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ETHINO BOTANICAL STUDY OF WILD EDIBLE PLANTS IN KEDIDA GAMELLA WOREDA, KAMBATTA TEMBARO ZONE, SNNPRS, ETHIOPIA

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ABSTRACT

The Ethno botanical study of wild edible plants (WEPs) was conducted in Kedida Gamella Woreda of Kambata Tembaro Zone, Southern Ethiopia. The aim of this study was to identify and document the indigenous knowledge of the people on wild edible plants of the study area. Ethnobotanical information was gathered from 120 informants (76 males and 44 female) through semi structured interviews and Focus Group Discussion. Direct matrix ranking (DMR), pair wise ranking (PWR) and correlation were employed to analyze the data. The study documented 41 wild edible plant species belong to 27 genera and 35 families were recorded, of which 82% have more than one use categories. Out of the reported wild edibles 9 species (20%) were most commonly used during seasonal food shortage. Moreover, 31.1% have socioeconomic values and 51.1% have medicinal use. The study also showed that the majority (56%) of the species were collected from the forest. The results of direct matrix ranking also showed that *Cordia africana Lam.* and *Prunus africana (Hook.f) kalkam* were ranked 1st and 2nd interims of its multipurpose use value. Pearson correlation result revealed that there was a weak positive relationship(r=0.28) between age of informants and the number of wild edible plants reported by the informants, and there was negative relationship (r=-0.37) between educational level of informant and their knowledge of wild edible plants, which shows the decline/ decrease in the knowledge of WEPs in the contemporary generation, and will probably vanish in a few decades. Regarding threats of Wild edible plants indicates agricultural land expansion ranks first, followed by overgrazing, fuel wood collection, and uncontrolled fire respectively. With respect conservation action overtaken by local people, the elderly persons of the community set rules and regulations to avoid the exploitation of wild edible plants so that species abundance is great. Thus, finding of this study showed that the local community aware the management action to be undertaken to overcome the threats. Therefore, considering the nature and causes their threats integrated management approach that involve indigenous knowledge and community participation are suggested for the conservation and sustainable use of the wild edible plants in study area.

KEYWORDS: Direct matrix ranking, Kedida Gamella, Pearson correlation, wild edible plants.

1. INTRODUCTION

1.1. Background of the Study

Millions of people in many developing countries do not have enough food to meet their daily requirements and a furthermore people are deficient in one or more micronutrients (FAO. 2004). Thus, in most cases rural communities depend on wild resources including wild edible plants to meet their food needs in periods of food crisis. The diversity in wild species offers variety in family diet and contributes to household food security. Wild edible plants have constituted an important element in human nutrition as a component of daily meals or during periods of famine and starvation in different cultures throughout various periods of history (Kebu Balemie and Fassil Kebebew, 2006).

Most of these useful plants are found in the wild where they are threatened by changes and degradation in natural ecosystems, specific habitats, and vegetation types. These phenomena are more noticeable in countries like Ethiopia where there is high human population pressure and insufficient documentation and conservation of the local biodiversity. In Ethiopia, about 85% of total human populations rely on agriculture EPA (2012). Even though agriculture is the main source of food and income for many rural populations, it is not able to meet the annual food requirements. Thus, the use of wild plants from communal forests has been 'a way of life' to supplement dietary requirements in rural Ethiopia (Zemede Asfaw and Mesfin Tadesse, 2001).

However, developmental interventions, rural exodus, and the reduction of the verbal exchange of knowledge, are causing to the rapid loss of indigenous knowledge about the use of wild plants (Getachew Olana, 2001).

As a consequence, there is a lack of information about the diversity of species actually used locally. Furthermore, the management plans fail to regulate the use of this important resource. Such ignorance results in over-exploitation of commercially demanded species, random harvesting, a lack of equitable sharing of benefits from the use of resources from a community-managed forest and deprives the poorest groups in the community of the resource (Guinand, Y. and Dechassa Lemessa, 2000). Until today, most of Ethnobotanical studies in Ethiopia have concentrating on wild medicinal plants. Comparatively few works have been done on the systematic documentation of indigenous knowledge about the identity and use of wild foods (Guinand, Y. and Dechassa Lemessa, 2000).

The circumstances of Kedida Gamella Woreda are not far from this truth, which demands the documentation of useful wild edible plant species where there is high human and livestock population pressure on the limited resources of the area. Thus, the current study attempts to document indigenous knowledge of the local people on in use of wild edible plants, their distribution, and the associated management practice in the area. As a result, collecting and documenting indigenous knowledge on wild food plant before it is lost forever is a fundamental urgent task. Hence, documenting and conserving IK of the wild food plants of kedida Gamella Woreda would be Crucial and a timely endeavour. For this reason, this study is initiated to gather record and document indigenous knowledge of local communities on wild edible plants in kedida Gamella Woreda, to compile a checklist of ethno botanically most important plants for wild edible purpose and find how the local people try to conserve these habitats and the plant species of the area. Therefore, this research aimed at identifying and documenting ethno- botanical knowledge on wild edible plant species, in Kambata Tambaro Zone, Kedida Gamela Woreda. Moreover, this research intended at spotting out the challenges to the sustainability of WEPs which help to forward the management measures for the maintenance of important WEPs in the study area.

2. MATERIALS AND METHODS

2.1. Description of Study Area

2.1.1 Geographic Location, Climate and Demographic Characteristics

Kambata Tembaro (KT) Zone is one of the thirteen zones of SNNPR and it is located at 126 km from the Regional Capital, Hawassa, and 365 km from Addis Ababa. Kedida Gamela is one of the seven Woredas in Kambata Tembaro Zone, SNNPR of Ethiopia. The Woreda is bordered in the south by Badawacho Woreda/ an exclave of the Hadiya Zone, in the south west by Kacha Bira, in the west by Angacha, in the north by Damboya Woreda, and in the east by Bilate river which separates it from Alibi special Woreda. The Woreda is located astronomically at the latitude of $7^0$11'N, $7^0$25'N and 37^0 50' 30" E, 38° 4' 30''E Longitude (KGWAD 2012).

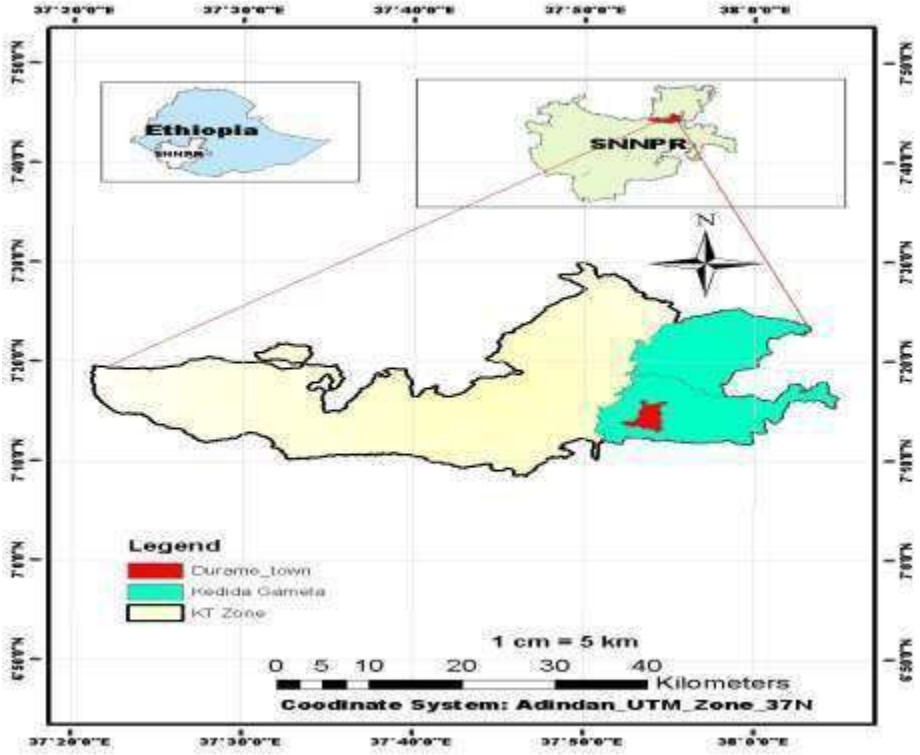

Figure 1: The Map of the study area.

The altitude of the Woreda ranges from 1700 to 3028 meters above sea level. The topography of the Woreda comprises mountainous or high land and plains. About 28 percent of the area is plain, 35 percent mountainous or high land and 37 percent is ragged. Its area is usually divided into agro ecological zones, Dega, Woynadega and Kola (KGWADA, 2012).

The main rainy season is locally called `*Ojaa*` that extends from July to September/October with the highest peak in August. The other minor rainy season locally called '*Gilaallo*' that extends from March to the beginning of June (Fig. 2). The highest average monthly rainfall was recorded in August (158.9 mm) and the lowest in December (24.10 mm) at Durame station. February to June is the hottest months of the year. The maximum mean temperature was recorded in June (26.8°C). In general, the mean annual temperature and mean annual rainfall of the Woreda was 19.3°C and 1144mm, respectively (Fig.2).

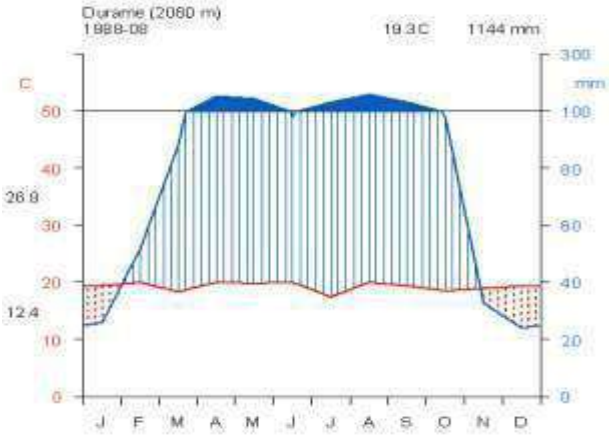

Figure 2: Clima diagram of the study area Durame station, (Data from National Meteorological Service Agency, 2011 taken from 1988-2008) (drawn using R program).

2.1.2 Selection of Study Sites and Informants

A reconnaissance survey of the study was conducted in January 2013 to see the general overview of the Woreda`s vegetation and to select representative Kebeles/Peasant associations. The researcher carried out discussions with the respective responsible Kedida Gamela Woreda agricultural office about plant population diversity (i.e. densely populated *kebeles*) before selecting the study *kebeles*. Accordingly, 6 *kebeles* were selected (Fullasa, Taza- Agara, Taza Garba, Jore, Addilo, Aze-doboo,) based on plant population diversity and the agro-climatic zones of woreda.

Moreover, to get representative sample and reliable information and to draw important conclusion about the study, employing sound methodologies principle is a pre-requisite. Thus, the researcher used non-probability (purposive) sampling methods as techniques of sampling. A total of one hundred twenty individuals (76 male's and 44 females) the ages of twenty and above were selected from six *kebeles*. These age groups were included, because of some WEPs are rare, some of them are common and frequent in the study areas and these rare species cannot be easily identified by below the above age levels. Hence, the researcher included these age groups in the study. These informants/respondents were chosen based on knowledge of wild food plants with the help of agricultural experts and development agents (DA), local authorities and elders in the study sites. Out of 120, 48 key informants (28 males and 20 females) were selected purposively for the group discussions as recommended by Martin, G.J. 1995. from the sampled respondents. The selection of these key informants was based on the recommendation of kebele Agricultural Development Agents (DAs), who work closely with peasants and know more about the cultural uses of plants, and other aspects of rural life.

2.1. 3 Data Collection

The primary data was collected through semi structured interview, group discussion and field observation. Secondary source of data was obtained from the agricultural office of the district, from different books, journal and research article.

2.1.4. Data Analysis

2.1.5. Descriptive Statistics

A descriptive statistical method such as percentage and frequency were employed to analyze and summarize the data on wild edible plants. Descriptive statics were summarized into botanical families; habitat, use categories and parts used (Cotton, C. M., 1996; Guinand, Y. and Dechassa Lemessa, 2000). The mean numbers of wild edible plant species at site level as well as per informant were determined.

2.1.6. Direct Matrix Ranking

Direct matrix ranking exercise was done by following Martin, G.J. (1995), in order to compare multipurpose wild edible plants commonly reported by informants and to relate this to the extent of its utilization versus its dominance. Based on the relative benefits obtained from each plant, informants were asked to assign values 1 up to 5 (5 = best 4 = very good, 3 = good, 2= less,1= least used, 0 = no use) to each attribute of the species compared and the resulting scores were summed and used to compare use values of the plants. This was done for the most important multipurpose plants that come up with three or more use values from the use reports of the informants.

2.1.7 Pair -Wise Ranking

To understand the local people perception on activities threatening wild edible plants, pair wise ranking was conducted, and the number of possible pairs was calculated using the relation:

Y= N (N-1)/2 (Ertug, F. 2004).

Where 'Y', is the sum all factors rated by respondents in each site, 'N' is the number of factors (activities).

Accordingly, most seven threatening factors were identified. Then the score from each respondent summed up, the ranks determined and the factors that received the highest total score ranked first.

Finally, the Spearman correlation test between the knowledge on wild edible plants and the age as well as the knowledge on wild edible plants and the educational status of the informants, respectively were analyzed using Origin Pro version 8.6, software package.

3. RESULTS AND DISCUSSION

3.1.1 Characteristics of the Respondents

In this study, a total of 120 respondents (76 males and 44 females) were involved. Regarding the age of respondents, it was categorized in to four groups. A little above half of the respondents (51.6%) had age between 31-45 years old, 29.2% of them had age between 46-55 years old, 15 % of them had age between 15-30 years old and insignificant number of the respondents (4.1%) had age greater than 55 years old. Concerning to the educational level of the respondents, 31.7 % were illiterate who can't read and write, 58.3% attended the primary school education, 6.7 % attended secondary school and 6.7% attended preparatory school. The result shows that the majority of the respondents (68.3%) were educated /able to read and write.

3.1.2. Wild Edible Plant Species in the study areas

A total of 41 wild edible plants species grouped within 35 genera and 27 families were identified and recorded in the study area. Families Rosaceae, Solanaceae, and Brassicaceae had the highest number of species (4, 4 and 2, respectively). But 21 families were represented only by a single species (Table 1).

Table 1: Botanical Families of the wild edible plant species of the study areas.

Family	Number of genera	Number of WEP species	Percentage of species
Amarantaceae	2	2	2.6
Anacadiacea	1	1	2.6
Apocynaceae	1	1	5.1
Asteraceae	1	2	2.6
Brassicaceae	2	3	5.1
Boraginaceae	1	1	2.6
Capparidaceae	1	1	2.6
Celastraceae	1	1	2.6
Euphorbiaceae	1	1	2.6
Fabaceae	1	2	2.6
Flacourtiaceae	1	1	2.6
Icinacaceae	1	1	2.6
Lamiaceae	1	1	2.6
Meliaceae	1	2	2.6
Moraceae	1	2	5.1
Moringaceae	1	1	2.6
Myrsinaceae	2	2	5.1
Myrtaceae	2	2	5.1
Passifloraceae	1	1	5.1
Poaceae	1	1	2.6
Polygonaceae	1	1	2.6
Resedaceae	1	1	2.6
Rosaceae	3	4	10.3
Solanaceae	2	2	10.3
Rutaceae	1	1	2.6
Tiliaceae	1	1	2.6
Urticaceae	1	1	2.6
Onagraceae	1	1	2.6
Total	**35**	**41**	**100**

In terms of species diversity from a total of 41 wild edible plant species recorded in the study area. 6 species were documented by Bayafers Tamene (2000) in semi-wetland of Cheffa area, South Wollo, 25 species by Getachew Addis, Kelbesa Urga and Dawit Dikasso (2005) in Alamata, Yilmana Densa, Cheha and Goma districts in Northwestern part of Amhara National Regional State, 20 species by Zemede Asfaw, and Mesfin Tadesse (2001) in Ethiopia and 7 species by Tilahun Teklehaymanot and Mirutse Giday (1996) in Southern Ethiopia, 5 species by Tesfaye Awas, Sebsebe Demissew and Tamirat Bekele (1997) in Gambela National Region State and Melesse Maryo (2013) in Kembata Tambaro, Southern Ethiopia.

According to the informants, the local people depend on wild edible plant species as alternative food when there is the shortage of stored food. This makes differences in the diversity of wild edible plant in the area. The difference in species diversity in various areas and cultures could be due to differences in agro ecological zones, which in turn depend on the soil, temperature, and rainfall. Beside this the practice of agro forestry in the area and conservation of tree species in the farm land may contribute to the diversity of WEPs.

The analysis of use diversity showed that the recorded edibles species provide 8 different uses to local communities. About 78% of the species are used for more than one use categories. Although some species have multiple uses, the average number of uses per species is three. The uses were placed under four major use categories, which had highest (79%) contribution of the total uses. These include food, medicinal, fuel wood, and construction. But the minor uses were categorized as miscellaneous since their contribution to the total uses is very small compared to others.

3.1.3 Distribution and Current Situations of Wild Edible Plants

The wild edible plant species in the study area are distributed in the forest around farmland as weeds and Live fence tree and roadsides vegetation's. Accordingly, out of the 41 WEPs about 23 (56%) of the species were found to occur in the forest, farm and open land, 11 (26.8%) were from inset, and cereal crop cultivation land, 4(9.8%) Fence and road sides However, the rest of the species were recorded from the grass land, wood land, Field of the study area. Many respondents informed that those edible plants are gathered from their natural habitat and prepared for food at different times. They support the food shortage of the family throughout the year. This shows that the wild plants are adapted and distributed in the different habitats of the study area. Wild edible plants especially herbs are also spread mainly around home gardens, cultivated lands, waste lands and along the farmland borders. Such occupation of varied niches could help them to adapt harsh condition of the environment and provide a better advantage for the conservation of these species while it could enhance the overall productivity and stability in the environment (Getachew Addis, Kelbesa Urga and Dawit Dikasso, 2005), (Tigist Wondimu, Zemede Asfaw and Ensermu Kelbessa 2006).

Table 2: Distribution and Current Situations of Wild Edible Plants.

Distribution	WEPs Number	Percentage (%)
Forest	18	44
Open land	5	12
Fence	2	5
Road side	2	5
Grass land,	2	5
Wood land	1	2
Enset plantation/field	8	20
Crop field	3	7
Total	41	100

3.1.4. Habits, Parts Used and Time of Gathering

3.1.5. Habit

A large number of the wild edible plant species were trees followed by herb, shrub, and climbers. Of the total recorded plant species, 41.5% were trees, 17.5% were shrubs, 36.2% were herbs and 4.8% were climbers. This reveals that tree and herbs make up the highest proportion (75.7%) of the wild edible species. This result also concurs with the works of Zemede Asfaw, and Mesfin Tadesse (2001), Tilahun Teklehaymanot and Mirutse Giday (1996) and Fentahun Mengistu (2008). Species occurring as trees could be advantageous in view of getting hold of diverse utilization in relation to agro forestry system (Fentahun Mengistu, 2008).

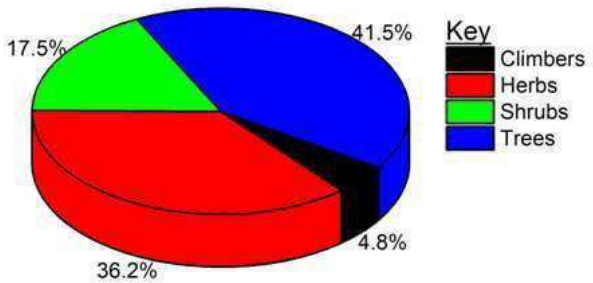

Figure 3: Habit of WEPs in the study area.

From the collected plant species, the most commonly utilized fruit tree species of WEP were *Syzgium guineense, Ficus palmata,* and *Carsia edulis*. Herbs like *Brassica nigra, Amaranthus graecizens L, Amaranthus caudatus, Brassica integrofolia, Solanium nigrum, Solanum macrocarpon, Urtica simensis* and Shrubs like *Maytenus gracilipes* and *Rubus steudner* are dominantly available in the study area.

3.1.6 Part Used

This study also showed that the majority of the wild edible plant parts used as food source for the local communities belong to fruits (56.5%), followed by leaves (16.6%), stem and leaf (7.3%), Stem (9.7%), Root (4.9%), Nectar/flower (2.4%), Leave and seed (2.4%) and all part (2.4%). Thus, fruits stand the major parts of wild edible plants in the study area (Fig. 4).

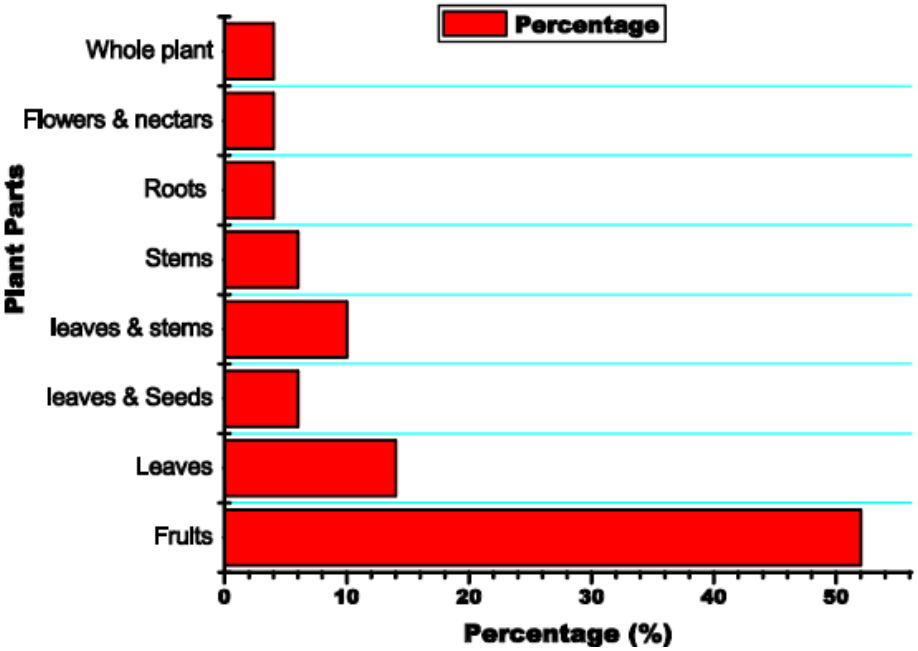

Figure 4: Number of wild edible plant parts used by the local people.

These results agree with Ermias Lulekal, Zemede Asfaw, Ensermu Kelbessa, and Van Damme, P. (2011) in Ethiopia, who reported that 51% of the WEP parts to be fruits species. In other word the result of finding opposite the work of Kebu Balemie and Fassil Kebebew (2006) and Getachew Addis, Kelbesa Urga and Dawit Dikasso (2005). Who reported that the fruit and leaves as major edible parts harvested or collected from the wild in southern Ethiopia. Thus, fruit and leaves are the most edible parts of wild edible plants in the study area because it is the most preferred parts of wild edible plants by the local people.

3.1.7 The Benefits of Wild Edible Plants

3.1.8. Contribution of Wild Edible Plants as Food

The people are highly dependent on plants and their products for household consumption. The wild edible plants are consumed mainly in many different ways according to local traditions or different culture. According to Kebu Balemie and Fassil Kebebew (2006), the occasion of regularity of harvesting varies from plant to plant depending on the availability of edible plants, which in turn vary from place to place due to ecological and climatic conditions.

The wild edible plants documented are edible both during the normal times and during food shortage. Among the recorded WEPs of this study, 78.1% (32 WEP species) are food plants. Famine foods are used only when chosen options are not available and in situations where successive seasonal food shortage occurs. In the study area over 21.9% of the wild edible herb plants were consumed during times of food scarcity and starvation, they are called as famine wild edible plants, the stored cultivated food crops were in plenty.

Wild-food plants are able to fill a variety of food gaps. In the study area the poverty periods are not constant because the rainy season is variable. The stored crops harvest was not able to provide enough food to last through to the next harvest, wild leafy vegetables. Famine food plants will be consumed to fill the food gap after the first rains, when farmers are preparing their fields. Currently many people (farmer) who stay at rural area loss enough food. Typical famine-food plants grow fast and can be consumed shortly after the first rain showers include plants like *Brassica nigra (*L) Koch, *Amaranthus graecizens* L, *Amaranthus caudatus, Brassica integrofolia, Solanium nigrum, Solanum macrocarpon* poir, *Urtica simensis and Moringa oleifera* were used as substitutes and fill the gap of food shortage. As depicted in the research, some edible plants are kept or stored for the time of famine due to the shortage of staple food. However, some wild edible plants such as *Brasica nigra (L)* and *Amaranthus caudatus* can be planted (occur throughout the year) in Fullasa Kebele highland area. The annual herbs are used as tackling strategy during famine besides some perennial wild edible plants.

Table 3: Famine wild edible plants in the study area.

Botanical name	Family name	Vernacular name	Habitats	Parts used
Amaranthuscaudatus	*Amaranthaceae*	*Haliba*	Herb	Leaf
Amaranthusgraecizans L.	*Amaranthaceae*	Rasuta	Herb	Leaf
Brasicaintegrofolia	*Brassicaceae*	*Chichile*	Herb	Leaf
Brasicanigra (L)	*Brassicaceae*	*Dankale*	Herb	Leaf
Eruacstrumarabicum	*Brassicaceae*	*Fessereka*	Herb	Leaf
Moriningaoliveira	*Morningaceae*	*Allako*	Tree	Leaf
Solaniumnigrum,	Solanaceae	Xo'nayye	Herb	Leaf
Solanummacrocarpon	*Solanaceae*	Santabula	Herb	Leaf
Uriticasimensis	*Urticaceae*	*Dobbeta*	Herb	Leaf and stalk

The study showed that most of food plants were traditionally processed before consumption. Among such plants the early maturing herbs like *Erucastrum arabicum, Brassica nigra* (L) Koch, *Amaranthus graecizens L, Brassica integrofolia, Urtica simensis*, and *Solanium macrocarpon* are either rinsed or washed with warm water before cooking. These plants grow early in commence of rain after drought begins.

The members of community in study area consume wild edible plant as raw (leaf and fruits), cooked (leaf), drink as coffee or tea and suck the flower nectars. The analysis of the result indicated that majority of the recorded wild edible species parts are consumed raw (63.4%). This agrees with the reports of Guinand, Y. and Dechassa Lemessa (2000) in southern Ethiopia, Tigist Wondimu, Zemede Asfaw and Ensermu Kelbessa (2006) in Oromia Region and Redzic, S. J. (2006) in Bosnia- Herzegovina. The other parts were eaten cooked as vegetables (21.9%), sucked like flower nectar (12.2%), and drunk with coffee, or tea (2.4%).

Table 4: The form of consumption of 'wild food' plants, align corrected.

Ways of consumption	Total number of WEP	Percent (%)
Cooked	10	24.4
Drinking with tea, coffee	1	2.4
Raw	25	61
Sucking flower nectar	5	12.2

3.1.9. Traditional Knowledge of WEPs

3.1.10 Traditional Knowledge with Respect to the Age of Informant

In the determination of indigenous knowledge of informants about wild edible plant species, the ages of the respondents were categorized into three (below 20, 20- 40, 40-60). Thus, the knowledge on wild edible plants for food differs with age (Figure 5). The knowledge is becoming fragmented and the practice is restricted almost exclusively to older people. The Spearman correlation test result revealed that there is a weak significant positive correlation (Spearman correlation, r = 0.28, P<0.001) between the age of informants and the knowledge on the number of wild edible plants listed a (Figure 5). It is clearly observed that the age groups between 40-55 have high knowledge on the uses of WEPs but 20-35 has very little knowledge on the uses of WEPs. Moreover, older persons know more wild edible plants than youngster (Figure 5).

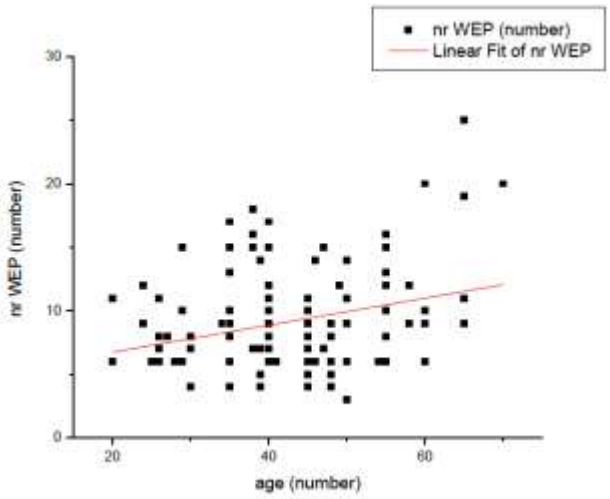

Figure 5: The relationship of age of informants and number of wild edible plants recognized (Person correlation coefficient r = 0.28, P= 0.001).

3.2. Traditional knowledgewith Respect to Educational Level

Literacy and modernization are one of the factors for the decline in indigenous knowledge about wild food gathering and using habit. Moreover, urban dwellers, educated and young people have ignorance to utilize WEPs that is one of the factors for the decline in wild

edible plant species. Regarding the attitude of people towards wild edible plants, the elderly people are more Knowledgeable than the educated people who are supposed to possess more knowledge about WEPs. This implies that as the extents of modern knowledge increase, the interest of the people to use these wild edible plants decreases. In addition, person correlation test result showed that there was significantly negative (person correlation r= -0.37, p<0.001). The correlation between the education level of the informants and their knowledge of WEP. This means as the level of education informant increases, the indigenous knowledge of the people on WEP decrees (Figure 6). There is a wide spread decline in indigenous knowledge about wild edible plants gathering and the habit of using them, especially among young people, educated and urban dwellers in the study area as well as other parts of Ethiopia.

Number of WEPs= 11.03 + -0.4 education

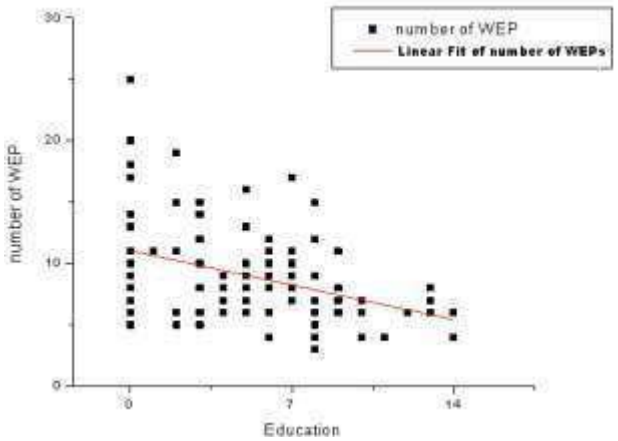

Figure 6: The relationship of educational level of informants and number of wild edible plants recognized (person correlation coefficient=-0.37, p<0.001).

4. CONCLUSION AND RECOMMENDATIONS

The study of wild edible plants reveals that there is a diversification of wild edible plant species regarding use categories' as tree, herbs, shrubs and climbers. The growth duration, habitats and agro-ecological conditions determine the presence of the WEPs. The results indicate that the WEPs are used during shortage of food as staple food. The wild food plants used as copping strategy during hungry time, especially after long dry spell and in case of constraints between the two season harvests. The different parts of wild edible plants are gathered from various natural and agricultural habitats & harvested at different times, supporting the food shortage throughout year-round. According to this study, the following recommendations are forwarded:

- Encourage public awareness on the importance of wild edible plants and community-based management of these plant resources by avoiding the false notion that edible wild plants are inferior in their nutritional value; Encourage farmers to protect and conserve wild edible plants that grow in their farmlands.

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