by key informants. Based on information gathered from informants, six multipurpose tree species were selected out of the total medicinal plants, and six use diversities of these plants were listed for six selected key informants to assign use values to each species. The six use-values include medicinal, firewood, construction, charcoal, forage, and edible fruit. By adding the scores given, it was possible to compare the use-values of medicinal plants and also to identify the main cause of over-harvesting of the plants. Based on information gathered from informants, the average value of each use of medicinal plant species was taken and the values of each species were summed up and ranked.

Paired comparison

This analytical tool can be used for evaluating the degree of preferences or levels of importance of certain selected plants/parts of plants in treating more prevalent diseases in an area [18]. Paired comparisons indicating the efficacy and popularity of five medicinal plant species that are used to treat malaria illness were employed based on [1]. Accordingly, ten key informants were randomly selected and allowed to show their responses independently for pairs of five traditional medicinal plants that are noted for malaria illness and several patients who visit the traditional medicinal practitioners. A list of the pairs of selected items with all possible combinations was made and the sequence of the pairs and the order within each pair was randomized before every pair is presented to selected informants and their responses were recorded, the total value was summarized and the rank was made based on the report of the informants.

Results and discussion

Socio-demographic characteristics of respondents

Of the 81 respondents who were involved as traditional plant practitioners in the study area, 61 (75.3%) were males whereas 20 (24.7%) were females. The ages of respondents were ranked between 20 and 85. But, the majority 47 (78.33%) were between 40 and 85 and only 13 (21.67%) were below 40 years. The educational level of respondents was characterized by the absence of formal education for many traditional healers and only 21 (35%) have reached grade 10.

Diversity of plants in the study area

A total of 105 plant species were collected, identified, and documented in the study area, which was distributed among 52 families and 105 genera (Table 1). *Asteraceae* was found to be the most dominant family that contained 8 species under 8 genera followed by *Fabaceae* having six species with six genera. *Solanaceae* was the third most dominant family in the study area. This was similar to the finding of [19-22] in which families *Asteraceae*, *Fabaceae, and Solanaceae* dominated the plant family in their study area. The dominancy of these families in the area might indicate that they are the most common plant families throughout most parts of the country.

Regarding the plant habit diversity, herbs were the most common and stood first with 45 species (47.25%), followed by shrubs 35 species (29.46%), trees 15 species (15.75%), and climbers 10 species (7.35%) (Figure 3). The analysis of the data also showed that the majority of medicinal plants in the study area were herbs. This finding is in line with most medicinal plant inventories in some parts of China and Ethiopia) [19,21,23,24] in which herbs are the dominant growth form of medicinal plants. The dominance of herbs might be associated with frequent farming that enhances their abundance in the area.

Ethnomedicinal plant species used by the community in the area

In the study area, a total of 105 plant species were gathered and documented, and from these 70 species were used for the treatment of human and livestock ailments. Of 70 medicinal plant species, 46(47.25%) species were used for human medicine, 8 species (8.4%) for livestock medicine, and the remaining 16 species (16.8%) were used for treating both human and livestock ailments (Figure 4). These medicinal plants are distributed in 70 genera and 32 families. The family *Asteraceae* stood first contributing 6 (11.9%) species, followed by *Fabaceae* 4 (6.77%) species, *Solanaceae* 5 (5.93%) species, *Lamiaceae* 4 (4.23%) species, *Euphorbiaceae* 4 (3.38%) species, *Cucurbitaceae* 3 (3.38%) and whereas, *Acanthaceae*, *Boraginaceae*, *Rosaceae*, and *Rutaceae*, *Rubiaceae*, *Ranunculaceae*, *Poaceae*, *Malvaceae*, *Convolvulaceae*, *Brassicaceae*, and *Anacardiaceae* having 1 (1.69%) species each. Of these 35(42.86%) were herbs, 25 (26.66%) were shrubs, 3(4.94%) were a tree, and 7 (5.93%) were climbers. Of these 70 medicinal plants studied, 40 (63.8 %) species were gathered from the wild and 30 (36.19%) species from home gardens. This result indicates that the local communities mostly depend more on medicinal plants collected from the wild than those from home gardens. But, the activity of cultivating medicinal plants in home gardens is also not bad because the number of medicinal plants obtained in home gardens is also promising. This finding correlates with the studies [19,21, 25,26], in which many medicinal plants were collected from the wild than home garden plant sources.

Service categories offered by medicinal plants in the study area

Medicinal plants in the study area provide different services

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Table 1: Distribution of collected species in different family.

Family	Number of genera	Percentage (%)	Number of species	Percentage (%)
Asteraceae	8	12.5	8	12.5
Fabaceae	6	9.45	6	9.45
Solanaceae	5	5.35	5	5.35
Euphorbiaceae	4	4.2	4	4.2
Lamiaceae	4	4.2	4	4.2
Cucurbitaceae	3	3.15	3	3.15
Moraceae	3	3.15	3	3.15
Myrtaceae	4	4.2	4	4.2
Polygonaceae	1	1.05	1	1.05
Rosaceae	4	4.2	4	4.2
Rutaceae	5	5.25	5	5.25
Alliaceae	3	3.15	3	3.15
Acanthaceae	1	1.05	1	1.05
Anacardiaceae	1	1.05	1	1.05
Myrsinaceae	2	2.1	2	2.1
Brassicaceae	4	4.2	4	4.2
Musaceae	1	1.05	1	1.05
Ranunculaceae	1	1.05	1	1.05
Verbenaceae	2	2.1	2	2.1
Boraginaceae	1	1.05	1	1.05
Poaceae	4	4.2	4	4.2
Rubiaceae	2	2.1	2	2.1
Lauraceae	1	1.05	1	1.05
Meliaceae	2	2.1	2	2.1
Proteaceae	1	1.05	1	1.05
Aloaceae	2	2.1	2	2.1
Bromeliaceae	1	1.05	1	1.05
Annonaceae	1	1.05	1	1.05
Iceacinaceae	1	1.05	1	1.05
Asparagaceae	1	1.05	1	1.05
Meliaceae	1	1.05	1	1.05
Melianthaceae	1	1.05	1	1.05
Chenpodiaceae	1	1.05	1	1.05
Caricaceae	1	1.05	1	1.05
Casuarinaceae	1	1.05	1	1.05
Ulmaceae	1	1.05	1	1.05
Araceae	1	1.05	1	1.05
Combretaceae	1	1.05	1	1.05
Commelinacea	1	1.05	1	1.05
Cucurbitaceae	1	1.05	1	1.05
Ulmaceae	2	2.1	2	2.1
Celastraceae	1	1.05	1	1.05
Cupressaceae	1	1.05	1	1.05
Dracenaceae	1	1.05	1	1.05
Discoreaceae	2	2.1	2	2.1
Sapindaceae	1	1.05	1	1.05
Apiacea	3	3.25	3	3.25
Dracenaceae	2	2.1	2	2.1
Podocarpaceae	1	1.05	1	1.05
Sapotaceae	1	1.05	1	1.05
Convolvulaceae	1	1.05	1	1.05
Rhamnaceae	1	1.05	1	1.05

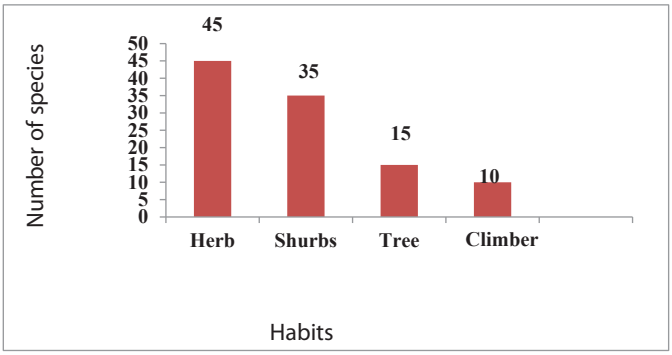

Figure 3: Habits of plants that are collected in the study area.

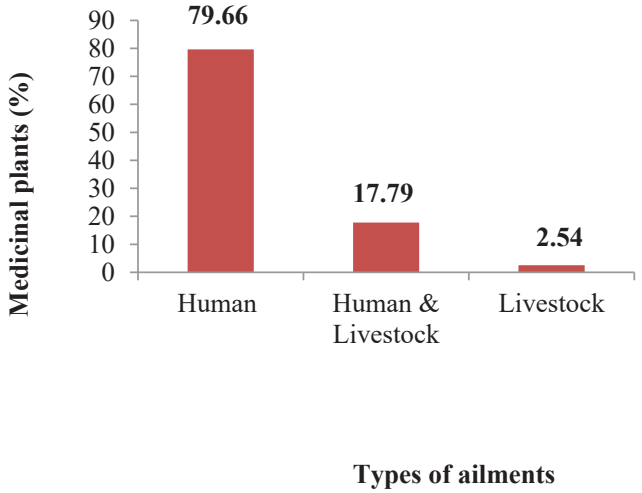

Figure 4: Medicinal plants are used for the treatment of human and livestock ailments.

for communities in addition to their role in medicinal value provision. The common services include; serving as a food source, forage for animals, construction purposes, fuel source, etc (Table 2).

Routes of administration

There are various routes of administration of traditional medicinal plant products prepared by the local community. The major routes of administration in the study area are oral, dermal, nasal, and ear. In the study area, oral administration is the dominant route with (50%) of the cases followed by dermal (30.92%) and others (Figure 5). Similar results were obtained by [21,23,24], which indicated oral administration dominates over other routes of administration. Both oral and dermal routes permit rapid physiological reactions of the prepared medicines with the pathogens and increase their curative power (Tadege, 2012).

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Modes of preparation

Various methods of Traditional Medicinal Plant preparations were used in the study area (Figure 6). In this study, the most popular mode of preparation identified was crushing which accounted for 44%, followed by boiling (17%), powdering (10%), chewing (9%), and others (20%). This result coincides with the study of (Gebeyehu and Gidey, 2001; Bekalo *et al*., 2009), which reported crushing as the most dominant method of preparation. While the present study contradicts a study by [23,27], in which decoction was the highest mode of preparation in their study area.

Solvents and additives

Some medicinal plants are taken with different additives and solvents such as water. The additives include butter, honey, milk, sugar, "tella (local drink)", "tej (local drink)", kerosene, oil, boiled coffee or tea, and Citrus juice (Table 3). These additives have importance in reducing pain, giving better taste and reducing adverse effects like vomiting and diarrhea, and enhancing the efficacy and healing conditions as explained by informants. This result correlates with the study of [27,28], which reported additives like making tea, honey, and plant juice which are essential and mixed with medicinal plants.

Medicinal plant species used to treat human diseases

Forty-six medicinal plant species that are used to treat 44 different human diseases were recorded in 12 kebeles of the study area. These plants belong to 55 genera and 21 families. Family *Asteraceae* comprises seven species followed by *Fabaceae* having six species, and *Solanaceae* having five species (Table 4). The dominance of the family *Asteraceae* for treating human diseases was also reported in other studies in different parts of Ethiopia [19,21,29].

Plant parts used for treating human ailments

About the plant parts used for medicinal purposes, different parts of the plants were reported to be used for medicines. The

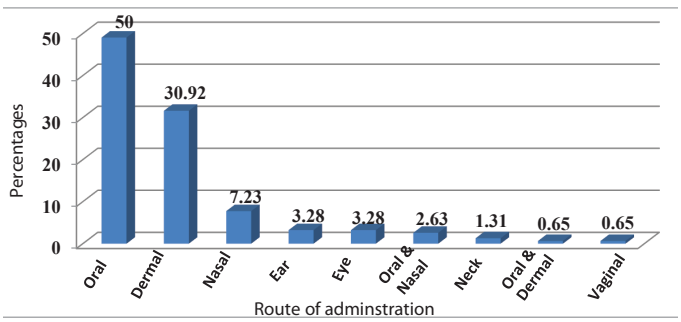

Figure 5: Route of administration of medicinal plants that used for human ailments.

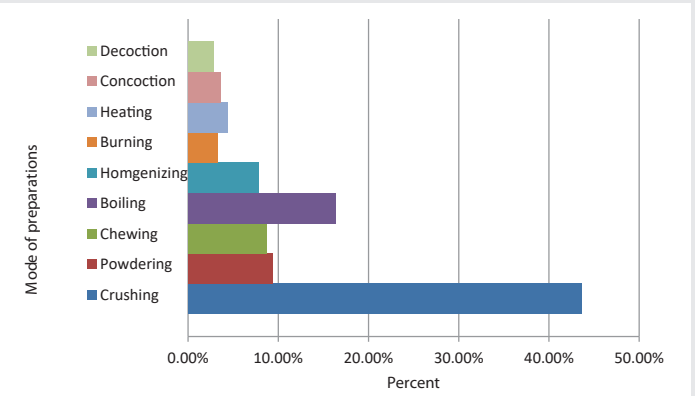

Figure 6: Graph showing popularity of modes of preparations for human ailments.

Table 2: Service categories of medicinal plants in the study area.

Service category	Total number of species	Percent (%)
Only medicinal	3	10.5
Medicine and Food	2	7
Medicine and Forage	2	7
Medicine and Firewood	2	7
Medicine and stimulant	1	3.5
Medicine and House construction	1	3.5
Medicine, Firewood, Fence	1	3.5
Medicine, Firewood, Forage	1	3.5
Medicine, Food, Cash income	1	3.5
Medicine, Stimulant, Cash income	1	3.5
Medicine, Food, Cash income, Forage	1	3.5
Medicine, Firewood, Fence, ornamental	1	3.5
Medicine, Food, Cash income, Edible	1	3.5
Medicine, Firewood, Fence, and Perfume	1	3.5
Medicine, Food, Spice, and Cash income	1	3.5
Medicine, Hose construction, Fence	2	7
Medicine, Forage, Firewood, House construction, Fence	2	7
Medicine, Charcoal, Firewood, House construction, Fence	2	7
Medicine, House construction, Forage, Traditional tools	2	7
Medicine, Firewood, Forage, Fence, Alcohol preparation	1	3.5
Medicine, Firewood, Forage, Fence, Lubricated leather	1	3.5

Table 3: Solvents and additives used in medicinal preparation.

Solvents and additives	Number of informants who cited the species	Percentage (%)
Water	27	33.33
Honey	14	17.28
Butter	12	14.81
Milk	12	14.81
Sugar	4	4.938
Oil	3	3.703
"tella"	3	3.703
Kerosene	2	2.469
"tej"	1	1.234
Sour milk or "yogurt"	1	1.234
Boiled coffee or tea	1	1.234
Citrus juice	1	1.234
Total	**81**	**100**

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most frequently utilized plant part were leaves 30 (31.15%) followed by roots 16 (18.42%), seeds10 (10.52%), stem barks 3 (5.92%), whole parts 2 (4.60%) each, and others (Table 5). Leaves were the most frequently utilized plant parts in the preparation of remedies. The preference for leaves may be due to their abundance compared to other plant parts and ease of preparation [30]. It may also be due to their efficacy as a result of their role as a site of chemical reactions and in acting as reservoirs for metabolites like photosynthesis, exudates, and others [2]. The other two main plant parts used were roots and barks, which may be related to the dropping of leaves under drought conditions or the level of concentration of chemicals. The utilization of roots and to some extent bark for the preparation of medicines could be a worrying issue due to the risk for the survival of the concerned medicinal plants. This finding is in line with the results of other ethnomedicinal studies [19,21,25,26]. While the present study contradicts the study of [16,31], in which the root was the highest part of medicinal plant preparation in their study area.

Medicinal plant species and parts used to treat livestock diseases

Eight species of medicinal plants that are used to treat livestock health problems were identified and collected in the study area (Table 6). The species were grouped under eight families and eight genera. Each family comprises one species in its category. Of the eight medicinal plant species, seven were obtained from the wild while one species was obtained from home gardens. This study has shown the significant role of wild medicinal plants in treating livestock diseases in the study area. The fact that most of the medicinal plants were found in non-cultivated areas, including in the natural vegetation, indicates that there is very little practice of keeping medicinal plants in home gardens and other cultivated premises. A further reason may be the fact that the villagers in the study area are living not very far from the forest, and that plants used in traditional medicine could still be accessed with relative ease from the nearby natural vegetation. Several studies conducted on medicinal plants in Ethiopia [30] have similarly shown that most human and livestock medicinal plants were sourced from non-cultivated areas, including the natural vegetation, even where home gardens were well developed. This shows that the bulk of the medicinal plant resources is found outside cultivation, and this observation further provides a major reason why the natural vegetation must be conserved in Ethiopia as well as in study areas and other countries to achieve the dual goals of protecting the vegetation and the species used by communities as integral parts of their biocultural heritage.

Table 4: Number of taxa and families used in the treatment of human ailments.

Family	Number of genera	Percent (%)	Number of species	Percent (%)
Asteraceae	7	7.4	7	7.4
Fabaceae	6	6.3	6	6.3
Solanaceae	5	6.3	6	6.3
Euphorbiaceae	4	5.3	4	5.3
Rutaceae	5	6.3	5	6.3
Cucurbitaceae	3	3.1	3	3.1
Moraceae	3	3.1	3	3.1
Myrtaceae	3	3.1	3	3.1
Polygonaceae	1	1.05	1	1.05
Rosaceae	3	3.1	3	3.1
Rutaceae	2	2.1	2	2.1
Acanthaceae	1	1.05	1	1.05
Anacardiaceae	1	1.05	1	1.05
Aloaceae	1	1.05	1	1.05
Ranunculaceae	1	1.05	1	1.05
Proteaceae	1	1.05	1	1.05
Boraginaceae	1	1.05	1	1.05
Poaceae	3	3.1	3	3.1
Rubiaceae	2	2.1	2	2.1
Bromeliace	1	1.05	1	1.05
Convolvulaceae	1	1.05	1	1.05

Table 5: Plant parts used for treatment.

Parts used	Total Plant parts	Percentage (%)
Leaf only	30	41
Root only	16	18
Fruit only	7	4.60
Stem bark only	3	5.92
Whole plant	2	4.60
Seed only	10	15
Latex only	1	0.65
Fibers	1	0.65
Shoot	1	2.63
Flower	1	0.65
Rhizome	1	1.31
Bulb	1	2.63
Latex & Leaf	1	1.31
Root & Leaf	1	2.63
Fruit and Leaf	1	2.63
Shoot & Leaf	1	1.31
Leaf & Stem bark	1	0.65
Seed & Leaf	1	0.65
Total	**70**	**100**

Table 6: Number of taxa and families used in the treatment of livestock ailments.

Family	Genera	Percentage (%)	Species	Percentage (%)
Fabaceae	1	12.5	1	12.5
Poaceae	1	12.5	1	12.5
Asteraceae	1	12.5	1	12.5
Flacourtiaceae	1	12.5	1	12.5
Sterculiaceae	1	12.5	1	12.5
Solanaceae	1	12.5	1	12.5
Malvacea	1	12.5	1	12.5
Phytolaccaceae	1	12.5	1	12.5
Total	**8**	**100**	**8**	**100**

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Concerning the medicinal plant parts used for livestock diseases, leaves make the major component of medicinal parts for treating livestock diseases. Leaf preparations account (36%), followed by root (21%), stem (14%), bark (14%), fruit (7%) and corm (1.5%) (Figure 7). The study by [32-34], indicates similar results in which leaf and roots are the main medicinal plant parts prepared to treat livestock diseases. This finding contradicts the study of [14] in which plant parts other than leaves and roots were widely used forms of medicinal plant part preparations.

Medicinal plant species used to treat both livestock and human ailments

A total of 16 medicinal plants are used for the treatment of both human and livestock diseases in the study area (Table 7). Nine of them were collected from the wild vegetation while 7 species were collected from the home garden. The identified medicinal plants belong to 14 families and 16 genera. Family *Asteraceae* was represented by three species while the remaining 13 families comprise one species in each of their categories. These medicinal plants are found to treat 32 types of human ailments in the study area. Likewise, these medicinal plants help to treat 14 livestock ailments that were identified in the area. As per the findings of this study, medicinal plant species were used as a remedy for human diseases such as fibril illness, bloating, rabies and stomach problem, tape warm and epidemic, toothache, gastric, dysentery, swelling, tonsil, and malaria. Similarly, these medicinal plants help to treat some livestock diseases namely bloating, leech, rabies, epidemic, stomach disorder, swelling, etc in the study area. The result of the current study is in line with the study [19,21], in which medicinal plants are crucial for the treatment of both livestock and human ailments.

Ranking of most important medicinal plants

Informant consensus: Among the total traditional medicinal plants, ten traditional medicinal plants were identified as the commonly known and used species by the local communities in the study area. These top ten species had a greater number of informants' agreements (over 33%). The outcome of this study showed that some of the medicinal plants are popular and had the highest informant consensus which is about 52 (*Carica papaya*) mentioned by 52 informants. The popularity of this medicinal plant is due to people's preference for the species to treat malaria illness in the community by collecting it from the home gardens of many individuals. Subsequently, *Allium sativum* was mentioned by 50 informants while *Dracana steudeneri* was mentioned by 48 informants (Table 8).

Preference ranking: When there are different species prescribed for the same health problem, people show a preference for one over the other. A preference ranking of six medicinal plants that were reported for treating wounds was conducted after selecting ten key informants. The informants were asked to compare the given medicinal plants based on their efficacy and they gave the highest number (6) for the medicinal plant which they use most in treating the wound and gave the lowest number (1) for the least effective plant in treating the wound. Based on this, *Dodonaea Angustifolia* had a score of (47) that made to be ranked first and indicating that it is the most effective species in treating wounds followed by *Achyranthes Aspera* which had a score of 42. In contrast, *Vernonia amygdalina* had a score of 20 and was mentioned as the least effective medicinal plant for treating a wound in the area (Table 9).

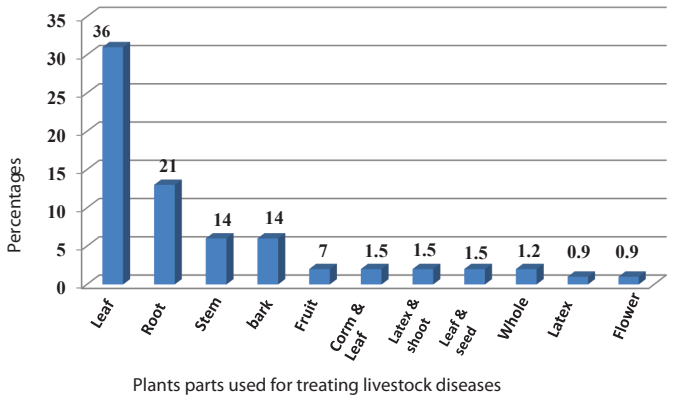

Figure 7: Plant parts used for treating livestock diseases.

Table 7: Medicinal plants used in the treatment of both livestock and human diseases.

Family	Number of Genera	Percent (%)	Number of Species	Percent (%)
Asteraceae	3	19.6	3	19.04
Poacea	1	6.25	1	6.25
Meliaceae	1	6.25	1	6.25
Fabaceae	1	6.25	1	6.25
Fabaceae	1	6.25	1	6.25
Ranuculacea	1	6.25	1	6.25
Asteraceae	1	6.25	1	6.25
Simaroubaceae	1	6.25	1	6.25
Boraginaceae	1	6.25	1	6.25
Bromeliace	1	6.25	1	6.25
Rutaceae	1	6.25	1	6.25
Acanthaceae	1	6.25	1	6.25
Moraceae	1	6.25	1	6.25
Proteaceae	1	6.25	1	6.25

Table 8: List of Medicinal plants and the corresponding informants.

Scientific name	Local name	Informants' agreements (%)
Carica papaya	Papaya	52
Allium sativum	Kulubi adi	50
Dracaena steudeneri	Afarfartu	48
Phytolacca dodecandra	Haranja	45
Ruta chalepensis	Sugeta	38
Achyranthes Aspera	Derrgu	37
Ocimum lamiifolium	Damakase	36
Brucea antidysenterica	Lafa	35
Nicotiana tobaccum	Tambo	34
Datura stramonium	Asteraceae	33

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Direct matrix ranking

Average score for direct matrix ranking of five medicinal plants with use diversity (Use values given from 0 to 5: 5 =Excellent, 4 = Very good, 3 = Good, 2 = Less, 1= Least and 0 = No use). Direct matrix ranking was performed to assess the relative importance of each of the plants. The result of the direct matrix ranking showed that *Cordia Africana* stood first in being the most multipurpose medicinal plant species followed by *Ficus Sur*, *Rosa abyssinica*, *Dodonaea Angustifolia*, and *Juniperus procera. Croton macrostachyus* was found to be the least multipurpose medicinal plant in the area (Table 10). Use diversity ranking exercises performed on six medicinal plants revealed that medicinal plant species are exploited in large amounts for other uses in the area such as firewood, charcoal, medicine, construction, forage, and edible fruits. Thus, as the use diversity ranking indicates, medicinal plants in the area are facing over-harvesting for non-medicinal benefits that lead to their destruction in ecosystems.

Paired comparison

A paired comparison was made to determine the most preferred medicinal plants among the five species that were used to treat malaria in the study area. The responses of ten key informants showed that *Carica papaya* ranked first followed by *Justice schimperina* while *Lepidium sativum* was the least favored plant species in treating malaria compared to others (Table 11). Therefore, the result of this study revealed that *Carica papaya* is the most preferred and significantly used medicinal plant to treat malaria in the study area.

Informant consensus factor (ICF)

The diseases of the study area have been grouped into different categories based on the site of incidence of the disease, condition of the disease as well as treatment resemblance of the disease to the local people. The informant consensus factor was calculated on the identified disease categories (Table 12). It is calculated as: ICF=nur−nt / (nur −1). Where, ICF: Informants Consensus Factor, nur: number of use citations in each category, and nt: number of species used. According to this finding, the highest ICF value was obtained from diseases related to malaria (0.87) whereas the least ICF was associated with Tumors and Epilepsy diseases (0.37).

Threats to medicinal plants in the study area

The main threats to medicinal plant species in the area were agricultural expansion (25.13%) ranked first followed by firewood collection (23.52%) (Figure 8). The least threat to medicinal plants mentioned by informants was drought (13.36%) (Table 13). The study by [20], in the Wonago District of Gedeo Zone, showed the presence of similar threats to

Table 9: Preference ranking of medicinal plants used for treating a wound.

Major medicinal plant species	Respondents										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Dodonaea angustifoli	5	6	6	2	6	6	4	5	4	3	47	1st
Achyranthes aspera	4	6	4	6	3	3	2	4	6	4	42	2nd
Vernonia amygdalina	4	2	4	5	6	5	4	2	4	3	34	4th
Brucea antidysenterica	4	2	2	1	2	3	6	2	3	6	31	5th
Ruta chalepensis	4	3	2	6	4	2	3	6	3	1	39	3rd
Vernonia amygdalina	2	3	3	1	3	1	2	1	2	2	20	6th

R: Respondents

Table 10: The average score for direct matrix ranking of Traditional Medicinal Plant with use diversity.

Main uses	*Juniperus procera*	*Croton macrostachyus*	*Dodonaea angustifolia*	*Ficus Sur*	*Cordia Africana*	*Rosa abyssinica*
Firewood	5	4	5	4	5	4
Medicine	4	5	4	4	4	4
Construction	5	5	3	5	5	5
Charcoal	5	3	5	5	5	3
Forage	0	0	3	3	3	3
Edible fruit	0	0	0	2	3	1
Total	19	17	20	23	25	21
Rank	5th	6th	4th	2nd	1st	3rd

Table 11: Paired comparisons of five medicinal plant species used to treat malaria.

Major medicinal plant species	Respondents										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Lepidium sativum	1	3	2	1	3	2	4	1	2	3	22	5th
Carica papaya	4	5	3	5	4	3	5	3	5	4	41	1st
Justice schimperina	5	4	4	2	3	4	3	5	4	3	35	2nd
Phytolacca dodecandra	4	3	3	2	5	3	4	3	2	3	32	3rd
Dracana steudeneri	3	4	2	1	3	2	5	1	2	2	25	4th

Key: R= Respondents

Table 12: ICF for the common disease categories in the study area.

Category	Species	Use citation	ICF
Malaria	7	49	0.87
Wound	11	76	0.86
Body swallowing, emergency	14	73	0.82
Evil eye, Devil sickness	10	49	0.81
Hypertension, Headache	3	11	0.80
Tinea nigra, Tinea versicolor, Eczema, Ringworms	8	35	0.79
Fire burn, Skin cut	5	19	0.77
Gastritis, Stomachache	13	52	0.76
Dandruff	4	13	0.75
Eye problem, Ear problem, Trachoma	13	48	0.74
Hemorrhoids, Herpes zoster	7	24	0.73
Leech, Blotting, Emaciation,	9	30	0.72
Rabies, Snakebite, Sudden sickness	11	36	0.71
Fibril illness	8	25	0.70
Unfit position of the fetus, Retained placenta, Rh factor	6	17	0.68
Tonsillitis, Toothache	11	32	0.67
Kidney Problem, Jaundice	5	13	0.66
Common cold, Cough, T.B	14	38	0.64
Diarrhea, Giardia and ameba, Dysentery	10	25	0.62
STDs	4	8	0.57
Ascaries, Tape Worm	7	14	0.5
Epitasis, Athletes foot	3	6	0.42
Tumors, Epilepsy	6	9	0.37

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Figure 8: Threats to medicinal plants in the study area (photo by: Tadeyos Mesfin, 2018).

Table 13: Threats to Traditional Medicinal Plants in the study area.

Major Threats	Respondents										Total	Percentage
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Agricultural expansion	4	5	5	4	5	5	5	4	5	5	47	25.13
Grazing	3	4	3	4	3	3	2	3	4	3	32	17.11
Construction	4	4	3	4	5	5	4	3	4	3	39	20.85
Drought	3	2	2	1	2	3	4	2	3	2	25	13.36
Firewood	4	3	5	5	4	5	4	5	5	4	44	23.52

medicinal plants in the area such as agricultural expansion and firewood collection. While the study by [35], indicates the intensification of negative impacts on medicinal plants associated with deforestation activities.

Medicinal plants conservation in the study area

According to the informants and personal observation of the researcher, the natural vegetation in the entire study site was cleared from the area for the contest of agricultural expansion. Overutilization of plant resources by the local communities was also seen except for some remnant patches in the midlands, highlands, and agroforestry of the study area. The home garden-produced medicinal plants have not been intentionally cultivated for medicinal purposes except by some traditional healers rather they were cultivated for their primary purposes such as food, spice, ornamental, aesthetic, ecological, and other values. Consequently, this helped in the conservation of medicinal plants indirectly in the area. But this has to be strengthened by creating awareness in the community to protect these natural resources. Wild medicinal plants were kept in forest remnants, fallow lands, forests, and agroforestry trees in the farmlands for a different purpose but not only for medicinal determination because the medicinal values of those plants were known only by the corresponding healers. However, most of the informants reported that people in the study area have awareness problems to conserve biodiversity in general. This revealed that there was no considerable conservation practice for medicinal plants in the study area rather they were conserved indirectly when cultivated in home gardens and farmlands for other purposes. Therefore, encouraging people to grow medicinal plants in their home gardens, and mixing with crops in farmlands and live fences is greatly important [36-38]. In addition, proper land use planning and development that allows effective protection of medicinal plants should be implemented to ensure their sustainable existence in the area.

Conclusion

The study carried out in the area showed that Dilla Zuria Woreda was relatively endowed with medicinal plant diversity comprising 70 medicinal plant species that are used by communities and associated with indigenous knowledge. These medicinal plants were used to treat both human and livestock ailments. Most of the medicinal plants in the area were obtained from the wild while some were obtained from home gardens that are cultivated for different purposes. Of all medicinal plants, herbs were found to be the major growth forms followed by shrubs and trees. Leaves were the principal plant parts used in traditional medicine preparation. Some of the medicinal plants in the area were used for other purposes like firewood, charcoal, construction, etc in addition to their traditional medicine. The major routes of administration in the study area were orally followed by dermal. In the same manner, the most popular mode of preparation identified was crushing followed by boiling. Medicinal plants in the area are taken with different additives. They include water, honey, butter, milk, etc. Moreover, medicinal plants have been threatened by agricultural expansion, overgrazing, and the like which diminishes the number of medicinal plants in the study area and the indigenous knowledge. Conservation of medicinal plants in the area was not given adequate priority despite their role in traditional medicine, food, spice, ecosystem services values, etc. Thus, careful attention is needed to upgrade and improve the cultivation and protection of medicinal plants in the area.

Recommendations

As per the current study, medicinal plants provide different values in the study area. However, some challenges need to be addressed for better conservation of medicinal plants and to enhance their role in the area. These are:

- Although there are indigenous medicinal plant uses and knowledge recognized in the area, gaps are observed related to local people's awareness. Hence, awareness rising should be made by the Woreda administration in collaboration with NGOs among the healers to avoid the decline of indigenous knowledge and to ensure the sustainable use and conservation of medicinal plants in the area.
- Initiating community-based management and incentivizing local people to cultivate medicinal plants in home gardens should be encouraged by Woreda agricultural office and other relevant stakeholders.

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- Conservation measures should be targeted at threatened medicinal plant species which are widely used as medicinal plants by the communities in the area.
- Regional or Woreda concerning bodies should encourage the local medicinal practitioners to improve the use of traditional medicine and enhance the licensing or certifying of the work of the practitioners at the Woreda, regional, or country-level to recognize their indigenous knowledge and medicinal plant's value.
- Further phytochemical and pharmacological studies and additional investigations should also be conducted by other researchers on the effective medicinal plant species of the study area to utilize them in modern drug development.

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