Hindawi
International Journal of Forestry Research
Volume 2023, Article ID 9243343, 10 pages
https://doi.org/10.1155/2023/9243343

Research Article

Ethnobotanical Study on Wild Edible Plants in Metema District, Amhara Regional State, Ethiopia

Getinet Masresha, Yirgalem Melkamu, and Getnet Chekole Walle

Department of Biology, College of Natural and Computational Sciences, University of Gondar, P.O. Box. 196, Gondar, Ethiopia

Correspondence should be addressed to Getnet Chekole Walle; gchekole1@gmail.com

Received 21 December 2022; Revised 20 April 2023; Accepted 26 April 2023; Published 10 May 2023

Academic Editor: Anna Źróbek-Sokolnik

Copyright © 2023 Getinet Masresha et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Wild edible plants are vital for the survival and sustainable livelihoods of rural people of Ethiopia. Thus, this study compiled wild edible plants, their use, threats, and management practices in Metema District, northwestern Ethiopia. Eight sample kebeles were selected purposively based on vegetation coverage and key informants availability. A total of 128 informants were selected using purposive and random sampling techniques. Data were collected using individual interviews, guided field walks, focus group discussion, and market surveys through semistructured questionnaires. Ethnobotanical data collected from the informants were summarized by descriptive statistics, and further verified by using informant consensus, preference, and direct matrix ranking. Knowledge difference among age and sex groups was evaluated by independent sample *t*-test. A total of 44 wild edible plant species distributed in 34 genera and 25 families were documented. Most (88.64%) of these plant species were found in the wild habitat. *Fabaceae* and *Moraceae* accounted for higher proportion of edible plant species. Trees were the dominant habit (59.09%). From the total recorded wild edible plants, 33 (75%) species were used as supplementary foods and 11 (25%) species were used during famine. Fruits were the most edible plant parts (66%) and raw fresh forms were the main conditions of consumption (81.8%). *Diospyros abyssinica* was the most cited (60.94%) and first ranked. Some edible species such as *Adansonia digitata* and *Balanites aegyptiaca* were marketable. *Ziziphus spina-christi* was found the most multipurpose wild edible plant species. Most of the species (33, 75%) were used as animal fodder followed with traditional medicines (25, 56.82%) and firewood (20, 45.45%). *Tamarindus indica*, *Moringa stenopetala*, *Balanites aegyptiaca*, *Grewia ferruginea*, *Corchorus olitorius*, and *Cordia africana* had nutraceutical values. Significant knowledge differences ($P < 0.05$) were obtained among sexes and age groups of informants on the number of wild edible plant species they listed. As a result of their multiple roles, wild edible plants are threatened by various anthropogenic activities. Despite this, Metema District still supports good numbers of wild edible plants from which the poor inhabitants complement their basic needs by consuming and marketing them. For sustainable utilization, conservation, value addition, and market linkage practices shall be strengthened to improve the livelihoods of local people and sustainable forest management.

1. Introduction

Wild edible plants are plant species that are used as a food source for humans that flourish in their natural environment without being cultivated or domesticated [1–4]. Traditional societies throughout the world built up a wealth of wild edible plants' knowledge during prolonged interactions with the natural world [5] and use the wild plant resources to fulfill their needs [6]. The consumption of wild edible plants seems more common and widespread in food insecure areas, leading to the notion of "famine foods" [4–7]. They are also used as staple food [8] since they are nutritionally rich and can supplement especially vitamins and micronutrients [9]. This could solve the micronutrient deficiency problem for the approximately two billion people that make them more susceptible to disease worldwide [10] and especially in developing countries [11]. They can also offer an alternative source of cash income for poor communities [8].

Likewise, in Ethiopia, the local people have a wider knowledge, tradition, and opportunity of using wild edible plants despite the variation in age, sex, time, and season [12]. The wide range of climatic and edaphic conditions in the

country permitted the growth of a variety of wild food plants [13]. Studies revealed that about 8% of the nearly 7000 higher plants are edible [14]. However, the bulk of useful plant parts collected from natural vegetation stocks are shrinking with degraded environment and is faced with a substantial reduction [15]. Along with this, the indigenous knowledge system descended from Ethiopia's multiethnic, cultural, and floral diversity is not documented fully and is eroding [16, 17]. More recently, some ethnobotanical studies have been undertaken in some parts of the country [4, 16, 18–21]. However, the majority of these studies have dealt with medicinal species and little emphasis has been given to wild edible plants [18, 22, 23].

Metema District, characterized by having a semiarid environmental condition and recurrent drought [23], is among the Districts of Amhara Region, Ethiopia. From prior field experiences and reconnaissance survey, it was found that indigenous communities in Metema District are often dependent on wild edible plants. In this area, there are plant species that have tremendous importance for food security and market income, but scientific studies on wild edible plants are lacking. Despite this, the vegetation with the associated indigenous knowledge is being lost due to the rapid increase of the population size that exposed unwise use of the plant resources. Before all of the resources are completely depleted, ethnobotanical research is essential for producing scientific data that can be used to build the sustainable usage of the biological resources (wild edible plants) [24]. Thus, documenting wild edible plants with the associated indigenous knowledge before their complete lose is crucial and timely. In addition, the result of the study could be valuable to concerned bodies so as to develop appropriate managerial interventions. Therefore, the objective of this study was to assemble information on wild edible plant species used as food along with their associated indigenous knowledge, threats, and management practices in Metema District.

2. Materials and Methods

2.1. Description of the Study Area. Metema District is located in West Gondar Zone of Amhara Region about 900 km far from Addis Ababa, the capital of Ethiopia, and 180 km west of Gondar town. Genda Wuha is the capital of the District. According to Agricultural Office [25], the total area of the District is about 440,000 hectares. Metema is predominantly rural encompassing one town and 17 rural kebeles (Figure 1). The District is bordered by Quarra and Alefa in the south, Chilga in the east, Tach Armachoho in the north, and Sudan in the west [26]. A total of 110,231 people existed in the District of which Orthodox Christianity followers were the dominant (83.4%) and the remaining 16.5% were Muslims [27]. It is the home of Amhara, Agaw, Kimnat, Tigrie, Oromo, and Gumuz ethnic groups [26].

The altitude of the District ranges from 550 to 1608 m above sea level [28] with harsh (hot) climatic conditions. The mean annual temperature of the study area is 26.2°C, ranging from 15.7°C–41.0°C. The mean annual rainfall of the area is 1008 mm with unimodal rainfall patterns having maximum and minimum monthly rainfall of 257.6 and 0 mm respectively (Figure 2).

The natural vegetation of Metema is largely composed of *Combretum-Terminalia*broad-leaved deciduous woodland type growing predominantly on vertisol (black soil) [26, 28, 29]. Forests and rangelands are the major (72%) land use types [25]. Sesame, cotton and sorghum are major crops and goats and cattle are the main livestock productions.

2.2. Study Sites and Informant Selection Techniques. Study sites and informants were selected based on the recommendation of local authorities and elders during the reconnaissance survey. Accordingly, eight Kebeles (the smallest administration unit) as study sites (Figure 1) were selected purposively based on vegetation cover and key informants' availability. Likewise, general and key informants were selected using systematic random and purposive sampling techniques respectively following Martin [30]. Numbers of households were used to select general informants through systematic random sampling techniques and prior information from the inhabitants was used to identify key informants using purposive sampling techniques. Both male and female informants within the age range of 20–85, who lived over ten years in the study area, were participated. Informants lived over ten years were considered during informant selection since people lived in one particular area for long period of time are believed to have good shared indigenous knowledge or develop rich indigenous knowledge about plant uses (wild edible plants). In addition, long lived informants can give accurate data and able to explain their indigenous knowledge confidently using their well-developed experiences. Accordingly, 80 general informants and 48 key informants were interviewed to collect ethnobotanical data.

2.3. Ethnobotanical Data Collection. Following Coton [5] and Martin [30], data were collected using individual interviews, guided field walks, focus group discussion, and market surveys through semistructured questionnaires in two rounds (March to May 2020 and August to December 2020). Individual interviews were done with general and key informants using checklists. The checklists of the interview were focused on informants' demographic profiles (age, sex, duration of residency in the area, education level, religion, and marital status). In addition, the checklists also emphasized on wild edible plant species local name, parts used, mode of preparation, condition of utilization marketability, and traditional conservational practices. To confirm the validity and reliability of the information given by the informants on the same topic, informants were interviewed thrice or more time. As result, only the responses of an informant which were similar to the former response were taken as correct data.

Guided field walks were used to collect data on plant habit, habitat, and additional information which were not addressed during individual interviews. Wild edible plant specimens were collected for identification during guided field walks. Specimen identification was made in the University of Gondar, Ethiopia, by using published volumes of the Flora of Ethiopia and Eritrea [31–38]. Qualitative information about indigenous knowledge transfer system, current status, threats, and conservation practices of the wild edible plant species were collected using focus group discussion with selected key informants. The

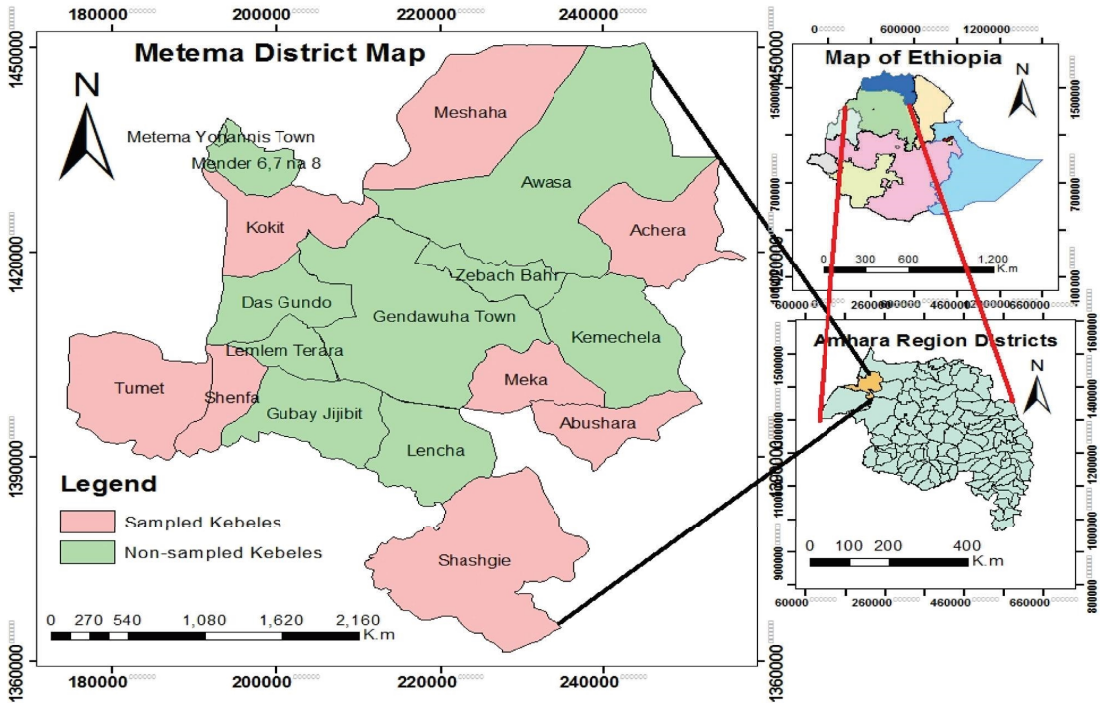

Figure 1: Map of Metema District with selected study sites.

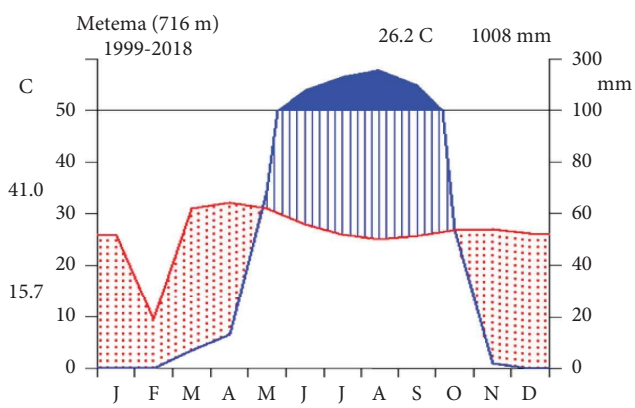

Figure 2: Climadiagram of Metema District from 1999–2018 (data source: National Meteorological Agency from 1999–2018).

marketability of wild edible plant species was assessed in the local markets of Genda Wuha, Kokit, and MetemaYohannes towns. During data collection, oral permissions were obtained from Metema District administration, agricultural, and kebele officials as well as informants after thorough discussion about the study objectives.

2.4. Ethnobotanical Data Analysis. Ethnobotanical data were analyzed using descriptive statistics through Microsoft Office Excel Spreadsheet (2010) and SPSS version 20 following Cotton [5] and Martin [30]. In addition, ethnobotanical data were verified and validated using informant consensus, preference ranking, and direct matrix ranking following the previous authors [3, 5, 39].

Informant consensus was analyzed for ten most frequently reported wild edible plant species so as to identify the most cited wild plant species in the study area following Phillips et al. [40]. Preference ranking exercise was done for seven wild edible plant species based on their preferred taste reports using ten experienced key informants following the previous authors [5, 39]. The highest value (7) was given to the most preferred species and the lowest value (1) for the least. Direct matrix ranking was computed using five key informants for five multipurpose wild edible plant species that had higher roles for the livelihood of the community following previous works [5, 30, 39]. For direct matrix analysis, traditional medicine, food, fodder, fuel wood, cash income, agricultural tools, construction, and shading attributes were used. The highest value (8) was given to the most preferred use value and the lowest value (0) to no use of the species. Finally, plant species were ranked based on the sum of each score.

3. Results

3.1. Indigenous Knowledge on Wild Edible Plants. Informants' report on wild edible plant species (Supplementary Table 1) indicated that the local communities use the plants for food during hunger and normal times. However, there was indigenous knowledge variation on age and sex regarding the number of wild edible plant species reported. Significant differences ($P < 0.05$) were obtained by independent sample t-test between males and females on the number of wild edible plant species they listed (Table 1). Males reported a greater number of wild edible plant species (Table 1). The test also confirmed that there was a significant difference in the number of wild edible plant species

Table 1: Statistical independent t-test of significance on the number of wild edible plants mentioned by informant groups in Metema District.

Parameters	Informant group	N	No. of plant species reported	Mean	t value**	P value
Gender	Male	68	1444	21.24	−4.03	0.001*
	Female	60	950	15.83		
Age	Younger (20–50 years)	48	1102	15.81	−3.281	0.001*
	Elder (51–85 years)	80	1292	20.44		

*Significant difference ($P < 0.05$), **t (0.05) (two tailed), d$f = 126$, and N = number of respondents.

mentioned by the two age groups (20–50 and 51–85 years) of informants (Table 1). Elder informants, whose ages were between 51 and 85 years, reported a greater number of wild edible plant species.

3.2. Wild Edible Plant Species. A total of 44 wild edible plant species distributed in 34 genera and 25 families were recorded. Trees accounted for a higher proportion of wild edible species (59.09%) (Figure 3). *Fabaceae* and *Moraceae* consisted of the higher number of edible plant species (6, 17.14% each) followed by *Malvaceae* and *Tiliaceae* (6.4% each) and the remaining five and sixteen families were represented by two (4.54%) and one (2.27%) species, respectively, (Table 2).

From the total wild edible plants, 33 (75%) species were used as supplementary foods and 11 (25%) species were used during famine (Supplementary Table 1). The wild edible plant species were distributed in the natural habitat except for *Cordia africana* and *Moringa stenopetala* which were found in the homegarden and *Hibiscus esculentus* and *Corchorus olitorius* were found in farmlands. While *Plumbago zeylanica* existed in the wild and farmlands (Supplementary Table 1).

Informant consensus showed that 24 wild edible species were cited by over 20 informants while *Terminalia laxiflora* was reported by only one informant (Table 3 and Supplementary Table 1). Informant consensus analysis on the 10 most repeatedly reported species showed that *Diospyros abyssinica* was the most preferred species with 60.94% consensus followed by *Balanitesa egyptiaca* (56.25%), whereas *Ekebergia capensis* (28.91%) was the least preferred species (Table 3).

In addition, preference ranking result showed *Diospyros abyssinica* ranked first in terms of taste followed by *Adansonia digitata* and *Cordia africana*, respectively, whereas *Ziziphus spina-christi* stood last (Table 4).

3.3. Parts Used and Mode of Consumption of Wild Edible Plants. Fruits were the most edible plant part (66%), whereas flowers were the least with 2.1% (Table 5 and Supplementary Table 1) and the edible plant parts were gathered at different months of the year (Supplementary Table 1). With regard to mode and condition of utilization, fresh forms were used more frequently (36, 81.8%) followed by both fresh and dried forms (13.6%). Most of the edible products (79.55%) were eaten in their raw forms and only 20.45% of them were eaten after cooking along with other ingredients (Supplementary Table 1). In addition, informants reported that raw forms were easy to eat with their natural taste in the wild environment.

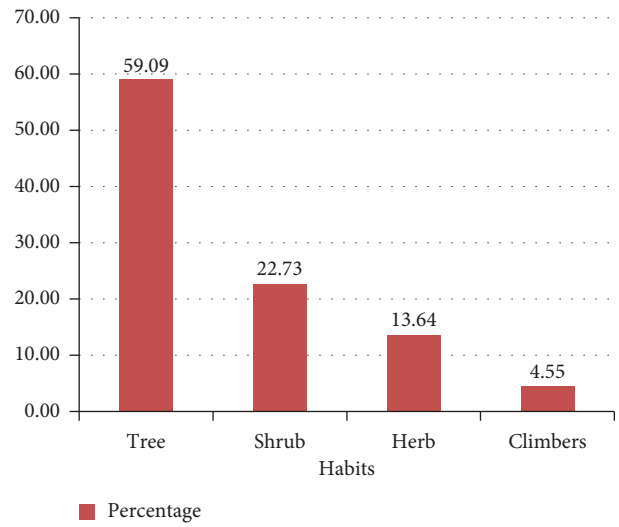

Figure 3: Habits of wild edible plant species.

3.4. Income Generating Role of Wild Edible Plant Species. In addition to their household consumption, ten wild edible plant parts were marketable (Table 6). All of the edible plant parts were fruits with the exception of *Corchorus olitorius* which had marketable leaves. From these, three species, *Temarindus indica*, *Balanites aegyptiaca*, and *Adansonia digitata* were exported to the Republic of Sudan with higher cost for oil extraction. From exportable wild edible products, *Balanites aegyptiaca* was the most expensive species followed by *Adansonia digitata* and *Temarindus indica*, respectively. The remaining seven species were sold in the local markets. *Ziziphus spina-christi* was the cheapest one due to its higher availability in the area. They provided an opportunity to supplement households' income in the study area especially the poor to meet their basic needs.

3.5. Other Uses of Wild Edible Species. In addition to food value, the wild edible plant species had many other uses to the local community of the District. Most of the species (33, 75%) were used as animal fodder and 25 (56.82%), 20

Table 2: Wild edible plant species distribution in genera and families.

Families	No. of genera	No. of species	Percentage
Fabaceae	4	6	12.8
Moraceae	2	6	12.8
Malvaceae and *Tilaceae*	2	3	6.4
Anacardiaceae, *Apocynaceae*, and *Rubiaceae*	2	2	4.3
Ebenaceae and *Rhamnaceae*	1	2	4.3
16 families	1	1	2.1

Table 3: Informant consensuses on top ten more frequently listed wild edible plants.

Plant species	Total no. of citations	Percentage	Rank
Diospyros abyssinica	78	60.94	1st
Balanites aegyptiaca	72	56.25	2nd
Adansonia digitata	69	53.91	3rd
Ziziphus spina-christi	68	53.13	4th
Ximenia americana	67	52.34	5th
Tamarindus indica	62	48.44	6th
Ficus sur	57	44.53	7th
Flueggea virosa	46	35.94	8th
Syzygium guineense	44	34.38	9th
Ekebergia capensis	37	28.91	10th

Table 4: Preference ranking for seven selected wild edible trees and shrubs based on taste (7 = most preferred and 1 = least preferred species).

Plant species	Key informants (1–10)										Sum	Rank
	1	2	3	4	5	6	7	8	9	10		
Diospyros abyssinica	7	6	7	7	4	6	6	6	7	7	63	1st
Adansonia digitata	5	4	6	4	5	7	7	3	6	5	52	2nd
Cordia africana	3	7	4	6	7	5	5	4	5	4	50	3rd
Ximenia americana	6	5	1	2	6	4	3	7	4	6	44	4th
Balanites aegyptiaca	4	3	5	5	3	3	4	5	3	3	38	5th
Tamarindus indica	1	2	2	3	2	2	1	2	2	2	19	6th
Ziziphus spina-christi	2	1	3	1	1	1	2	1	1	1	14	7th

Table 5: Plant parts used for wild edible purpose.

Parts used	Count each	Percentage each
Fruit	31	66
Leaf	5	10.6
Internal stem bark	4	8.5
Gum	3	6.4
Root	2	4.3
Flower	1	2.1

(45.45%), 13 (29.55%), 10 (22.73%), and 10 (22.73%) species were used for traditional medicines, firewood, agricultural tools, construction, and household implements, respectively, (Supplementary Table 1). *The result showed that six of the 25 medicinal plant species, Tamarindus indica, Moringa stenopetala, Balanites aegyptiaca, Grewia ferruginea, Corchorus olitorius, and Cordia africana, had nutraceutical values. Plant species included in this category were taken as food to provide nutritional and medicinal values to the consumers. By taking these plants as food, individuals get treated from different diseases like abdominal pain, abdominal dryness, intestinal parasite, common cold, headache, hypertension, diabetes mellitus, cancer, and other ailments. In addition, consuming fruits of Grewia ferruginea and Cordia africana were also acclaimed to avoid constipation in children. Direct matrix ranking of the five selected multipurpose wild edible species for eight use values showed that shading was found the most important attribute of the species followed by wild food and cash income, whereas agricultural tools were the least use value. Ziziphus spina-christi was found the most multipurpose plant species followed by Tamarindus indica and Terminalia laxiflora, respectively, (Table 7).*

3.6. Threats and Conservation Practices of Wild Edible Plants. Plant species in general and wild edibles, in particular, have been decreased as a result of agricultural expansion and other livelihood activities such as construction, intentional fire, firewood collection, charcoal production, constructional materials collection, and resettlements. Despite this, conservation activities were not given proper attention. Most of the plants were freely available in the communal lands without proper management, with the exception of high valued forests containing incense producing *Boswellia papyrifera* and gum producing *Acacia* species. However, some traditional practices helped to conserve plant species. On farmlands, large trees were allowed to grow sparsely primarily for shade value. In addition, religious dogma, taboos, and local rules were used practically to conserve plants. For instance, cutting plants in Orthodox Tewahedo Church compound is considered as a great sin. Likewise, cutting of *Ficus* species that were used as a shade during social affairs is considered as taboo.

4. Discussion

Nearly equal proportion of male and female participants might be good representatives of the study area population. However, the significant knowledge difference between the two groups might have a direct relation with the activities they regularly engage. In the area, males mostly spent their time out of their homes even for more than a week by performing different agricultural practices. This might lead them to be more knowledgeable than females and this is supported by the report of Wondimu et al. [21]. Likewise, significant knowledge variation between the two age groups might be observed due to rapid modernization that easily

Table 6: Marketability of underutilized wild edible trees and shrubs in Metema District.

Scientific name	Plant part	Unit	Average unit price (ETB)	Seller group
Adansonia digitata	Fruit	kg, quintal	7/kg, 700/quintal	All
Balanites aegyptiaca	Fruit	Cup, kg	1.2/cup, 8/kg	All
Corchorus olitorius	Leave	Fistful	5	All
Cordia africana	Fruit	Cup	0.6	Younger
Diospyros abyssinica	Fruit	Cup	0.75	Younger
Saba comorensis	Fruit	Number	1.2	All
Syzygium guineense	Fruit	Cup	1	Younger
Temarindus indica	Fruit	kg, quintal	5/kg, 400/quintal	All
Ximenia americana	Fruit	Cup	1	Younger
Ziziphus spina-christi	Fruit	Cup or highland	0.5/cup, 2.5/highland	All

Table 7: Direct matrix ranking for multipurpose use of five selected plant species for eight selected use values.

Use values	*Balanites aegyptiaca* Is	*Ficus scycomorus* Is	*Terminalia laxiflora* Is	*Tamarindus indica* Is	*Ziziphus spina-christi* Is	Total	Rank
MD	32	20	17	35	32	136	4th
FD	38	27	0	39	38	142	2nd
FR	18	13	17	20	32	100	7th
CH	8	19	40	14	25	106	6th
FW	16	12	40	21	19	108	5th
CI	39	3	38	29	29	138	3rd
SH	27	33	13	40	34	147	1st
AT	7	1	39	9	31	87	8th
Total	185	128	204	207	240		
Rank	4th	5th	3rd	2nd	1st		

Use values (MD = medicines, FD = food, FR = fodder, FW = fuel wood, CI = cash income, CH = construction and household implements, SH = shading, and AT = agricultural tools); Is = informants.

divert the attention of the young generation and this will be aggravated in the near future since documentation is not a trend of the local people. This is in agreement with other similar studies [41, 42].

Substantial number of wild edible plants recorded in a study area showed that the local people have good indigenous knowledge. Wild edible plant species documented in this study were found greater than the findings of Wondimu et al. [21], Assefa and Abebe [23], Seyoum et al. [43], Ayele [44], and Tebkew et al. [45] which were 41, 30, 30, 24, and 39 species, respectively, whereas a relatively higher number of wild edible plant species (46, 77, and 55) were recorded by Bahru et al. [46], Ashagre et al. [41], and Berihun and Molla [47], respectively. The variation of wild edible plant species among the different study areas could be the differences in culture, ethnicity, vegetation cover, and socioeconomic activities of the people. Other ethnobotanical studies [42, 48] reported similar justification. The study area shared 28 wild edible plant species with Chilga District [19], 18 with Quara District [45], 12 with Bullen District [47], 11 with Awash National Park and its buffer areas [46], and 16 with Lowland Areas of Ethiopia [49]. The higher similarity of wild edible plants of the study area with Quara and Chilga Districts [19, 45] might be due to similar environmental conditions, vegetation cover, and indigenous knowledge practice among communities as they are adjacent Districts. Similar records of wild edible plant species as food in different areas of Ethiopia confirm their function for food security. In this regard, different findings in Ethiopia [9, 23, 44–46, 50] showed that edible wild plants are essential components of daily food intakes and had a wide role in maintaining food security if conservation priorities are given to them.

Unlike herbaceous species that survived during the rainy season only, year-round availability of woody species make them to contribute more as wild edible plants in semiarid environmental condition of the study area. In line with this, previous studies [23, 42, 51] reported that dry land agroecology is mostly endowed with shrubs and trees. Hence, woody wild edible plant species have tremendous importance for food security and other values in the area. The higher proportion of trees as wild edible uses was also reported with other similar studies elsewhere in Ethiopia [19, 52, 53]. Similarly, the vegetation diversity study in Metema District [54] showed the highest number of tree species. The existence of higher number of wild edible *Ficus* species in the family *Moraceae* in Ethiopia and elsewhere [51, 55, 56] contributed for its dominance. In addition, adaptation potential of wild edible plant species in *Moraceae* and *Fabaceae* over wider range of altitudes and agroecological regions enabled them available in higher proportion [42, 57]. The dominance of *Fabaceae* and *Moraceae* was also reported in previous studies [19, 44, 45, 53].

The variation in the frequency of citation (informant consensus) and preference ranking of wild edible plant species could be their difference in agroecological distribution and indigenous knowledge sharing. In addition, the

quantity and quality of wild edible plant products could also be the reason for the variation. The highest informant consensus value of wild edible plant species showed that these plants had great edible value in the community. Wild edible plant species in the present study and Quara District [45] showed that *Adansonia digitata*, *Diospyros abyssinica*, *Ziziphus spina-christi*, *Ximenia americana*, *Tamarindus indica*, and *Balanites aegyptiaca* had better informant consensus analysis results. Likewise, *Balanites aegyptiaca*, *the* second ranked species in the present study, was the first preference by the local people of Dheerra Town in Arsi Zone [21] and the 4th preference in Burji District [41]. Generally, the most cited wild edible plant species could have great potential for food purpose in the community and needs conservation priority.

Availability of a higher proportion of fruit-bearing trees and shrubs might make fruits the most commonly used wild edible plant part. Ripe fruit is simpler to consume and ease of processing, making it superior to the other parts [50]. In addition, studies in other areas of the country [13, 21, 42, 44, 50, 53, 58] reported that fruits possess more nutritive fleshy part and taste than other plant parts [59]. However, other studies [23, 41, 44] reported that leaves were the most important edible parts. The variation of reports in wild edible plant parts could be the disparity of traditional knowledge in the community, climate condition and vegetation types of the study area, and socioeconomic activities of the community and quantity and quality of edible plant parts as it was reported by Anbessa [58]. The preference of using fresh forms for the edible purpose would have tremendous importance to alleviate both starvation and thirst. In addition, using fresh forms might be easy for preparation and retain its natural content. Other studies also reported the use of fresh forms for edible purposes [19, 50]. However, the use of dried wild edible plant parts would have great value to alleviate future food insecurity if the resources are scarce and seasonal.

Likewise, the preference of raw consumption indicated that the plant parts are eaten as soon as they are gathered from the place where they are found in the wild. Other research findings [58, 60] also reported the preference of raw forms for consumption. The findings of cooked vegetables in the study area could be helpful to develop the habits of using wild edible plant parts after processing. However, overcooking of wild edible plant parts might be causing the loss of the natural organic nutritive content and taste. Generally, eating wild edible plant parts after cooking and processing would have roles to reduce toxic nature and add taste and flavor. The availability of the edible plant parts at different periods of the year would provide the communities to access the edible parts at different times of the year. The existence of different wild edible plant parts at different periods of the year was also supported by Tebkew et al. [45].

Income derived from the sale of wild plant parts has particular importance to meet the basic needs of poor households. Market value of the wild edible plants was also reported by different authors at different parts of the country [41, 42, 45, 46, 51, 60, 61]. Among the recorded marketable plant species, seven were also reported to have the same role in Quara District [45] and six species with Chilga District [19]. Likewise, *Balanites aegyptiaca*, *Tamarindus indica*, and *Ximenia americana* in and around Awash National Park [46] and *Syzygium guineense* and *Temarindus indica* in Bule Hora District of Ethiopia [58] were also reported as marketable wild edible plant species. Generally, the diverse marketable wild plant species in the District could provide high cash income value beyond food if conservation priorities and emphasis are given.

The multiple uses of wild edible plant species indicated the presence of rich indigenous knowledge within the community on plant species. However, their multiple uses might affect the species availability in the area. Similarly, Anbessa [58] and Dalle et al. [62] stated that the more the plant species used for multiple values, the more is their exploitation in the area. Hence, great attention should be given to the multipurpose wild edible plant species to maintain them for future generations. Apart from their food value, multiple roles of wild edible food plant species were also reported by other different studies [42, 46, 50, 51, 60, 63]. Especially, in rural communities, wild trees and shrubs are the major sources of house construction and fuel wood. On the other hand, the local communities in the study area do not have a habit of planting trees. In addition, the great medicinal role of wild edible plants leads to their further depletion which was also reported elsewhere in Ethiopia [23, 46, 51]. Several plants with nutraceutical value are available in the study area which is also reported in other areas of the country [21].

5. Conclusions

The result of the study revealed that Metema District supports several numbers of wild edible plants with their associated knowledge. The District inhabitants meet their basic needs by consuming and marketing these plants. Since wild edible plants are easily affordable and accessible, the economically deprived segment of the community complements their diet by taking wild edible plants. Multiple roles of wild edible plants (food, medicine, fodder, construction, and fuel) resulted in their overexploitation. They are threatened by farmland expansion, forest clearing, over grading, and other destructive human activities. For sustainable utilization and conservation of these biological resources, migrants from highland areas and neighboring regions should be controlled. Strengthening farmers' traditional conservation practices such as growing wild edible plants in the homegardens and farmlands is the appropriate measure to bring these precious resources out of the grove. Moreover, awareness creation, value addition, and market linkage of high market potential wild edible plants would help to maximize income and improve the livelihoods of local people while contributing to sustainable forest management.

Data Availability

Most of the data used to support the findings of this work are found in the supplementary materials. In addition, some of the data used for this work are included in the figure files (figures and tables).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors had noteworthy contributions to the development of this paper. Dr. Getinet Masresha identified the area of the study, continuously facilitated the fieldwork, checked and confirmed the plant identification, wrote the manuscript, and follows the overall write-up of the paper until the final manuscript version. Yirgalem Melkamu conducted the fieldwork, identified the plants, organized and analyzed the data, and wrote the manuscript. Getnet Chekole participated in the design of the study, confirmed the plant identification, organized and analyzed the data, wrote the manuscript, and actively followed it up through revisions up to submission. All authors read and approved the final manuscript and agreed to its submission.

Acknowledgments

The authors thank the people of Metema District, its administrative, agricultural and information center affairs for their information provision starting from consent letter writing. The authors also thank Dr. Asmamaw Alemu, University of Gondar, Department of Forestry, and Dr. Teshome Tesema, Ethiopian Environmental and Forest Research Institute (EEFRI), for their technical support.

Supplementary Materials

Supplementary Table 1: quantitative and qualitative data of wild edible plants documented in Metema District. (*Supplementary Materials*)

References

[1] J. Tardio, M. Pardo-De-Santayana, and R. Morales, "Ethnobotanical review of wild edible plants in Spain," *Botanical Journal of the Linnean Society*, vol. 152, no. 1, pp. 27–71, 2006.

[2] A. Gidey, "Edible wild and semi-wild plants of Hamar and Konso (South Ethiopia) with emphasis on their ethnobotany and nutritional composition of selected species," Ph. D. Thesis, Addis Ababa University, Addis Ababa, Ethiopia, 2009.

[3] D. Teketay, F. Senbeta, M. Maclachlan, M. Bekele, and P. Barklund, *Edible Wild Plants in Ethiopia*, Addis Ababa University Press, Addis Ababa, Ethiopia, 2010.

[4] E. Lulekal, Z. Asfaw, E. Kelbessa, and P. Van Damme, "Wild edible plants in Ethiopia: a review on their potential to combat food insecurity," *Afrika Focus*, vol. 24, no. 2, pp. 71–121, 2011.

[5] C. M. Cotton, *Ethnobotany: Principles and Applications*, John Wiley and Sons Ltd, Chichester, UK, 1996.

[6] Y. Uprety, R. C. Poudel, K. K. Shrestha et al., "The Nutritional Role of Forest Plant Foods for Rural Communities," *Human Health and Forests*, Taylorfrancis, London, UK, 2008.

[7] Y. Guinand and D. Lemessa, *Ethiopia: Famine Food Guide*, United Nations Development Program Emergencies Unit for Ethiopia, Addis Ababa, Ethiopia, 2001.

[8] Y. Ju, J. Zhuo, B. Liu, and C. Long, "Eating from the wild: diversity of wild edible plants used by Tibetans in Shangri-la region, Yunnan, China," *Journal of Ethnobiology and Ethnomedicine*, vol. 9, p. 28, 2013.

[9] E. Adamu, Z. Asfaw, S. Demissew, and K. Baye, "Proximate, minerals, and vitamin C contents of selected wild edible plants in Lasta District, Northeastern Ethiopia," *International Journal of Plant Biology*, vol. 13, no. 4, pp. 613–624, 2022.

[10] Food and agricultural organization (FAO), *The State of Food Insecurity in the World: Economic Growth is Necessary but Not Sufficient to Accelerate Reduction of Hunger and Malnutrition*, Food and agricultural organization (FAO), Rome, Italy, 2012.

[11] Food and Agriculture Organization (FAO), "Building on gender, biodiversity local knowledge," *A Training Manual*, FAO, Rome, Italy, 2005.

[12] A. Gidey, Z. Asfaw, and Z. Woldu, "The role of wild and semi-wild edible plants in household food sovereignty in hamer and konso communities, south Ethiopia," *Ethnobotany Research and Applications*, vol. 11, pp. 251–272, 2013.

[13] A. Gidey, K. Urga, and D. Dikasso, "Ethnobotanical study of edible wild plants in some selected Districts of Ethiopia," *Human Ecology*, vol. 331, pp. 83–118, 2005.

[14] Z. Asfaw and M. Tadesse, "Prospects for sustainable use and development of wild food plants in Ethiopia," *Economic Botany*, vol. 55, no. 1, pp. 47–62, 2001.

[15] Institute of Biodiversity conservation (IBC), *Conservation National Biodiversity Strategy and Action Plan*, Addis Ababa University, Addis Ababa, Ethiopia, 2005.

[16] M. Giday, Z. Asfaw, and Z. Woldu, "Medicinal plants of the Meinit Ethnic Group of Ethiopia: an ethnobotanical study," *Journal of Ethnopharmacology*, vol. 124, no. 3, pp. 513–521, 2009.

[17] A. Enyew, Z. Asfaw, E. Kelbessa, and R. Nagappan, "Ethnobotanical study of traditional medicinal plants in and around Fiche District, Central Ethiopia," *Current Research Journal of Biological Sciences*, vol. 6, no. 4, pp. 154–167, 2014.

[18] A. Melaku and M. A. Ebrahim, "Critical review on wild-edible fruit species in Ethiopia," *International Journal of Financial Research*, vol. 2021, Article ID 8538188, 12 pages, 2021.

[19] A. Zebene and Z. Solomon, "Underutilized wild edible plants in the Chilga District, Northwestern Ethiopia," *Agriculture & Food Security*, vol. 3, pp. 12–37, 2014.

[20] G. Chekole, Z. Asfaw, and E. Kelbessa, "Ethnobotanical study of medicinal plants in the environs of Tara-gedam and Amba remnant forests of Libo Kemkem District, Northwest Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 11, no. 1, pp. 4–38, 2015.

[21] T. Wondimu, Z. Asfaw, and E. Kelbessa, "Ethnobotanical study of food plants around Dheerar Town, Arsi, Ethiopia," *Ethio J Sci*, vol. 29, pp. 71–80, 2006.

[22] M. Abdella, B. Cheneke, and M. Ketama, "Assessment of wild edible plant species in East Hararghe Zone, Oromia, Ethiopia," *International Journal of Science, Technology and Society*, vol. 11, pp. 81–94, 2023.

[23] A. Assefa and T. Abebe, "Wild edible trees and shrubs in the semi-arid lowlands of Southern Ethiopia," *Journal of Science*, vol. 1, pp. 5–9, 2011.

[24] L. A. Thrupp, "The importance of biodiversity in agroecosystems," *Journal of Crop Improvement*, vol. 12, no. 1-2, pp. 315–337, 2004.

[25] Agricultural and Rural Development Office(Ardo), "The Metema District annual report," Report, Agricultural and Rural Development Office(ARDO), Shihedy Town, Ethiopia, 2005.

[26] Ilri, "Improving productivity and market success of Ethiopian farmers project (IPMSP team)," *Metema Pilot Learning Site Diagnosis and Program Design*, Addis Ababa, Ethiopia, 2005.
[27] Central Statistical Authority (Csa), "Complete census 2007," Survey Reports, pp. 243–261, Addis Abeba, Ethiopia, 2007.
[28] D. Tesfa, "Studies on the impact of climate change on agricultural investment and coping strategies: the Case of Metema District, North Gondar Zone, Ethiopia," M.Sc. thesis, Gandhi National Open University, New Delhi, India, 2014.
[29] F. Adugna, S. Andualem, and M. Andargie, "Ethnozoological study of traditional medicinal appreciation of animals and their products among the indigenous people of Metema District, North-Western Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 14, pp. 37–48, 2018.
[30] G. J. Martin, *Ethnobotany, A Methods Manual*, Champan and hall, London, UK, 1995.
[31] I. Hedberg and S. Edwards, "Flora of Ethiopia and Eritrea," *Pittosporaceae to Araliaceae*, Department of Systematic Botany, Uppsala University, Uppsala and The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 1989.
[32] I. Hedberg and S. Edwards, "Flora of Ethiopia and Eritrea," *Poaceae (Gramineae)*, Department of Systematic Botany, Uppsala University, Uppsala and The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 1995.
[33] S. Edwards, S. Demissew, and I. Hedberg, "Flora of Ethiopia and Eritrea," *Hydrocharitaceae to Arecaceae*, Department of Systematic Botany, Uppsala University, Uppsala and The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 1997.
[34] S. Edwards, M. Tadesse, and I. Hedberg, "Flora of Ethiopia and Eritrea," *Canellaceae to Euphorbiaceae*, Department of Systematic Botany, Uppsala University, Uppsala and The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 1995.
[35] S. Edwards, M. Tadesse, S. Demissew, and I. Hedberg, "Flora of Ethiopia and Eritrea," *Magnoliaceae to Flacourtiaceae*, Department of Systematic Botany, Uppsala University, Uppsala and The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 2000.
[36] I. Hedberg, S. Edwards, and S. Nemomissa, "Flora of Ethiopia and Eritrea," *Apiaceae to Dipsacaceae*, Department of Systematic Botany, Uppsala University, Uppsala and the National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 2003.
[37] I. Hedberg, I. Friis, and S. Edwards, *Flora of Ethiopia and Eritrea Asteraceae*, Department of Systematic Botany, Uppsala University, Uppsala and the National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia, 2004.
[38] I. Hedberg, E. Kelbessa, S. Edwards, S. Demissew, and E. Persson, "Flora of Ethiopia and Eritrea," *Plantaginaceae*, vol. 5, Department of Systematic Botany, Uppsala University, Uppsala and The National Herbarium, Addis Ababa University, Addis Ababa Ethiopia, 2006.
[39] M. J. Balick and P. A. Cox, "Plants, people and culture," *The Science of Ethnobotany*, Scientific American Library, New York, NY, USA, 1996.
[40] O. Phillips, A. H. Gentry, C. Reynel, P. Wilkin, and C. Galvez-Durand B, "Quantitative ethnobotany and Amazonian conservation," *Conservation Biology*, vol. 8, no. 1, pp. 225–248, 1994.
[41] M. Ashagre, Z. Asfaw, and E. Kelbessa, "Ethnobotanical study of wild edible plants in Burji District, Segan Area Zone of Southern Nations, Nationalities and People Region (SNNPR), Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 12, pp. 1–15, 2016.
[42] M. Tahir, A. Abrahim, T. Beyene, and G. Dinsa, "The traditional use of wild edible plants in pastoral and agro-pastoral communities of Mieso District, Eastern Ethiopia," *Tropical Medicine and Health*, vol. 51, p. 10, 2023.
[43] Y. Seyoum, D. Teketay, G. Shumi, and M. Wodafirash, "Edible wild fruit trees and shrubs and their socioeconomic significance in Central Ethiopia," *Ethnobotany Research and Applications*, vol. 14, pp. 183–197, 2015.
[44] D. Ayele, "Ethnobotanical survey of wild edible plants and their contribution to food security used by Gumuz people in Kamash Woreda; Benishangul Gumuz Regional State; Ethiopia," *Journal of Food and Nutrition Sciences*, vol. 5, pp. 217–224, 2017.
[45] M. Tebkew, Y. Gebremariam, T. Mucheye, A. Alemu, A. Abich, and D. Fikir, "Uses of wild edible plants in Quara District, Northwest Ethiopia: implication for forest management," *Agriculture & Food Security*, vol. 7, p. 12, 2018.
[46] T. Bahru, Z. Asfaw, and S. Demissew, "Wild edible plants: sustainable use and management by indigenous communities in and the buffer Area of Awash National Park, Ethiopia," *Ethiop. J. Sci*, vol. 36, pp. 93–108, 2013.
[47] T. Berihun and E. Molla, "Study on the diversity and use of wild edible plants in Bullen District Northwest Ethiopia," *Journal of Botany*, vol. 2017, pp. 1–10, 2017.
[48] M. Bortolotto, M. C. D. Amorozo, G. G. Neto, J. Oldeland, and G. A. Damasceno-Junior, "Knowledge and use of wild edible plants in rural communities along Paraguay River, Pantanal, Brazil," *Journal of Ethnobiology and Ethnomedicine*, vol. 11, no. 1, p. 46, 2015.
[49] T. Dejene, M. Samy, A. Dolores, and P. Martin-Pinto, "Ethnobotanical survey of wild edible fruit tree species in Lowland Areas of Ethiopia," *Forests*, vol. 11, pp. 1–17, 2020.
[50] K. Balemie and F. Kebebew, "Ethnobotanical study of wild edible plants in Derashe and Kucha Districts, South Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 2, no. 1, pp. 53–61, 2006.
[51] M. Girmay, E. Lulekal, B. Belay, and K. Gebrehiwot, "Wild edible plants study in a dryland ecosystem of Ethiopia," *Daagu International Journal of Basic and Applied Research*, vol. 4, pp. 105–119, 2022.
[52] T. Teklehaymanot and M. Giday, "Ethnobotanical study of wild edible plants of Kara and Kwego semi-pastoralist people in Lower Omo River Valley, Debub Omo Zone, SNNPR, Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 6, no. 1, p. 23, 2010.
[53] B. Sina and H. Degu, "Knowledge and use of wild edible plants in the Hula District of the Sidama Zone," *International Journal of Bio-resource and Stress Management*, vol. 6, no. 3, pp. 352–365, 2015.
[54] H. Adamu, T. Bekele, and G. Dalle, "Floristic diversity, regeneration status and vegetation structure of woodlands in Metema Area, Amhara National Regional State, Northwestern Ethiopia," *Journal of Forest Research*, vol. 23, pp. 391–398, 2012.
[55] T. Regassa, E. Kelbessa, and Z. Asfaw, "Ethnobotany of wild and semi-wild edible plants of Chelia District, West-Central Ethiopia," *Science, Technology and Arts Research Journal*, vol. 3, no. 4, pp. 122–134, 2015.
[56] S. Ojelel, P. Mucunguzi, E. Katuura, E. K. Kakudidi, M. Namaganda, and J. Kalema, "Wild edible plants used by communities in and around selected forest reserves of Teso-

Karamoja Region, Uganda," *Journal of Ethnobiology and Ethnomedicine*, vol. 15, pp. 3–14, 2019.

[57] E. Kelbessa and S. Demissew, "Diversity of vascular plant taxa of the Flora of Ethiopia and Eritrea," *Ethiopian Journal of Biological Sciences*, vol. 13, pp. 37–45, 2014.

[58] B. Anbessa, "Ethnobotanical study of wild edible plants in BuleHoraWoreda, Southern Ethiopia," *Afri J Basic AppliSci*, vol. 8, pp. 198–207, 2016.

[59] K. A. Mahapatra, S. Mishra, C. U. Basak, and C. P. Panda, "Nutrient analysis of some selected wild edible fruits of deciduous forests of India: an Explorative Study towards non -conventional bionutrition," *Advance Journal of Food Science and Technology*, vol. 4, pp. 15–21, 2012.

[60] M. Kebebew and G. Leta, "Wild edible plant biodiversity and utilization system in Nech Sar National Park, Ethiopia," *International Journal of Biodiversity Science and Management*, vol. 7, no. 4, pp. 885–896, 2016.

[61] A. Kebede, W. Tesfaye, M. Fentie, and H. Zewide, "An ethnobotanical survey of wild wdible plants commercialized in Kefira Market, Dire Dawa City, Eastern Ethiopia," *Plant*, vol. 5, pp. 42–46, 2017.

[62] G. Dalle, B. L. Maass, and J. Isselstein, "Plant biodiversity and ethnobotany of Borana Pastoralists in Southern Oromia, Ethiopia," *The New York Botanic Garden Press, Economic Botany*, vol. 59, pp. 43–65, 2005.

[63] M. Tebkew, A. Zebene, and Z. Solomon, "Ethnobotanical study of medicinal plants in Chilga District, Northwestern Ethiopia," *Journal of Natural Remedies*, vol. 15, pp. 89–112, 2015.