Potential and Prospects of Utilization, Development, and Conservation of Wild Edible Plants of the Meinit Ethnic Community in Bench-Maji Zone, Southwestern Ethiopia

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Abstract

Background: Meinit sociocultural community widely use wild plants for food, medicine, and income generation. However, the diversity of wild edible plants is declining drastically, and the indigenous knowledge on their preservation and utilization is disappearing.

Objective: The study was conducted to document the available knowledge on wild edible plant species (WEPS) used by the Meinit socio-cultural community of Southwestern Ethiopia.

Material and Methods: An ethnobotanical study was conducted on the use of WEPS by Meinit community in Bench-Maji Zone, Southwestern Ethiopia, from May 2019 to March 2021. Individual interviews were conducted using a semi-structured interview questionnaire and focus group discussions. A total of 198 participants aged between 18 and 70 years were drawn from the community and interviewed. Descriptive statistics were used to analyze the data.

Results: A total of 66 wild edible plants were recorded, which belong to 34 families and 50 genera. The genus *Asteraceae* and *Fabaceae* contributed six species each, followed by *Amaranthaceae* and *Moraceae,* each of which contributed five species. Of these species, 28 are herbs, 14 are shrubs, 13 are climbers, and 11 are trees. Leaves (42), fruits (19), roots and tubers (5), seeds (3) and aerial parts (2) of the WEPS were found to be used for food. From the documented WEPS, 12 species were identified to have medicinal values, and one has a market value. The WEPS are consumed as raw, boiled, and local beverage. The anthropogenic factors are major potential threats to WEPS and associated knowledge.

Conclusions: It is concluded that a high diversity of WEPS exists in the study districts, and the identified plant resources are used by the community mainly for food, medicine, and income generation. The tesults imply that WEPS can play significant roles in dietary diversity, food security, and health of rural households if they are conserved and used for food and medicine and further developed and improved. Therefore, these plant species should be domesticated, and their nutritional, phytochemical, and toxicological properties studied for enhanced use and conservation.

Keywords: Conservation; Market value; Medicinal use; Traditional knowledge; Traditional Meinit recipe

1. Introduction

Wild plants and animals have been used as a source of human food and medicine since before the beginning of agriculture (Mekuanent Tebkew *et al*., 2018). Wild edible plant species (WEPS) contribute to food and nutrition security, medicine, income generation, cultural or social value, genetic resource, environmental protection, and aesthetic value (Singh *et al*., 2022). Wild edible plant species are also used as animal feed, construction material, fuel, cosmetics, and farm tools (Shumsky *et al*., 2014). WEPS are consumed as a staple food, supplement the main dish, fill the gap of food shortage and safety net during famine periods in Africa (Getachew Addis *et al*., 2013; Shumsky *et al*., 2014). Ethiopia is endowed with diverse fauna and flora, including wild edible plants, with rich endemic species of higher plants in which there are 647 endemic species from 6027 total plant species recorded in the country (Sebsebe Demissew *et al*., 2021). The country has much more ample traditional knowledge (TK) on the utilization of WEPS that have still been widely used in the country (Fentahun Mengistu and Hager, 2009; Ermias Lulekal *et al*., 2011).

In addition to their deep traditional knowledge on the use of edible wild plants, different communities in Ethiopia also have the wisdom to preserve, such as sun drying of the wild plant species to increase their shelf life (Merkuz Abera and Kindye Belay, 2022). Planting and field conservation of wild edible plants in the home gardens have also been practiced. However, the availability of wild edible plants has been declining mainly due to anthropogenic activities, whilst the traditional knowledge on their utilization by

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acculturation, introduction, and expansion of cultivation as cash crops has also been dwindling (Getachew Addis *et al.*, 2005; Ermias Lulekal *et al.*, 2011).

Consuming wild edible plant is a common practice in many rural areas of Southwestern Ethiopia. In Gurafarda district, Meinit Goldiye, and Meinit Shasha districts in particular in Bench-Maji Zone of Southwestern Ethiopia, where the Meinit ethnic community dwells, there is an extensive use of WEPS used for preparation of local recipes, such as sauce, beverages, bakery products, and maintaining health care (own observation). Abbink (1993) recorded the use of plants for medicinal, ritual value and other purpose by the Meinit community. Given the high potential for use of wild edible plants by the community, the documented information is not likely to include a complete list of the wild edible plants. Most of the plants have not yet been identified by their scientific names, and the associated ethnobotanical information is fragmentary. The knowledge and practice on conservation and cultivation of wild edible plants and preservation of edible plant parts for use during the off-season by the Meinit community has not yet been explored.

There are a number of widely used but, hitherto unidentified and undocumented wild edible plants in the Bench-Maji Zone of Southern Ethiopia. An ethnobotanical studies are, therefore, required to identify and document wild edible plant species and the associated knowledge before it is too late to conserve and preserve them for future generations. The output of this research study is expected to benefit both urban and rural society, particularly rural farmers, who will become more aware of the food and medicinal values of the wild edible plants and increase consumption, thereby obtaining dietary diversity as well as food and nutrition security. The study also will document the traditional knowledge of the people associated with WEPs on utilization and some management practices that promote the domestication of some WEPs. The WEPs will support the food and nutrition security of the rural people. The output of the research will also provide baseline information for researchers, agricultural policymakers, and related stakeholders.

The study was attempted to answer research questions, namely: Which WEPs exist in the study areas, and for what purpose (food, medicine, etc) does the Meinit community utilize the plants? Which edible plant parts are used and how are the edible parts prepared for consumption? What traditional recipes are prepared from WEPs? What are the potential threats affecting the diversity of WEPs and their traditional knowledge pertaining to the Meinit community? What trends exist in the availability of WEPs? What conservation practices are adopted for wild edible plants? Therefore, this study was conducted with the objectives of identifying WEPs, their use by the community, and assess the indigenous knowledge used for using and conserving WEPs for future generation(s).

2. Methods

2.1. Description of the Study Area and Community

The study was conducted in selected areas of the Bench-Maji Zone of Southern Nations, Nationalities and Peoples' Regional State of Ethiopia, where the Meinit community live. Bench-Maji Administrative Zone was purposively selected as the Zone has a rich source of plant diversity and traditional knowledge on the use of wild edible plants species (WEPS). The study districts were purposively selected by the districts' agricultural office experts and Meinit knowledgable people on criteria of the rich knowledge and practice of the local community in using WEPS for food. Accordingly, three districts, namely Gurafarda, Meinit Goldiye, and Meinit Shasha were selected for the study (Figure 1). The study districts are located between dry (= *kolla*) to wet (= *woinadega*) agro-climatic zones. The dry hot agro-climatic zone ranges between the altitude of 500 to 1500 meters above sea level (m a.s.l.). It receives an average annual rainfall of less than 900 mm in the dry season, 900 to 1400 mm in the moist season, and more than 1400 mm in the highly moist season (Azene Bekele *et al.*, 1993). The wet agro-climatic zone covers areas ranging in altitude from 1500 to 2300 m a.s.l. and is subdivided into dry, moist, and wet *woinadega* agro-ecological zones that obtain annual rainfall amounts that are equal to those received by dry (*kola*) sub-climatic Zone (Azene Bekele *et al.*, 1993). The Meinit socio-cultural community relies on subsistence agriculture supplemented with hunting and gathering wild edible animals and plants.

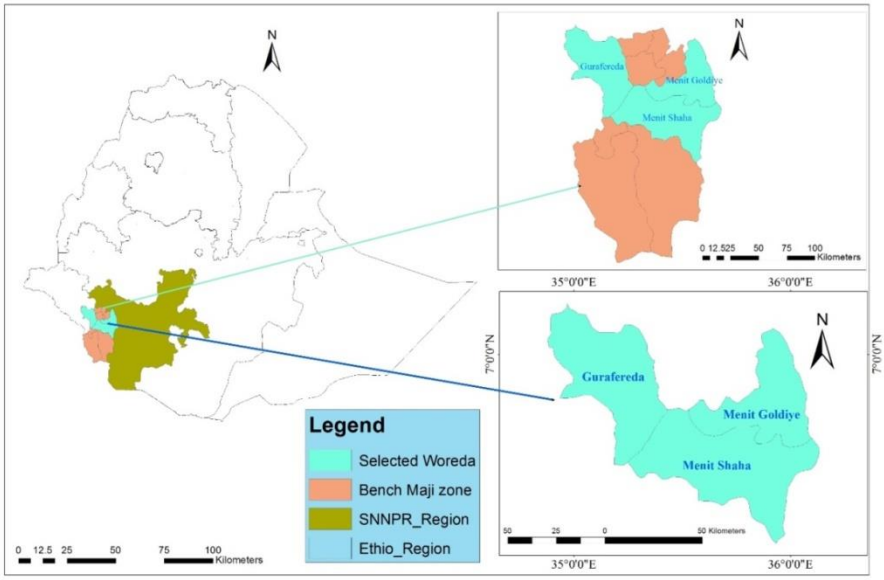

Figure 1. Map of the study areas.

2.2. Study Design

A longitudinal study design was used to investigate the diversity of WEPs used by the Meinit community as well as the knowledge, attitude, and practices of the community on using the plants. Longitudinal study, the study of processes and dynamism in a few locations for a longer period of time, was used to assure the validity of data collected from informants (Bernard, 2002). We frequently visited the study area to collect data sufficiently until the phenology and diversity of plants changed over time. This is, plant pecies have distict life cyle (annual, biannaul, and perennial). Every season, plant specimens were collected. Data were collected through the guidance of knowledgeable local community members.

2.3. Data Collection

A reconnaissance survey was conducted in Bench-Maji Zone before the actual data collection was done. The survey was employed to obtain general information about the study area, knowledge, and practices regarding the use of wild plants for food. Preliminary data were gathered from community leaders, traditional healers, religious leaders, and governmental agricultural development agents. Guided field walks were conducted to observe the geographical features of the study site. The Meinit socio-cultural community was selected based on the reconnaissance survey as the community widely uses WEPS. The Meinit people dwell in the Guraferda, Meinit Goldiye, and Meinit Shasha districts of the Bench-Maji Zone. A total of 12 sampling farmer associations (= kebeles, which is the smallest administrative structure in Ethiopia) were selected from the three study districts, each containing four kebeles.

Malagonak, Dankila, Peliya, and Bergi kebeles were selected from the Gurafarda district. Gimbab, Kushanta, Chat, and Goma kebeles were selected from the Meinit Goldiye district, while Kudim, Aira, Yirni, and Bas kebeles were selected from the Meinit Shasha district. With the guidance of district agricultural development agents and local knowlagable of the Meinit people, study sites were selected by a purposive sampling method based on closer proximity to the town, existing cultural use of WEPS and presence of the Meinit socio-cultural community. In addition, the relative difference in altitude was also considered to select the study sites. Moreover, a total of 36 key informants were recruited using a snowball sampling technique to collect general information on the use of WEPS (Bernard, 2002). Focused group discussions (FDG) were also held involving knowledgeable informants using pre-prepared discussion topics. One FGD per kebele was conducted, involving participants consisting of eight to ten persons. Two FGDs per study site were conducted to obtain information surrounding WEPS, which was later triangulated with the information collected through individual household interviews (Martin, 1995; Cotton and Wilkie, 1996).

A list of households was obtained from each kebele administration, and potential study informats were selected using a simple random sampling method, which was generated using Minitab statistical software

version 17 (MINITAB 2010). A total of 198 sampling units (135 male and 63 female) households were selected from three districts of Guraferda (n = 35), Meinit Goldiye (n = 73), and Meinit Shasha (n = 90) that these districs numbers were sampled from N = 167, N = 243, and N = 280 households, respectively. Study participants aged 18 to 75 years (median = 35) were participated in the interview. Actual ethnobotanical data collections were conducted from May 2019 to March 2021. Qualitative research approach was conducted to collect ethnobotanical data. This approach was performed to get an overview of the study site and population, and understand the the cause and reasons behind the phenomenon studied (Turreira-García *et al*., 2015). Ethnobotanical data were collected using a pre-prepared semi-structured questionnaires, direct observation, Key Informants (KI), Focus Group Discussion, priority ranking, and guided field walk (Martin, 1995; Alexiades, 1996). The interviews included a free listing of WEPS, local name, habitat, growth form (habit), edible parts, collection season, mode of preparation and preservation, and medicinal use. Threats to and conservation practices on the WEPs were also recorded. Oral informed consent was obtained from each study participants prior to interviews, and the interviews were conducted in the Meinit language.

2.4. Collecting and Identifying Plant Specimens

A voucher specimen of each WEPS was collected following a standard procedure (Martin, 1995; Alexiades, 1996). The plant specimens were collected through guided field walks assisted by key informants. Sometimes, collected specimens were presented to participants during FGDs on authenticating the local names of the plant species. Plant specimen collection trips were arranged following the phenology and abundance of the plants both in the dry and wet seasons. The plant specimens having reproductive organs and other unique features were collected, and the ethnobotanical information of each species was described in a field-note book. Voucher specimens of most edible plants were collected, pressed, and transported, for identification and deposition, to the National Herbarium of Addis Ababa University, Ethiopia. Voucher specimens were then identified using Flora Volumes of Ethiopia and Eritrea (Hedberg and Edwards, 1989; Edwards *et al.,* 1995, 1997, 2000; Edwards *et al*., 2003; Mesfin Tadesse, 2004; Hedberg *et al*., 2006), and deposited in the same herbarium.

2.5. Data Analysis

Descriptive statistics were used to organize and analyze the qualitative data. Percentage, pie charts and bar graphs were used to summarize the data. Priority ranking was also conducted to identify major potential threatening factors (1 = least threat, 2 = less, 3 = medium, 4 = more, and 5 = most threat) on wild edible plants diversity. All recorded ethnobotanical data were organized by using Microsoft Excel 2016.

3. Results

3.1. Wild Edible Plants

It was found that a total of 66 WEPS, which belong to 34 families and 50 genera, are used for food by the Meinit community (Table 1). Family *Asteraceae* and *Fabaceae* contributed six edible plant species, each followed by *Amarantceace* (five) and *Moraceae* (five). *Solanaceae*, *Curcubitaceae*, *Acanthaceae,* and *Verbenaceae* contributed to three edible plant species, whilst each of *Rubiaceae*, *Portulacaceae*, *Polygonaceae*, *Myrtaceae*, *Dioscoreaceae,* and *Commelinaceae* are represented by two species. The remaining 20 families had one species each. Among the 66 WEPS collected, 28, 14, 13, and 11 were herbs, shrubs, climbers, and trees in that order of presentation.

3.2. Collection Season and Harvesting Method of Wild Edible Plants

The seasons of collecting edible plant part(s) are presented in Table 1. The highest number of edible plant parts (28) are collected throughout the year, and 19 edible parts are collected during the main rainy season of winter (June to August). About 13 edible plant parts are collected for use during the short rainy season of autumn (March to May). Most of the wild edible leafy vegetables and fruits are available for consumption following the prolonged rainy season (winter) and short dry season (late December to early February). The least number of edible plant parts are collected from September to November (four species) and December to February (two species). Ripe mature fruits of 18 species are harvested by picking from trees or shrubs, but the ripe fruits of *Trilepisium madagascariense* is picked from the mother tree and the ground. All the leafy vegetables (42 species) are collected from the mother plants; roots and tubers (from five species) are harvested by hand digging; and seeds of two species are collected by stripping.

Table 1. Wild edible plants used by Meinit sociocultural community.

Scientific name	Family name	Local name	Growth form	Edible part(s)	Preparation method	Collection method	Season of availability	Voucher number
Asystasia gangetica (L.) T. Anders.	Acanthaceae	Torbol	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-03
Justicia heterocarpa T. Anders.		Antidy	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-21
Thunbergia alata Boj. ex Sims.		Karkakubu	Herb	Young leaves	Boiled	Plucking	Winter& autumn	AY-17
Aerva lanata (L.) Juss. ex Schultes	Amaranthaceae	Holly	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-15
Amaranthus spinosus L.		Bukut	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-37
Amaranthus dubius Mart. ex Thell.		Bukut	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-38
Celosia schweinfurthiana Schinz		Korayit	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-11
Celosia trigyna L.		Welbete	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-13
Carissa spinarum L.	Apocynaceae	Muchakerech	Shrub	Fruit pulp	Raw	Picking	Autumn	AY-62
Sauromatum venosum (Dryand. ex Aiton) Kunth	Araceae	Wenut	Herb	Tuber	Boiled	Digging	All-season	AY-51
Aspilia mossambicensis (Oliv.) Wild	Asteraceae	Beshayt	Shrub	Leaves	Boiled	Plucking	All- season	AY-09
Galinsoga quadriradiata Ruiz & Pavon		Baytena	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-27
Sonchus oleraceus L.		Kolfidekamajun	Herb	Young leaves	Boiled	Plucking	Winter& autumn	AY-49
Vernonia auriculifera Hiern		Garut	Shrub	Leaves	Boiled	Plucking	All- season	AY-58
Bidens macroptera (Sch.Bip.ex Chiov.) Mesfin.		Balti	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-43
Bidens pilosa L.		Gingu	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-07
Basella alba L.	Basellaceae	Amut	Climber	Leaves	Boiled	Plucking	All- season	AY-50
Cardamine trichocarpa Hochst. ex A.Rich.	Brassicaceae	Kineteshojun	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-14
Capparis sepiaria L.	Capparaceae	Kodoch	Climber	Leaves	Boiled	Plucking	All- season	AY-65
Cleome gynandra L.	Capparidaceae	Tichawoch	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-29
Drymaria cordata Willd. ex Schult.	Caryophyllaceae	Sisente	Herb	Leaves	Boiled	Plucking	Winter& autumn	AY-35
Maytenus arbutifolia (A.Rich.) R.Wilczek	Celasteraceae	Kuknit	Shrub	Young leaves	Boiled	Plucking	All- season	AY-64
Garcinia buchananii Baker	Clusiaceae	Chodut	Tree	Fruit	Raw	Picking	Autumn	AY-61
Commelina benghalensis L.		Zobut	Herb	Leaves	Boiled	Plucking	All- season	AY-19
Commelina diffusa Burm.f	Commelinaceae	Zobut	Herb	Leaves	Boiled	Plucking	All- season	AY-20
Ipomoea tenuirostris Choisy.	Convolvulaceae	Ra	Climber	Young leaves	Boiled	Plucking	All- season	AY-22
Cucumis dipsaceus Ehrenb. ex Spach	Cucurbitaceae	Kakashut	Climber	Leaves	Boiled	Plucking	Winter& autumn	AY-18
Momordica foetida Schumach.		Bererit	Climber	Tuber	Boiled	Digging	All- season	AY-63
Peponium vogelii (Hook. f.) Engl.		Entach	Climber	Fruit pulp	Raw	Picking	Spring	AY-31
Dioscorea bulbifera L.	Dioscoreaceae	Lekut	Climber	Tuber	Boiled	Digging	All-season	AY-06
Dioscorea praehensilis Benth.		Entut	Climber	Tuber	Boiled	Digging	All- season	AY-01
Acalypha ornata Hochst. ex A.Rich.	Euphorbiaceae	Kirijaj	Herb	Leaf	Boiled	Plucking	All- season	AY-32
Dolichos sericeus E. Mey.	Fabaceae	Ra-modoroy	Climber	Leaf	Boiled	Plucking	All- season	AY-44
Vigna luteola (Jacq.) Benth		Gelach	Climber	Leaf	Boiled	Plucking	All- season	AY-57
Senna obtusifolia H.S. Irwin & Barneby		Godach	Shrub	Leaf	Boiled	Plucking	All- season	AY-39
				Seed	Hot drink	Picking		

Table 1. Continued

Senna petersiana (Bolle) Lock		Gudimoch	Shrub	Fruit pulp	Raw or juice	Picking	Autumn	AY-12
Tamarindus indica L.		Rach	Tree	Fruit pulp	Raw or juice	Picking	Autumn	AY-23
Vigna membranacea A. Rich		Shotademodoroy	Climber	Leaf	Boiled	Plucking	All- season	AY-16
				Seed	Boiled	Picking		
Vitex doniana Sweet	Lamiaceae	Gorogit	Tree	Fruit	Raw	Picking	Summer	AY-05
Ficus glumosa Del.	Moraceae	Barach	Tree	Fruit	Raw	Picking	Spring	AY-26
Ficus platyphylla Del.		Fadut	Tree	Fruit	Raw/dried	Picking	Autumn	AY-66
Ficus sur Forssk.		Boboch	Tree	Fruit	Raw	Picking	Autumn	AY-52
Morus mesozygia Stapf		Gonjut	Tree	Fruit	Raw	Picking	Autumn	AY-28
Trilepisium madagascariense DC.		Gagut	Tree	Fruit	Roasted	Ground picking	Autumn	AY-30
Embelia schimperi Vatke	Myrsinaceae	Kemjach	Shrub	Fruit	Raw	Picking	Autumn	AY-54
Eugenia bukobensis Engl.	Myrtaceae	Golasit	Tree	Fruit	Raw	Picking	Autumn	AY-41
Syzygium guineense (Willd.) DC.		Chorut	Tree	Fruit	Raw	Picking	Autumn	AY-56
Boerhavia erecta L.	Nyctaginaceae	Belach	Herb	Leaf	Boiled	Plucking	All- season	AY-53
Ximenia americana L.	Olacaceae	Aurasech	Shrub	Fruit	Raw	Picking	Autumn	AY-59
Basananthe hanningtoniana (Mast.) WJ de Wilde	Passifloraceae	Rebdegorun	Climber	Leaf	Boiled	Plucking	All- season	AY-60
Piper umbellatum L.	Piperaceae	Ogach	Shrub	Leaf	Hot drink	Plucking	All- season	AY-42
Sporobolus pyramidalis P. Beauv.	Poaceae	Keri	Grass	Seed	Baked	Stripping	Autumn	AY-40
Rumex abyssinicus Jacq.	Polygonaceae	Solosolo	Herb	Leaf	Boiled	Plucking	Winter & Autumn	AY-36
				Rhizome	Boiled	Digging		
Rumex nepalensis Spreng.		Girshut	Herb	Leaf	Boiled	Plucking	All-season	AY-48
Portulaca oleracea L.	Portulacaceae	Chinguru	Herb	Aerial part	Boiled	Plucking	All- season	AY-33
Portulaca quadrifida L.		Chinguru	Herb	Aerial part	Boiled	Plucking	All- season	AY-34
Rubus apetalus Poir.	Rosaceae	Gormach	Climber	Fruit	Raw	Picking	Spring	AY-02
Galium aparinoides Forssk.	Rubiaceae	Katikonoy	Herb	Leaf	Boiled	Plucking	Winter & Autumn	AY-45
Mussaenda arcuata Poir		Carafurchit	Shrub	Fruit	Raw	Picking	Winter & Autumn	AY-04
Physalis peruviana L.	Solanaceae	Chunchoch	Herb	Fruit	Raw	Picking	Spring	AY-25
Solanum nigrum L.		Chaw	Herb	Leaf	Boiled	Plucking	All- season	AY-24
Solanum dasyphyllum Schumach. & Thonn.		Turkit	Shrub	Leaf	Boiled	Plucking	All- season	AY-55
Celtis philippensis Blanco	Ulmaceae	Shoboch	Tree	Leaf	Boiled	Plucking	All- season	AY-10
Lantana trifolia L.	Verbenaceae	Liptowelly	Shrub	Fruit	Raw	Stripped	Summer	AY-46
Lippia adoensis Hochst. ex Walp.		Kushita	Shrub	Leaf	Boiled	Plucking	All- season	AY-47
Lippia grandiflora Mart. & Schauer		Metoch	Shrub	Leaves	Hot-drink (brewed)	Plucking	All- season	AY-08

Note: *Seasons are Winter (June to August), Spring (September to December), Summer (November to February) and Autumn (March to May).*

3.3. Edible Plant Parts, Preservation, and Preparation for Consumption

The results of the study showed that 71 plant parts from 66 WEPS are used for food by the Meinit socio-cultural community. Leaves were found to be the most widely consumed edible plant parts (42 species, 59%), followed by fruits (19 species, 27%) and the smallest edible plant part was recorded as aerial part (2 species, 3%) (Figure 2). Most of the edible plant parts were collected for immediate preparation and use. The assessment showed that about six edible plant parts were preserved through sun drying for later use. Leaves of *Bidens macroptera*, *Galinsoga quadriradiata* and *Cleome gynandra* were collected during the surplus season, chopped, and dried using direct sunlight for use during food scarcity periods. It was also found that although fresh tuber of *Sauromatum venosum* and fruits of *Ficus platyphylla* and *Senna petersiana* were collected and sun-dried for use during the off season before many years, it is seldom practiced by the current generation of the Meinit community.

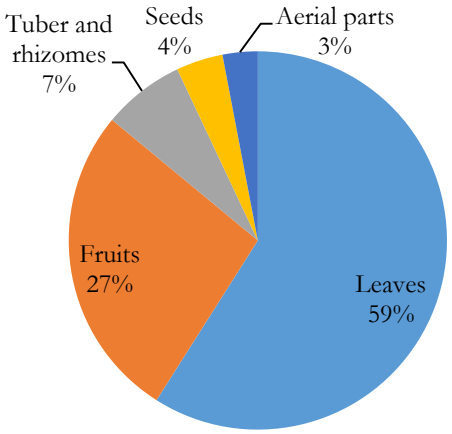

Figure 2. Edible parts of wild edible plants.

The Meinit community members prepare their food in different forms (Table 1). Porridge (*Porn*) and flattened bread (*Sabsa*) are popular staple foods that are prepared from maize, sorghum or amaranth grain. These staple foods are usually relished with a sauce made from leafy vegetables of domesticated and wild origins, including those that are stated. The highest number of wild edible plant parts were consumed after cooking by boiling (50 of them), followed by raw (25 of them), whilest the smallest consumption forms were recorded as fried (5 of them), followed by baking, making into hot drinks, roasting and as a beverage (Figure 3).

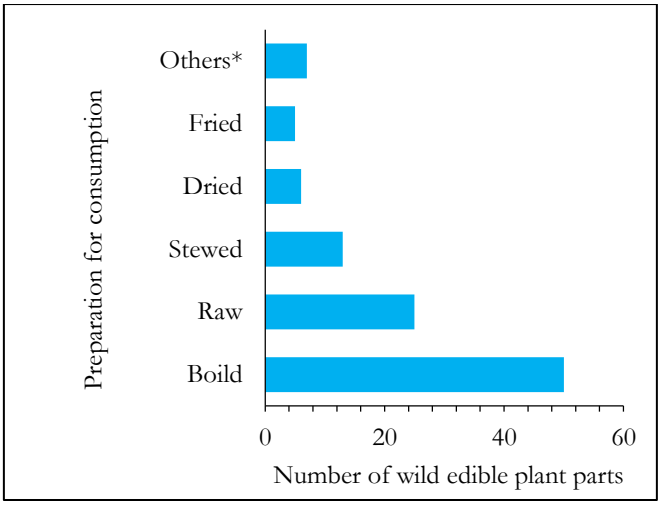

Figure 3. Wild edible plants consumption mode. ** Others denote for baked, hot drink, roasted, and beverage preparation methods of WEPS.

It was reported that about 19 fruits were eaten raw, and a few others were consumed as juice or as an ingredient in local beverages. Most of the wild green leafy vegetables, roots and tubers were boiled before consumption. Wild vegetables were also used as ingredients in the preparation of local recipes. These local recipes are usually prepared by mixing two or more locally available conventional or wild green leafy vegetables (*Brassica carinata*, *Amaranthus spinosus,* and *Galinsoga quadriradiata*). Five wild plant species were also documented for their culinary and spice uses. Rhizome of *Rumex abyssinicus* was used as a condiment to give a deep yellow colour to butter, which is used as an input in the preparation of stews. Leaves of *Aspilia mossambicensis, Lippia adoensis, Lippia grandiflora,* and *Piper umbellatum* were also used to add flavor to varieties of Meinit local recipes.

3.4. Traditional Meinit Recipes Prepared from Wild Edible Plants

***Borde (Sholu)*:** Borde is a traditionally fermented beverage made from maize, sorghum and some wild edible plants. The ingredients are prepared as follows: sorghum seeds are milled while maize grains are filled into porous sacks and submerged in a river overnight. The seeds are then drained and dried under direct sunlight, milled, and sieved to discard excess fiber. The wild edible plant parts viz. tuber of *Sauromatum venosum* (thoroughly washed, trimmed, chopped, and sundried), fruit pulp of *Senna petersiana* (dried) and the seed of *Sprobolus pyramidalis* is also milled separately. The slurry, which the Meinit community name as *Sholu,* is finally prepared by mixing the flours of the above ingredients using hot water and allowing it to ferment overnight.

***Chemo (Tika)*:** *Chemo* is a hot drink used by the Meinit cultural community. Ingredients of *Chemo* may vary from one locality to another and are accompanied by local staple food. *Chemo* is a decoction commonly prepared through boiling the dried juvenile coffee shoot powder, garlic, ginger, hot chilli, holy basil, salt, and filtration. Recently, dried *Aspilia mossambicensis*, *Lippia adoensis*, *L. grandiflora,* and *Piper umbellatum* leaves have been pulverized and used in the absence of coffee shoots. Leaves of *Aspilia mossambicensis, Lippia adoensis,* and *L. grandiflora* are also used to add flavour to varieties of Meinit local recipes, such as *Chemo*.

***Kolfu* (Sauce)**: *Kolfu* is consumed as a side dish to porridge and flattened bread. The dish is prepared separately or as assorted from conventional or wild edible vegetables. The available vegetable is trimmed, chopped, and boiled in water. The boiled vegetable is mixed and cooked with the addition of cooking oil.

***Poru* (Porridge**): *Poru* is a staple food of the Meinit community, which is commonly prepared from milled and sieved maize powder. The refined powder is slightly heated on a flat clay pan and cooled. Alternatively, to maintain the final colour and aroma of porridge, maize grain is slightly roasted on clay or iron pan, and the grain is milled. Finally, a required amount of water is heated in a clay jar, following the maize flour is added to warm water and subsequently heated for a few minutes with constant stirring. At times of food shortage, wild *Sporobolus pyramidal* seed flour is used instead of maize flour to prepare *Poru* following the same preparation method.

***Sabsa* (Flattened bread):** *Sabsa* is usually prepared from maize or sorghum grain. Maize grain is sometimes soaked in cold water for a few minutes to easily remove the seed coat after milling. The grain is drained and immediately milled manually or using a grain miller, and the flour is sieved to separate from unrefined particles. Boiled water is later added to the refined flour contained in the clay dish, kneaded and allowed to stay overnight. The slurry is further manually pounded with a traditional stone mill to prepare more fined slurry particles and left for two to three more hours. Pieces of slurry are prepared and wrapped with *Ensete ventricosum* (Welw.) or banana (*Musa X Paradisiaca* L.) leaves and put on flattened hot clay stove to baked flattened bread. During a shortage of maize and sorghum powder, wild *Sporobolus pyramidalis* seed powder is used to prepare to flattened bread following similar procedures.

***Shanta* (Fruit juice):** *Shanta* is prepared from *Senna petersiana* and *Tamarindus indica* fruits. *Senna petersiana* fruit juice is prepared through the cold infusion extraction method. This method involves trimming, removing the fibrinous parts from the edges of the fruit pod and then cutting it into pieces. Chopped fruit pod parts were macerated in water overnight in a clay pot to extract the juice. The extracted juice is relished after separating from the residue with a muslin cloth. A similar procedure is followed to prepare *T. indica* juice, except that its pod cover is completely peeled instead of merely removing the fiberous part, as in the case of *S. petersiana* fruit.

***Shotil* (Stew**): Stew is the other staple food mainly prepared by cooking whole maize grain with legumes composite, sometimes vegetables, roots and tubers also added in the stew mixture. Wild edible plants such as *Galinsoga quadriradiata* Ruiz & Pavon, *Amaranthus dubius* Mart. ex Thell and *Drymaria cordata* Willd. ex Schult. wild vegetables and *Trilepisium*

madagascariense fruit were boiled with maize grain to prepare the stew.

3.5. Plant Habitat

Each recorded wild edible plant was collected from more than one habitat (Figure 4). The highest number of species occurred in cultivated land (33), followed by bushy grassland (18), whilst the smallest number of species was found in forest margins (1 species) as depicted in Figure 4.

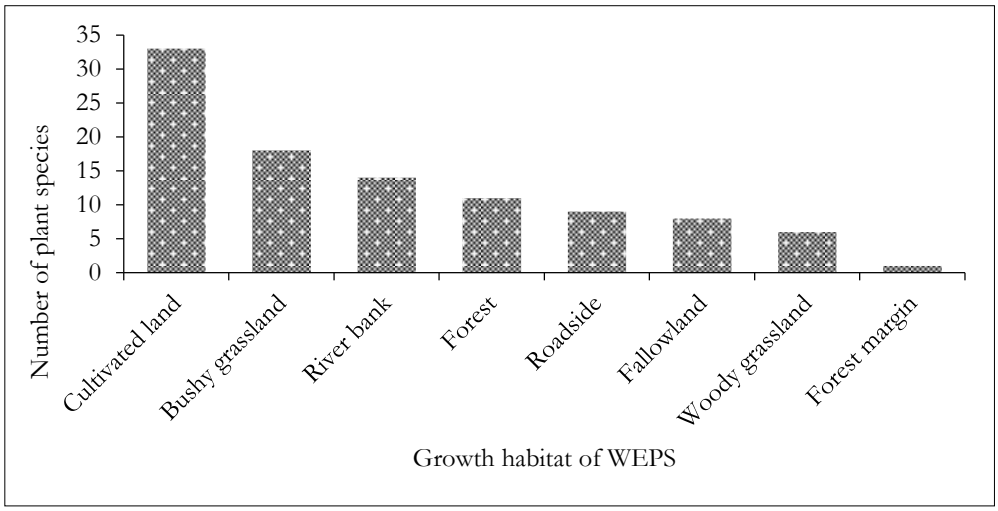

Figure 4. Wild edible plants habitat.

3.6. Medicinal Use of Wild Edible Plants

Among the 66 wild plant species identified and recorded for their edible parts, 12 species were recorded to have medicinal values. Sixteen plant parts from these 12 species were found to be used for their therapeutic effect. Of these, six plant parts were reported to be used both for food and medicine, and the other 10 plants have only medicinal uses (Table 2). These plants served to treat several human ailments, such as wounds, stomachaches, intestinal parasites, respiratory problems, and headaches. Mode of preparation for use included boiling, decoction, drying, and juicing, and oral administrations and topical applications were reported as the major routes of administration.

Table 2. Medicinal uses of wild edible plant species.

S/N	Plant species	Parts used	Ailments treated	Mode of preparation	Route of administration
1	*Trilepisium madagascariense* DC	Stem sap	Wound and itching skin	Direct use	Topical
2	*Solanum nigrum* L.	Leaf*	Gastritis, constipation, diabetics, and hypertension	Boiling	Oral
3	*Ximenia americana* L.	Fruit*	Inflammation	Decoction	Oral
		Root	Cough and chest ache	Dried, pulverized, and mixed with water or chemo	Oral
4	*Celosia trigyna* L.	Leaf*	Ascariasis	Boiling	Oral
5	*Embelia schimperi* Vatke	Fruit*	Dysentery	Direct use	Oral
6	*Tamarindus indica* L.	Fruit*, leaf	Malaria	Juicing (fruit) and Direct use	Oral
7	*Rumex nepalensis* Spreng.	Rhizome	Ameobiasis	Direct use	Oral
8	*Carissa spinarum* L.	Root	Snakebite, wound and boils	Direct use	Oral
9	*Vernonia auriculifera* Hiern	Bark, stem, root	Toothache	Direct use	Local (Diseased tooth)
10	*Cleome gynandra* L.	Flower	Tonsillitis	Direct use	Oral
11	*Ficus platyphylla* Del.	Sap	Itching skin	Direct use	Topical
12	*Mussaenda arcuata* Poir	Fruit*	Ascariasis	Boiling	Oral

Note: * *referes to plant parts used for food and medicine.*

3.7. Market Value of Wild Edible Plants

The market survey and response of key informants revealed that the marketability of wild edible plants had declined over the years. The decline in market value was due to changes in local dietary habits, less choice of the younger generation to use WEPs, dietary shifts, and a decline in the availability of the plants. The study participants revealed that the root of *Dioscorea praehensilis*, leaves of *Bidens macroptera* and *Drymaria cordata* were reported to be sold in local markets before a few decades. Currently, only the leaves of *Solanum nigrum* are being sold for food in local markets.

3.8. Threats and Management Practices of Wild Edible Plants

The study participants indicated that the abundance of WEPS has declined from time to time mainly due to anthropogenic factors. Expansion of cultivated land where wild edible plant naturally grows, use of the wild edible plants for house construction and introduction of modern food (industrially processed food products) were the major contributors to the dwindling species richness, dietary change, and abundance of WEPs (Table 3). Of these, agricultural expansion and the use of wild edible plants for house construction appear to be major potential threats. It was, however, observed that a few older individuals from the Meinit community have started tolerating and/or cultivating some wild edible plants such as *Cleome gynandra*, *Dioscorea praehensilis, Solanum nigrum,* and *Tamarindus indica* in their agricultural fields and homesteads.

Table 3. Priority ranking of threatening factors on wild edible plants by eight key informants (1 = least threat, 2 = less, 3 = medium, 4 = more, and 5 = most threat).

Threats	Key informants (KI)									
	KI_{-1}	KI_{-2}	KI_{-3}	KI_{-4}	KI_{-5}	KI_{-6}	KI_{-7}	KI_{-8}	Score	Rank
Agricultural land expansion	4	3	2	3	4	2	3	4	25	1
Modern food	3	2	2	1	2	3	2	3	18	3
House construction	2	1	2	3	3	4	2	3	20	2
Charcoal making	2	1	1	2	2	1	3	1	13	5
Climate change	1	2	3	1	3	2	2	2	16	4

4. Discussion

4.1. Diversity of WEPs, Edible Parts and Their Mode of Preparation

In the present study, 66 wild plant species were identified and recorded to be used for food by the Meinit socio-cultural community living in three study districts of Southwestern Ethiopia. Abbink (1993) reported the use of about 21 wild plant species in Southwest Ethiopia, in which seven were similarly reported to be used for food during the present investigation. Most of these WEPS were also reported to be used for food by other communities in different parts of Ethiopia, including Derashe and Kucha (Kebu Balemie and Fassil Kebebew, 2006), Kara and Kwego (Tilahun Teklehaymanot and Miruse Giday, 2010) and Konso communities (Getachew Addis *et al*., 2013) of Southern Ethiopia. This could be attributed to differences in study locality, collection season, indigenous knowledge, and practices of the study communities. Some of the 66 WEPS used by the Meinit community were also documented to have similar use in other African countries. To mention a few, nine of the WEPS were documented to be used for food in Uganda (Ojelel *et al*., 2019) and 16 WEPS by the Kitui community in Kenya (Mutie *et al*., 2020). It may be attributed to the popularity of the respective WEPS for food and their wider distribution across the different African countries. Edible parts of fruits, leaves, roots and tubers, and seeds were documented in the Meinit cultural community. Leaves (65%) were the highest recorded edible plant parts, followed by fruits (28%).

The results of the study revealed that fruits of WEPS are mostly consumed fresh as a snack or prepared for consumption as juice. In the contrary, wild green leafy vegetabls (GLVs), roots and tubers passed through different traditional processing and preservation methods before use. Some of the recorded traditional processing methods include boiling, frying and sun drying. These findings are in agreement with research findings from other parts of Ethiopia (Leul Kidane and Alemu Kejela, 2021) that indicate most fruits are eaten fresh or raw and most leafy vegetables are consumed after boiling or cooking. Similar reports were also reported from Uganda (Nyakoojo and Tugume, 2020), in which wild fruits were often eaten as snacks, whereas leafy vegetables were cooked to make soup.

Some fresh wild leafy vegetables, fruits and a tuber were reported to be collected and dried under direct sunlight to be used at times of their scarcity. It was, however, reported that the trend in sun drying the edible parts for preservation has been declining over the past many years. Other reports elsewhere (Flyman and Afolayan, 2006) also described that some wild leafy vegetables were subsequently blanched and sundried for preservation. Similarly, solar drying was used for the preservation of WEPS elsewhere in other areas (Ojelel and Kakudidi, 2015). The declining trend in sun drying of GLVs, fruits and roots by the Meinit community, whether for relatively immediate use or preservation, must be encouraged.

In was also documented that some herbs and shrubs of wild origin were also used as spices and condiments for food colorants, providing aroma and taste to different traditional recipes. The use of wild plants that contain volatile oils such as *Lippia adonesis* (leaves) and pigments such as *Rumex abyssinicus* (rhizome) as spices and condiments is a common practice in Ethiopia (Getachew Addis *et al*., 2005; Yemisrach Fikadu *et al*., 2022). Preparation and use of traditional fermented beverage (*borde*); non-fermented hot (*chemo*) and cold (*shanta*) drinks; porridge (*poru*); and flattened bread (*sabsa*) from WEPS by the Meinit community are also documented in the present study. The preparation of different traditional fermented and non-fermented beverages by different socio-cultural communities in Ethiopia is also well documented (Getachew Addis *et al*., 2013; Niguse Hotessa and Jedala Robe, 2020).

4.2. Collection Season and Harvesting Method of Edible Plant Parts

About 36% (24) of wild edible leaves and 8% (4) of starchy wild edible roots and tubers were collected and available throughout the year. About 27% (18) of the recorded leafy vegetables existed and were gathered during the rainy season (winter or autumn). Comparable results were reported by (Mekuanent Tebkew *et al*., 2018), who found that wild edible vegetables were gathered following the winter and spring rainy seasons. The majority of fruits, 21% (14), were collected from late March to early June. About 5% (3) wild fruits were also collected during the spring season, and 3% (2) were also gathered during the summer season during dry period. The present study was supported by other reports elsewhere in Ethiopia (Leul Kidane and Alemu Kejela, 2021) that indicate fruits collected during the dry season and beginning of the rainy season when there is a shortage of food crops. Phenology of each plant species is a natural phenomenon that cannot be altered, at least to date, but the fact that most edible fruits from the wild were collected from perennial and drought-resistant trees and shrubs could be the reason for the wider use of fruits during the dry season. Root and tubers were also mainly collected during the dry season, between late December and early June. Preference for the collection and consumption of roots and tubers from the wild during the dry season was also reported in a previous study finding (Billong *et al*., 2020). This could be attributed to the better taste and palatability of roots and tubers during the dry season.

4.3. Growth Forms and Habitats of Wild Edible Plants

The results of the study showed that WEPS exhibited different growth forms, such as trees, shrubs, herbs, and climbers. The present study revealed that herbs (42%) were the highest growth forms, followed by shrubs (21%) and climbers (20%). The higher use of herbs used for food by the Meinit community may have been due to their easy availability, accessibility, and higher abundance as compared to trees and shrubs in the existing degraded environment. Moreover, herbs are more widely used for medicine than shrubs, trees, and climbers by the Meinit community (Mirutse Giday *et al*., 2009), and hence, the community could associate the use of herbs for food may also improve health.

This result agrees with other findings reported for northwestern Ethiopia (Derebe Alemneh, 2020) who reported that herbs are more more widely used for food than trees and shrubs. In contrast, other findings from Southern Ethiopia (Tilahun Teklehaymanot and Miruse Giday, 2010; Leul Kidane and Alemu Kejela, 2021) indicated that edible parts from trees and shrubs than herbs were widely used for food. These variations might arise from agro-ecological differences; anthropogenic disturbance in the environment, which directly affects variation in plant species richness, abundance and existing plant growth forms in the areas; and cultural differences among the communities studied. The majority of WEPS were collected from cultivated land (22%) and woody grassland (18%). Different reports are available on major habitats of WEPS in different areas and agro-ecologies of Ethiopia (Tinsae Bahru *et al*., 2014). These variations may also be associated with differences in plant diversity among study areas included in the reports, a cultural differences of the communities under investigation and proximity of the wild edible plant parts for collection.

4.3. Market Value of Wild Edible Plants

According to the key informants, market demand for WEPS has been declining over the years. This must have reduced the income that women and children in rural households would have mostly generated. Currently, only the leaves of *Solanum nigrum* are being sold for food in markets of Guraferda, Meinit Goldiye and Meinit Shasha districts where the Meinit dwell. Marketing of WEPS has been reported by different authors in other countries like Botswana (Badimo *et al*., 2015) and Konso of Ethiopia (Getachew Addis *et al*., 2013) and creates job opportunities and income generation for rural households. It is, therefore, imperative to improve the yield and quality of selected WEPS through the support of farmers on innovative agricultural practices. These can be achived by the production and supply of higher quality seeds or other planting materials; use of manure; integrated pest management practices; preparation and distribution of user-friendly social and behaviour change communication (SBCC) materials for production, harvesting, processing, transporting and marketing of WEPS; face-to-face discussions with stakeholders, especially women; and using different media outlets, and establishing appropriate value chain, and supporting with seed money for those who come to the front line for promotion. This will not only create job opportunity and improve the household income of the poor rural community but also improves food and nutritional security in Meinit. The positive practices can also be embraced by other rural and even urban communities in other parts of Ethiopia and beyond.

4.4. Threats and Conservation of the Wild Edible Plants

Interview and ranking results on factors responsible for the demise of WEPS indicated that agricultural expansion, followed by the use of plants for house construction is the potential threats facing WEPS in the study districts. This is in agreement with previous reports in Asia (Pawera *et al*., 2020) that indicate man-made and ecological environments were the main drivers of change for the availability and use of WEPS. Reports from different parts of Ethiopia also revealed that WEPS face disappearance in their growing environment from diverse anthropogenic activities (Kebu Balemie and Fassil Kebebew, 2006; Tariku Berihun and Eyayu Molla, 2017). According to Mirutse Giday *et al.* (2009), in particular, it is indicated that expansion of land for agriculture through deforestation, an increasing trend in the use of herbicides, and selective cutting practices for house construction and firewood are the main threats facing the wild flora, which include WEPS, in areas where Meinit community inhabit. The investigators observed that a few older Meinit community members tolerate and/or cultivate selected WEPS around their homes and in agricultural fields. This agrees with a previous study finding from Central Ethiopia (Yigremachew Seyoum *et al*., 2015), which indicated over half of the informants have grown wild plants for their edible fruits. A report from DR Congo (Termote *et al*., 2010) also revealed the gathering of *Dioscorea sp.* tuber for food from the forest by some individuals while others grow the same for use.

5. Conclusion and Recommendation

The study has revealed that 66 wild edible plant species, which belong to 34 families and 50 genera are used for food. Among these total edible plant species documented, 12 species were recorded for being used for their nutraceutical value by the Meinit community living in the study area. The results of the study have demonstrated that the local tradition of using the wild edible plants is still alive. The community's livelihood depends strongly on a wild edible resources that are used to complement the cultivated crop during food shortages and to generate income for rural subsistence farmers. Leaves are the most important edible parts among the total of 71 edible plant parts from 66 wild plant species. These wild edible green mainly contribute to traditional culinary use, household health care, and income generation. For example, *Solanum nigrum* leaves are sold in the local market to generate income, as a food vegetables to diversify local dishes as well as medicinal value for treating gastritis and constipation that is perceived by local consumers. These WEPS generally play significant roles in the food and nutrition security of the households of rural people. The present study will also give a beneficial role in community based local wild edible production and mainly preserve cultural heritage through use of WEPS and plant diversity in the study area. However, the traditional knowledge of use, and diversity of wild edible plants has been changed due to anthropogenic factors. Human activities in rural areas of Meinit are negatively affecting the diversity of WEPS and the conveyance of the associated knowledge to the next generation. Luckily, elders from the Meinit community have the knowledge and exemplary practice in the conservation and use of edible wild plants through the cultivation of selected WEPS in backyards. Therefore, the youth of the community must be sensitized on multiple benefits of cultivating and using WEPS and learn from their elders to acquire the knowledge and practice. Biodiversity research and conservation

institutions must also include germplasms of these orphan crops in their collections and *ex situ* conservation practices for the gradual introduction of selected WEPS into the agricultural and food systems and immediate use as insurance at times of failure of domesticated crops. Investigation on nutritional and ant-nutritional compositions, phytochemicals of biomedical importance, safety for consumption, and agronomic practices required for better yield and quality production of priority wild edible plants is warranted.

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