CARE is one of the leading independent, non-political, and non-religious international humanitarian organizations working in collaboration with governments, institutions and communities to fight poverty and provide assistance in humanitarian emergencies. CARE works in 87 countries in Africa, Asia, Latin America & Caribbean, the Middle East and Eastern Europe. CARE started working in Ethiopia in November 1984 in response to severe drought

Table of Contents

Abbreviations

IPGRI: International Plant Genetic Resources Institute

PLWs: Pregnant and lactating Women

U2: Under two

KAP: Knowledge, attitude and practice

WEPs: Wild edible plants

FGD: Focus Group Discussion

KI`s: Key informants

BIT-BDU: Bahir Dar Institute of technology-Bahir Dar University

NU-WEP: Neglected and Underutilized Wild edible plants

List of Tables

List of Figures

EXECUTIVE SUMMARY

Background

A lot of rural populations are facing food insecurity while living in a highly biodiverse environment that comprises the availability of wild edible plants (WEPs). However, studies addressing the contribution of WEPs to peoples' diets are rare and information on nutrient values of WEPs is lacking. Together with the lack of food composition data on WEPs, the contribution of WEPs to the diet is under evaluated and neglect by researchers, policy makers and nutritionists (Figueroa *et al*., 2009). A healthy diet depends on a diversity of foods rich in vitamins and minerals and NU-WEP are untapped sources of important micronutrients (IPGRI. 2002).

Objective

The principal objective of this study was to investigate the contemporary role and importance of WEPs in the diets of PLWs & under two children and to Collect, document, prioritize and publicize the nutrition contribution of selected WEPs in CARE-Ethiopia project areas of South Gondar.

Methodology

Guided field walk and collection of WEPs in the study area.

In each kebele the PI`s and trained enumerators and surveyor were carried out a number of field observations with the help of guidance and interviewed informants to collect WEPs specimens.

Quantitative dietary assessment and determinants

Quantitative data were collected in 12 kebeles of Ebinat and Simada Woredas using interviewer administered structured Amharic version questionnaire. The main variable of interest during the quantitative survey were , Background information about the area, Socio-demographic information of mothers/caretakers, the size of agricultural land the house hold own , the proportion of land allocated for cereals, legumes and fruit and vegetables, Food taboos targeting young children and PLWs, the role of WEPs to the diet of PLWs and U2

children and KAP of the household towards consumption of WEPs under different circumstance and their preference ranking of WEPs for future domestication.

24 hr Dietary Recall

Dietary quality was assessed by asking the consumption of the major food groups (16 food groups to assess individual dietary diversity score & 10 food groups to assess womens dietary diversity score) over the reference period of 24 hours prior to the survey and calculating dietary diversity score as a composite variable constituted by the food groups.

Focus group Discussion

A qualitative study was conducted in 12 kebeles of the two woredas using focus group discussion (FGD) technique with 120 KI`s from various groups of community members such as, men and women from diverse backgrounds: grand fathers and mothers, Elderly women and Men traditional birth attendants, Religious leaders and community models, livestock herders, Agriculture experts and representatives of community based associations of the study area.

Major topics covered during the 12 Focus Group Discussions were:

- Knowledge and practices related to feeding practices of children under 2 years & Maternal nutrition during pregnancy & lactation
- Knowledge & practice about WEPs and contribution of WEPs to the diet of U2 children and PLWs diet
- Major preparation, Preservation and consumption methods practiced for WEPs
- Specific time to consume WEPs (Food availability, occasion)
- Current availability and consumption of WEPs compared to the previous time
- Major facilitators and barriers s in accessing WEPs
- List of WEPs (among collected WEPs collected during the field survey) they think better contribute for Maternal and child nutrition and other related topics

Summary Result

Collection, preservation and identification of WEPs

A total of 54 wild edible plant species were collected and identified. Among which the result showed that, 38 (70.4%) of the edible plant parts were fruits and the remaining 9 (16.7%), 2 (3.7%) , 2 (3.7%) ,1 (1.9%) , 1(1.9%) and 1(1.9%) of the edible parts were leaf, seed, Flower sap , root, gum and young shoot respectively. Very few are eaten as cooked where as the majority are consumed without any further processing by local communities (Table 1).

Quantitative Dietary assessment and determinants

About 337 (76.6%) and 75 (17%) of the represented households had private or rented agricultural land, respectively. While 28 (6.4%), used both private and rented land for agricultural purpose at the time of the survey. In accordance with this, the average size of agricultural land (owned or rented) per household in all twelve kebeles is 0.85 hectares. On average only 6.2 % of the land is used for the growing of fruit and vegetables where as 64.0% & 28.2 % of the land used for the cultivation of cereal and Legume respectively. Regarding food taboos targeting PLWs and U2 children, about 153 (34.7%) of the total respondents named at least one food type that is not cultural acceptable to be given to children. Food types frequently linked with food taboo were cabbage, pepper and honey for children and Chick pea, pea and bean for PLWs.

Dietary Diversity

The minimum women dietary diversity score of PLWs of the study area was 2.9 which is by far below the recommended minimum dietary diversity for healthy life. Whereas the average dietary diversity score of the children for the two woredas was found to be 3.56. Overall, 100 % of the respondents (women and children) have non-diversified diet. Only 2.4 % and 14.64 % of women have animal source foods and vitamin A rich vegetables in their diet during the last 24 hour before the survey respectively.

WEPs – knowledge, perception and availability

Result on knowledge, perception and consumption of WEPs under different circumstances showed that the contribution of dietary intakes from WEPs to total dietary intake has little significance or non existence due to inaccessibility, low knowledge & consumption frequency of WEPs. However the perception data on WEPS is positive and showed the potential contribution to the poor dietary intake of cereal dependent community of the studied

area. These results illustrate the potential of WEPs to the diets which is however not taped. Furthermore, many women reported unavailability, inaccessibility, lack of knowledge on preparation, conservation and commercialization as constraints associated with WEPs.

Qualitative study /Focus Group discussion findings

Parallel to the quantitative survey, the qualitative study witnessed analogous findings that, the majority of households in the study areas rarely use edible wild plants in their diets. Though WEPs are perceived as important source of nutrients as they practiced previously (by elders) or heard from their parents their present consumption and contribution to the nutrient intakes of women and children is minimum or non-existence.

The most frequently mentioned reasons for low contribution of WEPs to the diet of the community were inaccessibility, low knowledge & consumption frequency of WEPs. Beside participants from Office of agriculture mentioned lack of reliable data on the chemical composition of edible wild plants is a major constraint to ignore or underestimate the role of WEPs in agriculture programs focused on food and nutrition security. They further suggested that as composition data often is lacking or unreliable, nutrient analysis or use of substitution values may be necessary.

Proximate composition and Mineral content of selected WEPs

After the quantitative and qualitative dietary assessment, samples of the 14 most commonly used and currently available species were collected in the study sites .Analysis of Protein, Fat, carbohydrate, Ash, Moisture content , fibre , minerals selected by Ethiopian ministry of health to address micronutrient deficiency (Fe, Ca, and Zinc) were done in Food & Chemical research laboratories of BIT-BDU. For the proximate chemical analysis Official standard methods of analysis of Association of Official Analytical Chemists (AOAC, 2005) were used and the mineral contents were determined by the procedure of US epa 200.7 using an Atomic Absorption Spectrophotometer (ICP-Spectroscopy: "ULTIMA-2"). The analysed WEPS have average energy value of 188kcal/100gm (61.1-358.8 kcal/100gm) whereas the average percentage of carbohydrate, protein, fat was 37.8 (3.9-79.1%), 6.4 (2.7-10.8%), 1.3(0.3-2.6%) respectively. The mineral composition of revealed that the selected WEPS have On average 360 mg/100gm, 20 mg/100gm and 2mg/100gm of Ca, Fe and Zn respectively. Detail result from the chemical analysis of 14 widely used WEPs species is present together with pictures of WEPs (Annex 1).

Conclusion

The main conclusions derived from the present study is large proportions of the study community had low quality diet implying the fact that they are nutritionally insecure and are at risk of developing

micronutrient deficiencies and other chronic diet related diseases .The study also indicate edible wild plants have a potential to make important contributions to the nutrient intakes of women and children. If this is neglected in diet assessments and nutrition interventions our understanding of the overall dietary adequacy may be misinterpreted and much valuable knowledge of traditional food diversification may be lost.

Recommendations

Cultivation of the most preferred WEPs and documentation of information about easier and more efficient WEP use need attention to increase their consumption and therefore improve nutritional adequacy of the study population. Furthermore, strategies for conservation, production and commercialization needs due attention to exploit the full potential WEPs can play in improving food security and better nutrition of the community in general and PLWs and U2 children in particular.

Key words: WEPs, PLWs and U2Children diet, Dietary diversity, proximate and mineral composition

1. BACKGROUND

In resource-poor settings worldwide, low-quality, monotonous diets are common and the risk of micronutrient deficiencies is high (FAO, 2013b). Food insecurity is a severe and growing problem (Brussaard et al., 2010). With close to 218 million people undernourished (more than one in four Africans) sub-Saharan Africa remains the world's most food-insecure region (UNDP, 2012). In Ethiopia many children and mothers are affected by malnutrition. According to mini EDHS , 2014 the prevalence of stunting among children is 40 %, underweight 28.7% and wasting is 9.7% percent. Surveys also revealed that the level of chronic malnutrition among women in Ethiopia is relatively high, with 27 percent of women either thin or undernourished that is, having a body mass index (BMI) of less than 18.5 kg/m2 (NNP2013-2015). Similarly, the prevalence of anemia among women in the age groups (15–49) was found to be 17 % (CSA, 2011).

The existence of diverse farming systems, socio-economics, cultures and agro-ecologies has endowed Ethiopia with a diverse biological wealth of plants, animals, and microbial species, especially crop diversity (IBC, 2007).This raises the questions if and how food insecure populations make use of biodiversity and Wild Edible Plants (WEPs) and what kind of potential available WEPs have to contribute to peoples diets. These aspects are particularly interesting due to the facts that food insecurity is increasing (Brussaard *et al*., 2010) and global biodiversity is declining (Chapel and LaValle, 2009). In many regions of the world this decline has led to the elimination of essential food and nutrient sources, particularly for rural people (Burlingame *et al*., 2009). The international community is increasingly recognizing the potential of biodiversity to increase food security. The Food and Agriculture Organization (FAO) for instance is aware of the fact that wild foods are significant for global food security (FAO, 2009). However, studies addressing the contribution of WEPs and biodiversity to human diets are still rare and there are huge deficits with respect to information on WEPs nutritional properties. A healthy diet depends on a diversity of foods rich in vitamins and minerals and NU-WEP are untapped sources of important micronutrients (IPGRI. 2002). Global supply of food energy is dependent on only a small number of cultivated species and varieties (FAO, 2013a).

Finding ways to alleviate hunger and poverty doesn't always depend on new crop varieties that are bred in a laboratory. Instead, reigniting an interest in—and a taste for—indigenous and traditional foods can help improve nutrition, increase incomes, restore agricultural

biodiversity, and preserve local cultures (Amanda et al., 2011).Together with the lack of food composition data on WEPs, this has led to a routine undervaluation of WEPs in diets and to their neglect by researchers, policy makers and nutritionists (Figueroa et al., 2009).

Wild edible plants (WEPs) defined as the species that are neither cultivated nor domesticated, but are available from their wild natural habitat and used as sources of food (Teklit and Afework, 2015).

If a plant is considered as a wild plant depends on the location. In some areas it may grow wild, while in other areas it can be protected and managed by farmers. Many WEPs can be found in different cultivation stages. Those WEPs include roots, shoots, leafy greens, fleshy fruits, nuts, grains, seeds and other species. Cultural knowledge is important for the harvest and preparation of these plants (Turner *et al*., 2011). Investigation on WEPs is characterized by its multidisciplinarity, involving nutrition, ethnobotany, medicine, anthropology, analytical chemistry and phytochemistry (McBurney *et al*., 2004). While food research and policy tend to distinguish between "wild" and "cultivated" foods, local communities rarely consider these terms separately (Bharucha and Pretty, 2010). Besides the term "Wild Edible Plants" the terms "indigenous plants" and "traditional plants" are found in the literature. These terms describe plants that have been part of food system since several generations. Throughout this Project the term "Wild Edible Plants" will be used as the focus is rather on the non-cultivation aspect than on the long-term existence in the food system.

The Food and Agricultural Organization (FAO,2009) maintains that around 30,000 plant species around the world are edible, but of these, only 7,000 are used as human food resources. It is estimated that 6,376 indigenous plants exist in Africa (Smith and Eyzaguirre, 2007). From studies in 22 African and Asian countries, on average 90-100 wild species are used per place and community group. There are indigenous communities using 300 up to 800 WEPs, for instance in India, Ethiopia and Kenya (Bharucha and Pretty, 2010).
However, as a result of socioeconomic changes and urbanization, the global food base is narrowing. From the 7,000 plant species that have been used for food, 120 species are cultivated today. Nine of them provide more than 75% of human food and only the three species maize, wheat and rice provide more than 50% of human food (Frison *et al*., 2006). With regard to the total global energy intake, 80% is covered by only 12 species. This dependence on a few species has been contributing to the declining stock of WEPs and to

their ignorance in land use planning and implementation, biodiversity conservation, economic development and official statistics (Asfaw, 2009). Wild edible species are also absent from regional and national food balances that guide policies on aid, trade and the announcement of food crises (Bharucha and Pretty, 2010).

Wild-food plant species to world nutrition is still very limited. This is despite their domestication being an important source of human food and nutrition in these times of climate change. The promotion of utilization and commercialization of indigenous wild-food plant species, especially in the arid and semi-arid areas of Africa including Southern Africa, could provide a viable alternative to sustainable livelihood and community food security (Fanti *et al.,2014*).

Finding ways to alleviate hunger and poverty doesn't always depend on new crop varieties that are bred in a laboratory. Instead, reigniting an interest in—and a taste for—NU-WEP foods can help improve nutrition, increase incomes, restore agricultural biodiversity, and preserve local cultures (*Amanda et al.,2011).*

A case in point was expressed by BIT-BDU to CARE-ETHIOPIA to investigate the contemporary role and importance of wild plants in the diets of PLWs & under two childrens and to Collect, document, prioritize and publicize the nutrition contribution of selected WEPs using quantitative & qualitative data collected from in-depth interview and focus group discussion with randomly/Purposely selected Mothers, Fathers, Grand fathers, Grandmothers, Traditional healers, traditional birth attendants, Religious leaders and community models, representatives of community based associations, livestock herders & Agriculture experts of the study area.

2. OBJECTIVE OF THE STUDY

The principal objective of this study was to investigate the contemporary role and importance of WEPs in the diets of PLWs & under two children and to Collect, document, prioritize and publicize the nutrition contribution of selected WEPs in CARE-Ethiopia project areas of South Gondar

2.1. Specific objectives:

- ✓ ***First*** to Identify, prioritize and documentation (Photos, edible part, preparation methods and portion size to meet RDA) of Existing acceptable, feasible, affordable, sustainable, and safe

(AFASS) WEPs in the project area through ethno botanical survey, international and local knowledge .

- ✓ To better interpret the dietary contribution of WEPs, ***Secondly***, Knowledge, use and perception of the local community towards consumption of the identified WEPs was examined.

- ✓ ***Thirdly***, a 24 dietary diversity score assessment was conducted to assess the dietary intake of PLWs and U2 children.

- ✓ ***Fourthly,*** Conduct FGDs to Identify knowledge practice , consumption status of WEPS by the local community ; to identify barriers and enablers for consumption of WEPs as well as to identify BCC and awareness creation strategies to promote use of the selected (Based on AFASS) WEPs

- ✓ ***Lastly,*** to conduct proximate and mineral analysis of selected WEPs to examine the nutritional contribution and potential of WEPs to the diet of PLWS & U2 children and to use the information to advocate consumption of WEPs by creating synergy & network across levels (INGOs and GOs) and Dissemination of findings to CARE- Ethiopia N@c project areas, zonal, regional & national level.

3. SCOPE OF THE PROJECT

1. Documentation of national and international knowledge toward the potential of WEPs to food and nutrition security PLWS & under two children
2. Identify , prioritize and documentation (Photos, edible part, preparation methods and portion size to meet RDA) of Existing acceptable, feasible, affordable, sustainable, and safe (AFASS) WEP in the project area through ethno botanical survey, Community participation, international and local knowledge
3. Identify Potential & definite toxic WEPs consumed during food stress time (if any)

4. Examine the nutritional contribution and potential of WEPs to the diet of PLWS & under two children (from national and international food composition data or by laboratory proximate composition analysis
5. Development of assessment design and tools to collect information on:
    - ✓ The prominent purposes for which these identified plants are used
    - ✓ Method of preparation & utilization by Assessing Knowledge, use and perception of the local community towards consumption of the identified WEPs
    - ✓ Womens and under two children `s Dietary diversity /intake data (24hrs recall) of the study area
    - ✓ Dietary intake coming from WEPs
    - ✓ Barriers and enablers for consumption of WEPs
    - ✓ Changes in consumption pattern following awareness creation and BCC campaign
6. Identify & networking INGOS, GO`S , donors, experts and communities working on the documentation, advocacy, processing and Utilization of WEPs
7. Identify BCC strategies to promote use of the recommended (Based on AFASS) WEPs by nutritionists and local community
8. Awareness creation about WEPs & their role to fill micro and macro nutrients deficiencies and document change in consumption pattern
9. Dissemination of findings to CARE- Ethiopia N@c project areas community, zonal, regional & national level.

4. LITERATURE REVIEW

4.1. Wild edible plants: their status and their benefits

In this study, the term "Wild Edible Plants" refers to plants that are not cultivated and that can be gathered in the field. If a plant is considered as a wild plant depends on the location. In some areas it may grow wild, while in other areas it can be protected and managed by farmers. Many WEPs can be found in different cultivation stages. This results from human selection (Heywood, 1999). Those WEPs include roots, shoots, leafy greens, fleshy fruits, nuts, grains, seeds and other species. Cultural knowledge is important for the harvest and preparation of these plants (Turner *et al*., 2011). Investigation on WEPs is characterized by its multidisciplinarity, involving nutrition, ethnobotany, medicine, anthropology, analytical chemistry and phytochemistry (McBurney *et al*., 2004). While food research and policy tend to distinguish between "wild" and "cultivated" foods, local communities rarely consider these terms separately (Bharucha and Pretty, 2010). Besides the term "Wild Edible Plants" the terms "indigenous plants" and "traditional plants" are found in the

literature. These terms describe plants that have been part of food system since several generations. Throughout this work the term "Wild Edible Plants" will be used as the focus is rather on the non-cultivation aspect than on the long-term existence in the food system. According to ethnobotanical surveys, more than 30,000 plant species are edible. From this amount about 7,000 species have been used for food (Wilson, 1990). It is estimated that 6,376 indigenous plants exist in Africa (Smith and Eyzaguirre, 2007). From studies in 22 African and Asian countries, on average 90-100 wild species are used per place and community group. There are indigenous communities using 300 up to 800 WEPs, for instance in India, Ethiopia and Kenya (Bharucha and Pretty, 2010).

However, as a result of socioeconomic changes and urbanization, the global food base is narrowing. From the 7,000 plant species that have been used for food, 120 species are cultivated today. Nine of them provide more than 75% of human food and only the three species maize, wheat and rice provide more than 50% of human food (Frison *et al*., 2006). With regard to the total global energy intake, 80% is covered by only 12 species. This dependence on a few species has been contributing to the declining stock of WEPs and to their ignorance in land use planning and implementation, biodiversity conservation, economic development and official statistics (Asfaw, 2009). Wild edible species are also absent from regional and national food balances that guide policies on aid, trade and the announcement of food crises (Bharucha and Pretty, 2010).

4.2. The multiple benefits of WEPs

The position of WEPs in local food resource systems and their multiple and often over-lapping functions in relation to nutrition can be set in a framework as outlined in *Figure 1*.

The upper part of the framework builds on the widely used conceptual framework of nutrition problems in society (Jonsson,1984), with subsequent adaptations to also include "care giving behaviour" and not only human food and health concerns but also those of livestock (Engle et al. 1997, Eide and Oshaug,1999). Factors of food, care and health at the household level are closely interlinked and strongly related to women's knowledge, control of resources and position in society.

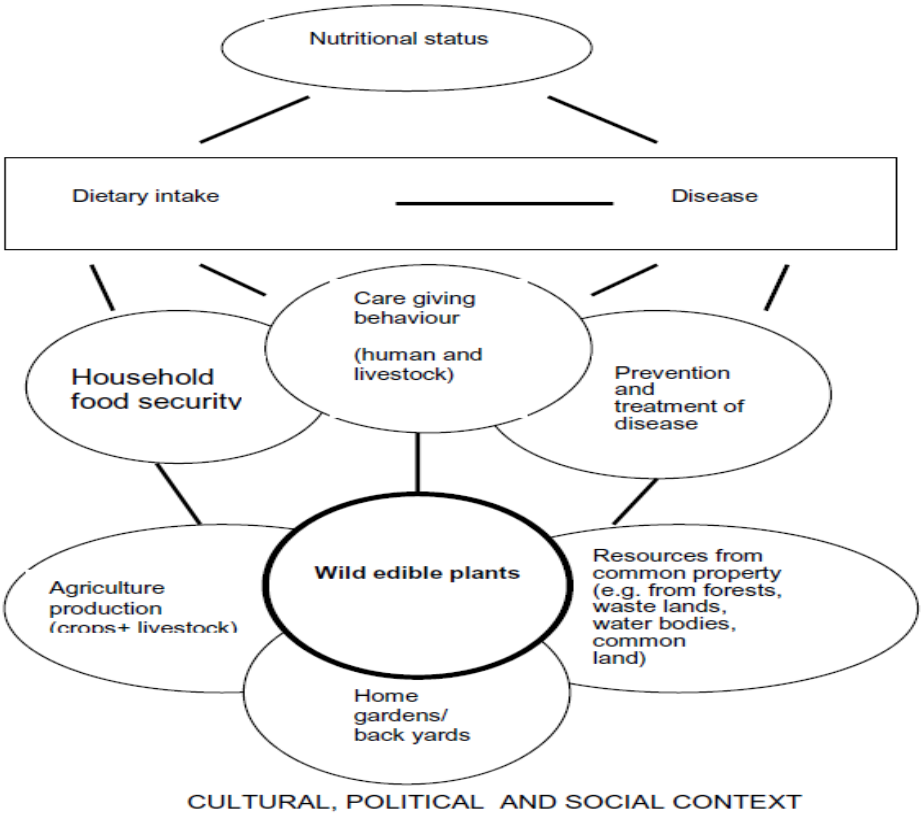

Figure 1. Nutrition and the multifunctional roles of wild foods resources (adapted from UNICEF 1990, Antonsson-Ogle et al.2000, Eide and Oshaug 1999)

The lower part of the framework places edible wild plants in the broader setting of resources available for food acquisition (Antonsson-Ogle *et al*., 2000). They are harvested from very diverse habitats in rural food systems, niches that Chambers (1990) has called "unobserved microenvironments". This includes not only home-gardens, backyards and fields, but also many additional sites not usually considered as food resource habitats, for example dykes, common lands, forests, road sides, water bodies or marsh lands. Knowledge about wild plants is important to enhance the utilization and conservation of diversity. People in rural areas of Ethiopia, particularly elders, have a deep and time-tested indigenous knowledge concerning the availability, management and use of Wild Edible Plants (WEPs). The knowledge, values and beliefs of the caregivers, most importantly women, will determine the nutritional contribution of wild plants through their multiple uses as foods, feeds or medicines.

4.2.1. Micronutrient deficiencies and the role of edible wild plants

Micronutrient deficiencies are among the high priority public health concerns in many countries. Several global meetings, including the UNICEF World Summit for Children (1990), the ACC/SCN Policy Conference on Micronutrient Malnutrition (1991) and the International Conference on Nutrition (1992) have called for global action to address

micronutrient deficiencies. However, in developing countries diets are often cereal based and contain only a small share of animal foods, fruits and vegetables. Within this group, gathered wild vegetables and fruits deserve greater attention, as our reviews show numerous examples on how they are easily accessible, culturally accepted and inexpensive sources of vitamins and minerals to many rural population groups. In many areas WEPs play an important role in supplementing staple foods with micronutrients and represent nutrition quality for both the rural and urban population in sub-Saharan Africa (Termote, 2011). Wild vegetables are a rich source of micronutrients and the nutritional quality is often comparable or even superior to cultivated species (Guerrero *et al*., 1998; Ogle, 2001; Turan *et al*., 2003).

However, the data on the contribution of local vegetables and fruits, even the cultivated varieties, is often too fragmentary to be useful in the development of food based strategies (Haddad and Oshaug 1999, Ruel and Levin 2000). Yet the diversity and number of examples from different regions indicate their importance at an aggregated level.

Micronutrient data are part of the results in many different types of studies on WEPs, including anthropological and ethnographic work, botanical inventories, chemical analyses, dietary intake reports and intervention studies (Becker,1983, 1986, Booth *et al*., 1992, FAO,1989, 1991, Grivetti and Ogle,2000, Kuhnlein and Turner,1991, Scoones *et al*.,1992). This illustrates the interest in this research area by many disciplines and brings to our attention the wide range of inputs, from the agro-ecological and botanical, to the socio-cultural aspects, that is needed to capture the nutritional importance of wild plant use. It also shows that many studies have been conducted in professional isolation e.g. they are simple inventories or composition reports and that more systematic and interdisciplinary studies of the current nutritional role of wild plants are relatively few. From our review on research on wild foods and micronutrients, we conclude that there is a lot of evidence that edible wild plants provide important micronutrients throughout the year in many rural agricultural societies. Such species thus play critical roles during periods of drought and civil unrest, and knowledge of these species may be the most important determinant as to whether individuals or families maintain nutritional wellbeing, become malnourished, or succumb (Grivetti and Ogle, 2000).

Dietary intake studies

A subset of the research publications on WEPs has included dietary intake studies are summarized in Annex 5. These provide important examples of the major nutritional contributions that wild plants can make to different population groups and at the same time they illustrate many of the

problematic features of dietary assessments in wild edible plant research. These include for example the necessity to identify botanically an often large number of species that may be used, the variation between sites in species use, the social and ethnical differentiation in use, their often low status and the lack of data on chemical composition. From a methodological view point the studies in Annex 5 illustrate how researchers have made use of combinations of methods to make in depth assessments possible (Fleuret,1993, Ogle & Grivetti,1985, Omori & Greksa,1996 and Uiso & Jones,1996).

Lack of composition data on wild foods

The conversion of consumption data on wild foods to nutrient intake often poses practical problems. Composition data, especially micronutrient data on wild foods, are not usually included in food composition tables, or the values are questionable, as the tables do not indicate references or analytical methods used (Grivetti and Ogle,2000). In this situation, researchers interested in the role of wild foods in contemporary diets either need to make assumptions founded on unreliable tables or use substitute values from similar products, or they have to include analyses of chemical composition. Annex 6 provides an overview of published researches that have integrated chemical analysis into the studies to allow interpretation of the nutritional significance of wild foods in diets.

4.2.2. Security in times of food shortage

Since a long time WEPs have been a "hidden harvest" to farmers. Many WEPs can be found within or around their fields (Bharucha and Pretty, 2010). According to several studies, populations can become heavily reliant on the "free", readily accessible WEPs in times of food insecurity due to natural or man-made disasters (Muller and Almedon, 2008). This association led to the development of the term "faminefoods". The potential importance of WEPs in Ethiopia during times of low agricultural productivity is also rooted in their innate resilience to short-term climate change. Exotic species are often not that resilient (Fentahun and Hager, 2009). Exotic vegetables are often not able to adapt to local environments and need intensive production systems (Shackleton *et al*., 2009). Even if WEPs cannot completely bridge the gaps of demand and supply, those gaps would be much wider without them (Bharucha and Pretty, 2010). However, the dependency on WEPs can also lead to their depletion, especially when it's coupled with population growth (Vodouhe *et al*., 2009). Until now, food security policies worldwide have too less acknowledged the significance of WEPs. This has often constrained food security and biodiversity conservation (Dovie *et al*., 2007).

4.2.3. Source of income

WEPs also have another "safety net" function in terms of money earned from their sale. This is especially important in isolated regions without insurance mechanisms, but with high price, health

and environmental risks (McSweeny, 2003). According to several studies wild fruits are an important source of income through commercialization (Styger *et al*., 1999; Teklehaimanot, 2004). Even though there are no global estimates of the economic value of wild foods, there is no doubt that their use and trade becomes important during economic hardship (Bharucha and Pretty, 2010). These days an increased attention on the contribution of wild foods to rural livelihood and poverty reduction can be observed. In some communities in southern Africa, the sale of WEPs can amount to 50% of the total net income (Wiesum and Shackleton, 2005). The use of WEPs as source of income In Ethiopia WEPs is also common. The widely sold wild indigenous fruit species at local level are *Dovyalis abyssinica, Mimusops kummel, Ximenia americana, Adansonia digitata, Annona senegalensis***,** *Balanites aegyptiaca, Flacourtia indica, Oncoba spinosa* and *Syzyguim guineense.* Whereas *Mimusops kummel* and *Ziziphus spina-christi* are marketed at national level, *Balanites egyptiaca* and *Tamandus indica* marketed internationally (Teketay and Abeje, 2004).

4.2.4. Diverse uses

WEPs are not only used as a food source, but also as medicine, flavourants, building material, tools, thirst quenchers and for chewing (Bharucha and Pretty, 2010). They can also be used as fodder and fertilizer or for crop pollination and pest and predator control. The wild relatives of cultivated plants offer genetic diversity that can be applied in crop improvement (Scherr, 2003). In addition, wild edible trees in Africa can play an important role with regard to crop diversification and agroforestry development for sustainable agricultural production (Assogbadjo *et al*., 2012).

4.2.5. Cultural identity

For communities that traditionally use wild foods, this often represents a key element of their culture and a link with the land of origin (Pretty, 2007; Pilgrim and Pretty, 2010).

4.3. Edible WEPs data & the use of WEPs in Ethiopia and their food group

WEPs are consumed during periods of ample food production to supplement the staple food and to fill the gap of seasonal food shortage, whileothers are consumed during famine, drought, war and other hardships. Examples of WEPs consumed during famine are: *Amaranthus graecizans, Amorphophallus gallaensis, Balanites spp., Commelina spp., Corchorus olitorius, Cyprus bulbosus , Dobera glabra, Erucastrum arabicum, Guizotia*

scabra, *Maerua angolensis*, *Piliostigma thonninghii*, *Portulaca spp.* and *Urtica simensis* (Guinand and Dechassa 2000).

These days, anthropogenic and natural factors are threatening the natural ecosystem. As a result the diversity of WEPs is decreasing from time to time. Besides, due attention has not yet been given to study the genetic erosion of WEPs and factors affecting it. As such, the state of intra-specific diversity of WEPs is not well known. Even the available limited studies on WEPs covered only about 5% of the country's districts (Lulekal *et. al*. 2011).

The limited studies conducted in some parts of the country and summarized by IBC (2012) indicated the presence of WEPs of significant importance for local people. For instance, Awas (1997) reported 84 WEPs in Gambella Region. Awas and Zemede (1999) have also reported 25 WEPs used by the Bertha People of the Benshangul Gumuz Region. In addition, the limited available information indicate the following;

i) More than 80 wild-food species were identified in North and South Omo Zones of SNNP (Southern Nations, Nationalities and Peoples) Region of Ethiopia (Guinand & Dechassa, 2000);

ii) One-hundred-thirty species of wild plant species were reported to be edible in Alamata, Cheha, Goma and Yilmana Denssa districts of Tigray, SNNP, Oromia and Amhara regional states, respectively (Addis *et al.*,2005);

iii) Sixty-six edible plant species were documented in Derashe and Kucha Districts of South Ethiopia (Balemie and Fassil,2006);

iv) Forty-six species of edible wild fruits were documented in Adiarkay, Debark and Dejen districts of Amhara region of the country (Mengistu and Herbert, 2008);

v) Thirty-eight wild plant species were reported as food sources in Kara and Kwego semi-pastoralist people in Lower Omo River Valley, SNNP region of the country (Teklehaymanot & Mirutse, 2010);

vi) In Benna Tsemay district of the SNNP Region of Ethiopia, 30 wild edible trees and shrubs were identified and documented (Assefa & Tesfaye, 2011);

vii) In Boosat and Fantalle districts of Oromia region 37 WEPs were identified and documented, and about 24.3 % of them were locally marketed (Hunde *et al.*, 2011).

There are also studies conducted which have wider area coverage and has national perspective, mostly based on herbarium specimens, literature review and also field studies. Some of the studies include the following:

i) Asfaw (1997) reported the presence of 170 species of noncultivated angiosperms consumed by Ethiopians, and of these 29% are wild and weedy indigenous vegetables;

ii) Teketay *et al.* (2010) documented information on 378 WEPs of Ethiopia;

iii) According to Asfaw & Mesfin (2001), there are 203 WEPs in Ethiopia.

iv) The study conducted by Lulekal *et al.* (2011) also revealed the presence of 413 WEPs in the country. Among which ,Shrubs represented 31% of species followed by trees (30%), herbs (29%) and climbers (9%). Families Fabaceae (35 species), Tiliaceae (20) and Capparidaceae (19) were found to be represented by the highest number of edible species. About 56% (233) of species have edibility reports from more than one community in Ethiopia.

Leaves, stems, fruits, flowers, tubers, barks, seeds, roots, and so on, of lots of WEPs are still consumed for their dietary value in many communities around the globe. Some of these WEPs are used as primary food sources while others are used as secondary condiments in dishes prepared from domesticated cultivars (Lockett and Grivetti, 2000). Fruits were reported as the commonly utilized edible part in 51% of species. These plants play an important role as a source of energy and micronutrients (Afolayan and Jimoh, 2009; De Caluwé, 2010a and 2010b).Nutritional analysis results of WEPs provide clues to aid the promotion of those species that have the best nutritional values which helps to ensure dietetic diversity and combat food insecurity (Tardio *et al.*, 2006). In addition, Becker (1983) reported the presence of vitamins A, B2, and C in WEPs of Senegal. Research on six WEPs from Spain also confirmed the occurence of lipids, fatty acids and carotenes in the leaves of these species (Guill-Guerrero and Rodriguez-Garcia,1999). Protein content in a proportion that is comparable to the amount in domesticated plants was also reported from a nutritional study of WEPs in South Africa (Afolayan and Jimoh, 2009). A study on the dietary value of eight wild edibles in Iran and India also showed the presence of sodium, calcium, potassium, iron, zinc, protein, and fat in a ratio comparable to that found in cultivated plants (Aberoumand, 2009). Generally, the information available from the nutritional analysis of WEPs shows their potential contribution to dietetic diversity and food security.

However to the best of our knowledge in Ethiopia *Nutritional* analysis reports on WEPs *is* not available and so far a considerable amount of research has been conducted on WEP ethnobotany with an emphasis on field surveys and documentation. Table 3 reveals the Major WEPS in Amhara Region and their food groups (Base on their edible part) to be used in dietary diversity score studies as summarized by Lulekal *et al*. (2011) .

Table 1: WEPs and their food group (Edible part) in Amhara Region

No	WEP species	Family	Local Name	Used part*	**Food Groups****
1.	Acacia aibida Del.	Fabaceae	Grar	Seed	Nuts and seed
2.	Acacia etbaica Schweinf.	Fabaceae	Girar	Gum	All Starchy staple foods
3.	Acacia nilotica (L.) Willd. ex Del.	Fabaceae	Grar	Bark and fruit	Beans and peas
4.	Acacia Senegal (L.) Wild.	Fabaceae	Grara	Seed	Nuts and seeds
5.	Acacia sieberiana var. laoodii (Burtt- Davy) Keay and Brenan	Fabaceae	Nech-girar	Gum	All Starchy staple foods
6.	Acanthus sennii Chiov.	Acanthaceae	Kusheshilie	Nectar	
7.	Acokanthera schimperi (A. DC.) Schweinf.	Apocynaceae	Merenz	Fruit	Other Vegetables
8.	Argemone mexicana L.	Papaveraceae	Dandaro	Seed	Nuts & Seeds
9.	Albizia schimperiana Oliv.	Fabaceae	Sessa	Gum	All Starchy staple foods ***
10.	Allophylus abyssinicus (Hochst.) Radik.	Sapindaceae	Imbis	Fruit	Beans and peas
11.	Arundinaria alpina K. Schum.	Poaceae	Kerkeha	Young shoots	Other vegetables ***
12.	Bosioellia papyrifera (Del.) Hochst.	Burseraceae	Meker	Gum	All Starchy staple foods ***
13.	Capparis decidua (Forssk.) Edgew.	Capparidaceae	Gumero	Fruit	Other vitamin A-rich vegetables and fruits
14.	Carissa spinarum L.	Apocynaceae	Agam	Fruit	All Starchy staple foods & Beans and peas
15.	Cordia afikana Lam.	Boraginaceae	Wanza	Fruit	Other Vitamin A rich vegetables &

					fruits , Beans & peas
16.	Cyperus usitatus Burch.	Cyperaceae	Engicha	Bulb	Beans and peas
17.	Douyalis abyssinica (A. Rich.) Warb.	Flacourtiaceae	Koshim	Fruit	Vitamin A rich vegetable and fruits
18.	Eriobotrya japonica (Thunb.) Lindl.	Rosaceae	Woshimela	Fruit	Vitamin A rich vegetable and fruits
19.	Erythrina Brucei Schweinf.	Fabaceae	Korch	Root	All Starchy staple foods & Beans and peas
20.	Euclea racemosa Murr.	Ebenaceae	Dedaho	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
21.	Ferula communis L.	Apiaceae	Dog	Young shoot	Other Vitamin A rich vegetables
22.	Ficus mucuso Ficalho	Moraceae	Shola	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
23.	Ficus ovata Vahl.	Moraceae	Warka	Fruit	Other Vitamin A rich vegetables & fruits , Beans peas
24.	Ficus palmata Forssk.	Moraceae	Yekola-Beles	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
25.	Lantana camata L.	Verbenaceae	Yeregna genfo	Fruit	All Starchy staple foods & Beans and peas
26.	Lepisanthes senegalensis (Juss.ex Poir.) Leenh	Sapindaceae	Sembo	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
27.	Mimusops kumme	Sapotaceae	Ishe	Fruit	All Starchy staple foods & Beans and peas
28.	Momordic ajbetida Schumach.	Cucurbitaceae	Ye'kurra areg	Fruit and tuber	All Starchy staple foods & Beans and peas
29.	Morus alba L.	Moraceae	Injori	Fruit	Other vitamin A-rich vegetables and fruits & All Starchy

					staple foods
30.	Physalis micrantha Link	Solanaceae	Yefereng Awit	Fruit	Other vitamin A-rich vegetables and fruits
31.	Phytolaca dodecandra L. H'erit.	Phytolacaceae	Indod	Leaf	Vitamin A-rich dark green leafy vegetables
32.	Rhamnus prinoides L'Herit.	Rhamnaceae	Gesho	Leaf and stem	Vitamin A-rich dark green leafy vegetables , All Starchy staple foods
33.	Rosa abyssinica Lindley	Rosaceae	Kega	Fruit	Other vitamin A-rich vegetables and fruits
34.	Rubus uolkensii Engl.	Rosaceae	Yedega Injorii	Fruit	Other vitamin A-rich vegetables and fruits & All Starchy staple foods
35.	Saluadora persica L.	Salvadoraceae	Mero	Fruit	Other vitamin A-rich vegetables and fruits
36.	Sporobolus afikanus (Poir)	Poaceae	Muriye	Seed	Nuts & Seeds
37.	Schinus molle L.	Anacardiceae	Qundo	Fruit	Other vitamin A-rich vegetables and fruits
38.	Syzyyium guineense (Willd.) DC.	Myrtaceae	Dokma	Fruit and Leaf	Other vitamin A-rich vegetables and fruits
39.	Tagetes minutu L.	Asteraceae	Zwdearem	Leaf	All Starchy staple foods ***
40.	Thymus serrulatus Hochst.	Lamiaceae	Yedega Tosign	Whole part	Other vegetables
41.	Urtica simensis Steudel	Urticaceae	Sama	Leaf and stem	Vitamin A-rich dark green leafy vegetables
42.	Ximenia amerkana L.	Olacaceae	Inkoy	Fruit	Other vitamin A-rich vegetables and fruits

***Summary of WEPs based on Edible part : Bark & Fruit 1/42, Bulb 1/42, Fruit 21/42, Fruit & Leaf 1/42, Fruit & Tuber 1/42, Gum 4/42, Leaf 2/42, Leaf & stem 2/42, Nectar 1/42, Root 1/42, Seed 4/42, Whole part 1/42 & Young shoot 1/42**

****Food groups based Minimum Dietary Diversity – Women (MDD-W) (FAO & FANTA,2014)**
***** Rich in Minerals**

4.4. *Conclusion*

Despite the substantial evidence that wild foods represent a significant part of the global food basket, literature on food security has been focusing on cultivated foods (Ericksen *et al*., 2009). In comparison to cultivated foods, wild vegetables are often more resilient, need less care and are rich in micronutrients. Furthermore it was shown that WEPs are important in times of food shortage, that they have diverse other uses and can represent cultural identity. However, even if nutritional properties of several WEP species are identified, the documentation of the contribution of macro- and micronutrients from WEPs to the diets remains a necessary research objective. Furthermore wild foods need more attention for ecological, agronomic and marketing research (Leakey, 1999). To preserve the significance of wild foods, it is important to integrate policies on food security, agriculture and conservation (Bharucha and Pretty, 2010). Different projects that intend to increase wild food consumption and prevent traditional communities to be hit by the 'nutrition transition' exist (Pilgrim *et al*., 2009). In addition, more and more evidence demonstrates that participatory domestication of high value WEPs could be a feasible strategy to improve nutrition security and farmer's income while protecting the environment from overexploitation (Leakey, 1999 & Leakey *et al*., 2003).

5. MATERIALS AND METHODS

The studies included in this project are based on field observations, Key informant interviews (KII), Focus group discussions (FGD), dietary diversity study, collection ,identification and ranking WEPs in the study area and laboratory analysis (Proximate and mineral composition) of the top 14 ranked WEPs. For the study twelelve kebeles representing the three agro-ecological regions of Ebinat & Simada woredas were selected.

5.1. *Study area Selection*

The two woredas are located in CARE-Ethiopia N @ C Project areas of South Gondar Zone, Amhara Regional State of Ethiopia. They are located in the northern highland part of Ethiopia known to be chronically food insecure. Scouting survey of the study area was done . Accordingly, basic information was collected from Simada & Ebinat wereda offices, CARE-Ethiopia Amhara office, traditional healers, leaders of kebele administration, natural resource management/Forestry experts, religious leaders and local people before conducting field study. This gave us a general impression to identify the study sites. Following this, a total of 12 Kebeles (Embacheko, Eyada , Mechena , Jimman , Gela matebeya and Balarb of Ebinat kebeles of Ebinat woredas and Medkahana Yequas abo , Sergawit , GUjini , Giraru and

Ashara & Argana kebeles of simada woreda) representing the three agro ecological zones of the two woredas were selected.

5.2. Training of Data Collectors

Field observation & WEPs specimen collection , dietary diversity study , WEPs knowledge, perception and availability data was collected using 24 experienced enumerators and with 24 local guides and 2 principal investigators . The enumerators were proficient in local languages & culture. Two days intensive training was given to the enumerators before deploying them to the actual data collection. The training sessions was cover overall introduction about the assessment, discussion on ethical data collection, orientation on general principles of data collection, line by line discussion on the tool, paired in-class mock interview, field mock interview and discussion on the mock interviews.

Figure 1: Map of N@C WEPs study Districts.

5.3. Informant selection

The Quantitative survey was employed proportional stratified/Cluster sampling technique. Based on the sampling frame developed from the EPI registration book of HEWs, households having children aged under two and /or a pregnant woman will be identified using simple random sampling technique. The total sample size 440 households were distributed to the two woredas proportionally to their total population size. Then the allocated sample size was distributed to the available agro-ecological zones of the respective woredas depending on their population size composition.

5.4. Data collection

Ethnobotanical data was collected between 10-20-Decemebr 15, 2015, following the method by Martin (1995), Cotton (1996) and Cunningham (2001). Accordingly, semi-structure interview, guided field walk was applied to collect WEPS of the study area, obtain KAP of the local people on WEPs. All of the interviews were held based on check list of questions prepared before hand in English language and translated into Amharic, the language of the inhabitants and back translated to English to check consistency of translation of the language.

5.4.1. Field observation/ guided field walk

During guided field walk, the interview was conducted, while walking through the study sites to collect the data on WEPs. Accordingly, a number of field observations was performed with the help of guidance and interviewed informants to collect WEPs specimens. Full notes about the mode of collection, land forms, soil type, the nature of human activities and habit and habitat were recorded on site. Based on ethnobotanical information provided by informants, collected voucher specimens during guided field walk were pressed, numbered and vernacular names were given on each sheets and dried. Some of informants, study sites and WEPs species were photographed in order to document ethnobotanical information. Most of the botanical identification was performed in office by using taxonomic keys in published volumes of the flora of Ethiopia and Eritrea.

5.4.2. Dietary Diversity data collection

Face to face interviews with 440 PLWs & Mothers of U2 children was carried out in the homes of the respondents. To make possible an evaluation of the significance of WEPs in the overall diet of the respondents, an adapted food frequency methodology with a recall period of 24 hours was used in food consumption interviews with PLWs & Mothers/Caregivers of under two children`s. The survey instruments was developed on the basis of information from the initial visits to the study areas and identified WEPs was included in to the 16 food groups proposed for the individual dietary diversity score (IDDS) (FAO, 2011) and 10 food groups proposed for Minimum dietary diversity-Womens (M-WDD (FAO & FANTA, 2014).

Specific care was take to cover foods commonly available in the area, especially local (Cultivated and Wild) vegetables, fruit. Beside the close and open ended questions was included the following:

1. Background information about the area
2. Socio-demographic information of mothers/caretakers
3. Food frequency/Dietary diversity (PLWs & Mothers /Care givers of under two children)
4. Knowledge, use and perception of the house hold on WEPs
5. Barriers/Taboos and enablers/Motivation for consumption of WEPs by PLWs
6. Barriers and enablers/Motivation for consumption of WEPs by under two Children

The questionnaire was initially be prepared in English language and later translated into Amharic language by the principal investigators and back translated to English to check consistency of translation of the language. Prior to data collection, the questionnaire was pretested among 20 households (10 with pregnant women, 10 with mother/caregiver of under two children) and modifications was made accordingly. Maximum effort was made to assure privacy and comfort to the participants. Strict onsite supervision was made by the principal investigators.

5.4.3. Key informant Interview & Group Discussion

In addition to the information gathered from selected households, the community as a whole had several opportunities to attend meetings and engage in activities in which their unique knowledge could be shared, debated, and included as an important component of the study. A total of 12 focus group sessions were conducted by the principal investigators with the assistance of local facilitators from kebele Agriculture and health office These meetings took place over the duration of the study period (December 25-30, 2015), providing an opportunity for community input on the research design and results dissemination. These activities also served to gather the background information necessary to contextualize the data collected through surveys, interviews, and subsequent focus group sessions. At the start of each session a briefing was held to discuss the goals and requirements of the project. After the initial presentation, an informal focus group discussion was conducted to determine:

- Knowledge and practices related to feeding practices of children under 2 years and PLWs
- Cultural habits/Food taboos affecting child feeding practice of U2 children & PLWs
- Community Knowledge and perception about WEPs

- How do you evaluate the contribution of WEPs to the diet of mothers and U2 children (Previous and current)
- WEPs known to the community, their importance to food security and cultural traditions, and the degree to which each species was appreciated.
- The major barriers in accessing WEPs
- What are the major facilitators in accessing WEPs
- The availability and consumption of WEPs today and in previous time
- The major WEPs they think better contribute for Maternal and child nutrition

Beside information about the local names and uses of various species was obtained. Botanical samples for each of the selected WEPs from WEPs mentioned by survey respondents and identified during the field survey were collected with help from participants and field assistants.

5.4.4. Proximate composition and Mineral Analysis of selected WEPs

Proximate composition

Official standard methods of analysis of Association of Official Analytical Chemists (AOAC, 2005) were used for proximate chemical analysis of prepared weaning foods.

Determination of Moisture Content

Empty dishes were dried using drying oven for 1h at 105°C, transferred to the desiccators (with granular silica gel), cooled for 30 min, and weighed. About 2.00g of samples were transferred to the dried and weighed dishes. The dishes and their contents were placed in the drying oven at 105°C for 5hr and were cooled in desiccators and reweighed. Then, the moisture content was estimated by the formula:-

$$\text{Moisture content}(\%) = \frac{[\text{weight of fresh sample} - \text{weight of dry sample}]}{\text{Weight of fresh sample}} * 100\%$$

Determination of Total Ash Content

The crucible which was used for the analysis was cleaned and drying at 120^{0}C. Then the crucible was removed from the oven (Oven Model FN 400) and cooled in desiccators. The mass of the crucible was measured by analytical balance (M_1). About 5gram of the sample was weighed in to crucible (M_2). The sample was then placed in muffle furnace (Thermolyne, Model 48000) at 550^{0}C until white ash color is obtained. Then the crucible was removed from the furnace and placed in the desiccator. Finally the mass was weighed (M_3).

$$Ash = \frac{[M_3 - M_1]}{M_2 - M_1} * 100\ \%$$

Where M1= Weight of the dish

M2= Weight of fresh sample and dish

M3= Weight of ash and dish

Determination of crude protein

A digestion flask containing about 1 g of sample, to which 6 ml of acid mixture (conc. Sulphuric acid and conc. orthophosphuric acid) and about 3g of catalyst mixture (K2SO4 and Selenium) were added and exposed to about 370 0C in order to allow digestion. Then, distillation took place by adding 25 ml of 40% NaOH and using 25 ml of boric acid with 10 drops of indicator solution. Finally, the distillate was titrated with standardized 0.1N sulphuric acid to a reddish color. Then, crude protein content was estimated using the formula:

Total nitrogen= (((V2-V1)* N*14.007*100)/W)

Protein = 6.25*total nitrogen

Determination of crude fat content

Crude fat was determined by exhaustively extracting a known weight of sample in petroleum ether (boiling point, 40 to 60oC) in a soxhlet extractor. The ether was evaporated from the extraction flask. The amount of fat was quantified gravimetrically and calculated from the difference in weight of the extraction flask before and after extraction as percentage. The extraction flask were cleaned, dried in drying oven at 92°C for 1h, cooled in desiccators for 30 min, and then weighed. The bottom of the extraction thimble was covered with about 2cm layer of fat free cotton. About 2g of fresh samples (in triplicate) were added into the extraction thimbles, and then covered with about 2cm layer of fat free cotton. The thimbles with the sample content were placed into soxhelt extraction chamber. The cooling water was switched on, and a 70ml of petroleum ether was added to the extraction flask through the condenser. The extraction was conducted for about 4 h. The extraction flasks with their content were removed from the extraction chamber and placed in the drying oven at 92oC for about 1h, cooled to room temperature in the desiccators for about 30min and re-weighed.

W= W2-W1

$$\text{Fat } \frac{g}{100g} \text{ fresh sample} = \frac{[W + 100]}{W_D}$$

Where; W= weight of fat; W2= weight of extraction flask after extraction (wt. of flask & fat)

W1 = weight of extraction flask before extraction (wt. of flask);

WD = weight of fresh sample.

Determination of crude fiber content

1.5 g weighed sample was transferred into a 600 ml beaker and approximately 200 ml of 1.25% sulfuric acid was added and then boiled for 30 min. Recording took place by placing a watch glass over the mouth of the beaker. After 30 min heating by gently keeping the level constant with distilled water, 20 ml 28% KOH was added and again boiled gently for another 30 min. Subsequently, washing was conducted with 1% sulfuric acid and NaOH solution. Next, the sample was filtered and dried in an electric oven (Oven, Model FN 400) at 130°C for 2 h. Then it was cooled at room temperature for 30 min in a desiccator and weighed, and finally transferred to muffle furnace (Thermolyne, Model 48000) for 30 min ashing at 550°C. Afterwards, the sample was cooled again in a desiccator and re-weighed. The crude fiber content was determined using equation:

$$\text{Crude fiber g/100g} = \frac{[W1 - W2 + 100]}{W3}$$

Where: W1 = weight of (Crucible + sample) after drying; W2 = weight of (Crucible + sample) after ashing; W3 = weight of fresh sample.

Determination of crude carbohydrate

Total carbohydrate content of the samples was determined by subtraction of the above tested parameters from 100%

Total carbohydrates [%] =100- [%Moisture + % Protein+ % Fat + % Ash]

Determination of energy

The energy values for one gram of the three groups of nutrients which provides the body with energy were calculated by using specific values of Atwater factors for protein, fat, and total carbohydrate as recommended by Birch et al. (1980).

$$\text{Energy value} = (P * 16.76) + (F * 37.71) + (C * 15.71) \text{ in } \frac{KJ}{100g} \text{ of the sample}$$

Where:

P = Protein content (%).

F = Fat content (%).

C = Available total carbohydrate (%).

Mineral and Antinutritional Factors analysis and determination of phytate/Mineral Molar Ratio

Calcium, iron, and zinc were determined by the procedure of US epa 200.7 using an Atomic Absorption Spectrophotometer (ICP-Spectroscopy: "ULTIMA-2"). After removal of organic materials by dry ashing, the residue was dissolved in dilute acid. The solution was sprayed into the flame of Atomic Absorption Spectrophotometer (ICP-Spectroscopy: "ULTIMA-2") and the absorption of the metal to be analyzed was measured at a specific wavelength.

$$\text{Mineral content } \left(\frac{mg}{100g}\right) = \frac{\lfloor (a - b) + v \rfloor}{10W}$$

Where: W = weight (g) of samples; V= volume (V) of extract; a = concentration (µg/ml) of sample solution; b = Concentration (µg/ml) of blank solution.

Phytic acid content was determined as described by Wheeler & Ferrel (1971). Briefly, the sample (0.2 g) was extracted four times for 40 min with 3% Trichloracetic acid (TCA) and then centrifuged for 30 min at 5000 rpm. Aliquot (10 mL) of the supernatant was precipitated with 4 mL $FeCl_3$ solution containing 0.2% FeCl3 in 3% TCA. The solution was heated for 45 min in a water bath (Aston VII) at 100 °C and centrifuged at 5000 rpm for 15 min. The $Fe(OH)_3$ obtained was dissolved in 40 mL of hot 3.2 N $HN0_3$ and the Iron determined calorimetrically (Corning Calorimeter, 253). The absorbance of the solution was read in a spectrophotometer (Perking Elmer Lambda 3B) at 480 nm against a reagent blank for each set of sample. The Iron content was calculated from a standard curve. Phytate phosphorus was calculated from determination assuming 4:6 Iron: Phosphorus molecular ratio. Phytic acid content was determined by multiplying the phytate phosphorus content by a constant factor of 3.55 based on the empirical formula $C_6P_6O_{24}H_{18}$.

Among the techniques used to determine the bioavailability of minerals in the human body measuring the molar ratio of phyate and minerals in the food is suggested by several authors (Morris & Ellis, 1989). The suggested desirable molar ratios *levels for mineral absorption are phytate:iron < 1* (Hallberg *et al.*, 1989), *phytate:zinc < 15* (Turnlund *et al.*, 1984;

Sandberg *et al*., 1987; Morris and Ellis, 1989),, *phytate:calcium < 0.24* (Morris and Ellis, 1985). The mole of phytate and minerals was determined by dividing the weight of phytate and minerals with its atomic weight (phytate: 660g/mol; Fe: 56g/mol; Zn: 65g/ mol; Ca: 40 g/mol). The molar ratio between phytate and mineral was obtained after dividing the mole of phytate with the mole of minerals.

For the Determination of tannin content 0.2g of the milled sample was weighed into a flask and 10ml of 4% helin methanol was pipette and close the flask with Paraffin. Shake for 20 minutes on a wrist action Shaker Centrifuged for 10 minute (4500 revolution per minutes). Absorbance of the standard Solution, Sample extract and Sample blank were read 20 minute after incubation in the Spectrophotometer at 500nm exactly.

$$\%\text{Tannin} = \frac{AU * Cstd}{Astd}$$

Where:

AU = Absorbance of unknown

Cstd = Concentration of Standard

A Std = Absorbance of Standard

5.5. Data analysis

5.5.1. Quantitative data analysis

Data collected during the household surveys were entered into spreadsheets and converted for descriptive statistical analysis using SPSS 16 . The main variable of interest, WEPs of the study Area, Socio-demographic profile of households , Agricultural land ownership (land allocated for cereal, legume and fruit and vegetable production),Food Taboo , Dietary diversity score, WEPs – knowledge, perception and availability , Limitations associated with WEPs availability and quality , WEP consumption status and frequency, WEPs available, harvested, and eaten by household members. However, during home visits, we found that the survey questions were often answered collaboratively by several family members who made an effort to represent the consumption patterns of their relatives by singling out specific groups such as children, pregnant women, and elders when discussing WEP species preferences, harvest activities, and consumption rates..

Data on the different reasons or motivations given by the survey respondents for harvesting WEPs were analyzed by calculating the incidence (i.e., 0 or 1) of a given motivation for different types of WEPs (fruit, vegetables, nuts, roots, barks) .

5.5.2. Qualitative data analysis

The qualitative data collected in focus group discussions were analyzed to help inform the quantitative data collection and analysis, complementing our understanding of the issues at hand. Focus group discussions were approached using the constant comparison technique (Glaser and Strauss 1967), which involves creating broad categories of incidents (in this case, discussion topics and responses) that are later used to develop theories that can be applied to the research question (Grove 1988). Preference ranking sessions were analyzed with help from participants during the discussion following each event to identify WEPs or further domestication or disagreement regarding the selection of WEPS species.

6. RESULTS AND DISCUSSION

6.1. WEPs of the study Area

The guided field walk and specimen collection indicated that over 54 species of wild plants were used as food **(Table 2).** Among which the result showed that, 38 (70.4%) of the edible plant parts were fruits and the remaining 9 (16.7%) , 2 (3.7%) , 2 (3.7%) ,1 (1.9%) , 1(1.9%) and 1(1.9%) of the edible parts were leaf, seed, Flower sap , root, gum and young shoot respectively **(Figure 2).** Very few are eaten as cooked where as the majority are consumed without any further processing by local communities. WEPs were identified in the office using the book "Floras of Ethiopia and Eretria", a catalog of plants and their environment and the communities where they located. During the field walk the team list more than 54 species. However, some WEPs that were cited by the participants were not available at the time of the study due to seasonality.

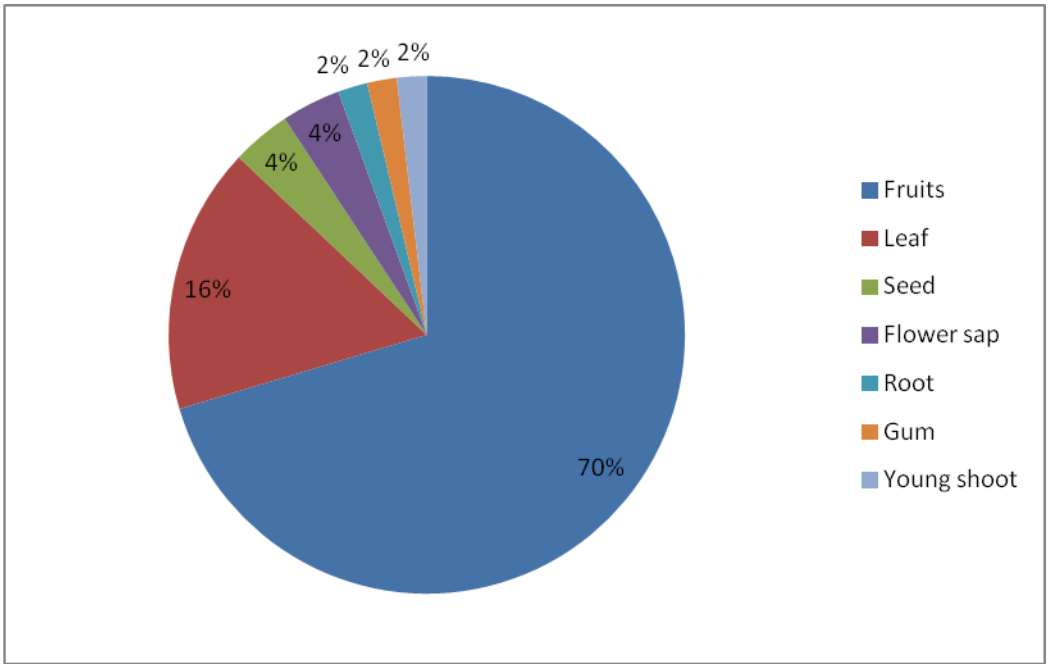

Figure 3. Used part of WEPs identified in the study area.

Table 2: Identified WEPs of the study area (Botanical name, family, used part and Mode of consumption)

S/no	Scientific Name	Family	Local name	Part used	Mode of consumption
1.	*Ferula communis* L.	Apiaceae	Dog	Yong Shoot	Raw
2.	*Capparis deciduas*	Capparidaceae	Gemero	Fruit	Raw
3.	*Carissa spinarum* L.	Apocynaceae	Agam	Fruit	Raw, Ripen
4.	*Cordia africana* Lam.	Boraginaceae	Wanza	Fruit	Raw, Ripen
5.	*Dovyalis abyssinica* .	Flacourtiaceae	Koshim	Fruit	Raw, Ripen
6.	*Embelia schimperi*	Myrsinaceae	Enkoko	Fruit	Raw, Ripen
7.	*Euclea racemosa*	Ebenaceae	Dedeho	Fruit	Raw, Ripen
8.	*Opuntia ficus-indica* (L.)	Cactaceae	Eyerusalem	Fruit	Raw, Ripen
9.	*Ficus carica* L.	Moraceae	Beles	Fruit	Raw, Ripen
10.	*Ficus sur* .	Moraceae	Sholla	Fruit	Raw, Ripen
11.	*Ficus sycomorus* L.	Moraceae	Banba	Fruit	Raw, Ripen
12.	*Ficus vasta* Forssk.	Moraceae	Warka	Fruit	Raw, Ripen
13.	*Gardenia ternifolia*	Rubiaceae	Gambillo	Fruit	Raw, Ripen
14.	*Grewia ferruginea* .	Tiliaceae	Lenquata	Fruit	Raw, Ripen
15.	*Lantana trifolia* L.	Verbenaceae	Argagifo	Fruit	Raw, Ripen
16.	*Lycopersicon esculentum*	Solanaceae	Abafinjale	Fruit	Raw, Ripen
17.	*Mimusops kummel*	Sapotaceae	Eshe	Fruit	Raw, Ripen
18.	*Oxalis latifolia*	Oxalidaceae	Michamicho	Leaf	Raw
19.	*Physalis peruviana* L.	Solanaceae	Komeydero	Fruit	Raw, Cooked, Ripen
20.	*Prunus persica* (L.)	Rosaceae	Kok	Fruit	Raw, Ripen
21.	*Pterolobium stellatum*	Fabaceae	Kentefa	Gum	Raw,Chewing
22.	*Rhus vulgaris*	Anacardiaceae	Kimmo	Fruit	Raw, Ripen
23.	*Rosa abyssinica*	Rosaceae	Kega	Fruit	Raw, Ripen
24.	*Rumex abyssinicus*	Polygonaceae	Mekmoko	Root	As spice
25.	*Rumex nervosus*	Polygonaceae	Enbuacho	Leaf	Raw, Yong
26.	*Schinus molle* L.	Anacardiaceae	Kundo berbere	Seed	Raw, Ripen
27.	*Physalis micrantha*	Solanaceae	Awut	Fruit	Raw, Ripen
28.	*Syzygium guineense*	Myrtaceae	Dokma	Fruit	Raw, Ripen
29.	*Urtica simensis*	Urticaceae	Sama	Leaf	Cooked/Boiled,
30.	*Ximenia americana* L.	Olacaceae	Enkoy	Fruit	Raw, Ripen
31.	*Ziziphus spina-christi* (L.)	Rhamnaceae	Gava	Fruit	Raw, Ripen
32.	*Allophylus abyssinicus*	Sapindaceae	Embis	Fruit	Raw, Ripen
33.	*Diospyros mespiliformis*	Ebenaceae	Betre Musie	Fruit	Raw, Ripen
34.	*Dovyalis abyssinica*	Flacourtiaceae	Koshim	Fruit	Raw, Ripen

35.	*Lantana camara* L.	Verbenaceae	Yeregna genfo	Fruit	Raw, Ripen
36.	*Morus alba* L.	Moraceae	Injori	Fruit	Raw, Ripen
37.	*Sporobolus africanus*	Poaceae	Mureye	Seed	Raw, Ripen
38.	*Moringa oleifera*	Moringaceae	Sheferaw	Leaf	Infusion, cooked as powder
39.	*Lepisanthes senegalensis*	Sapindaceae	Senbo	Fruit	Raw, Ripen
40.	*Amaranthus graecizans*	Amaranthhaceae	Aluma	Leaf	Cooked
41.	*Saba comorensis*		Ashkam	Fruit	Raw, Ripen
42.	*Acacia etbaica*	Fabaceae	Girar	Flower Sap	Sucking
43.			Sulina	Fruit	Raw, Ripen
44.			Siha	Fruit	Raw, Ripen
45.			Ababina	Fruit	Raw, Ripen
46.			Tilisa	Leaf	Raw, Ripen
47.			Welmed	Leaf	Raw
48.			Talo	Leaf	Raw
49.			Ashkambo	Fruit	Raw, Ripen
50.			Yeeregna kolo	Fruit	Raw, Ripen
51.			Abute	Leaf	Raw
52.			Chebeha	Fruit	Raw, Ripen
53.			Tulisa	Fruit	Raw, Ripen
54.	*Achanthus sennii* chiove.	Acanthaceae	Kosheshele	Flower sap	Sucking

6.2. Quantitative Dietary Assessment

Socio-demographic profile of households

The 440 women were on average 39 years old and the age group ranging from 17 (2%) to 45 (8%). Most of the women 412(92.7%) were married and living together. Some socio-demographic characteristics of the sample are summarized in **Table3**.

Agricultural land ownership

About 337 (76.6%) and 75 (17%) of the represented households had private or rented Agricultural land, respectively. While 28 (6.4%), used both private and rented land for Agricultural purpose at the time of the survey. In accordance with this, the average size of agricultural land (owned or rented) per

household in all twelve kebeles is 0.85 hectares. On average only 6.2 % of the land is used for the growing of fruit and vegetables where as 64.0% & 28.2 % of the land used for the cultivation of cereal and Legume respectively. Among the respondents 176 (40.0) have small plot of land for growing vegetables and fruits whereas 264 (60%) household have no back yard garden for the growing of fruits and vegetables. Of the produced vegetable and fruits only 93(21.1%) of the household used for own consumption whereas 77(17.5%) of the household partially sold the vegetables to generate income

Food Taboo

About 153 (34.7%) of the total respondents named at least one food type that is not cultural acceptable to be given to infants and young children. Food types frequently linked with food restriction to infants and children were cabbage, pepper and honey. Whereas during the KII and FGD discussion in all studied kebeles prohibition of consumption of legumes such as chick pea and pea was mentioned as food taboo for PLWs with a fear that if the mother eat such legumes it will cause stomach upset for the child at birth and during breast feeding.

Table 3: Basic socio-demographic characteristics of the respondents

Characteristics	Frequency (%)
Total number of subjects	440
Agro Climaatic Zone of the subjects	
Dega	176(40%)
Woyina dega	140(31.8%)
Kola	124(28.2%)
Religion	
Orthodox Christian	427 (97%)
Protestant	----------
Muslim	13(35%)
Catholic	----------
Occupation	
Farmers	385(87%)
Petty Traders	23 (5.2%)
Daily Labor	14(3.2%)
Private owned business	7(1.6%)
Other	13 (3%)
Educational status	
Illiterate	283(64.3%)
Informal education	23(5.2%)
Grade 1-4	89(20.2%)
Grade 5-8	42(9.5%)
Grade 9-12	3(0.9%)
Occupation of the Husband	

Farmers	395(89.8%)
Petty Traders	8 (1.8%)
Daily Labor	7(1.6%)
Private owned business	21(4.8%)
Other	9 (2.0%)
Partner Education Level	
Illiterate	217(49.3%)
Informal education	80(18.2%)
Grade 1-4	106(24.1%)
Grade 5-8	31(70%)
Grade 9-12	6(1.4%)

6.3. DIETARY DIVERSITY

Dietary diversity as measured by the number of different foods or food groups consumed over a given reference period is an attractive indicator of dietary quality as more varied diet is a valid nutritional outcome measure . It has been documented by many studies that dietary diversity/variety and consumption of animal source foods are promising measurement tools in developing countries, and they are indicators of overall dietary quality. They can be useful indicators of household food security and nutritional status.

The minimum women dietary diversity score of PLWs of the study area was 2.9 which is by far below the recommended minimum dietary diversity for healthy life. Whereas the average dietary diversity score of the children for the two woredas was found to be 3.56. Overall, 100 % of the respondents (women and children) have non-diversified diet . Only 2.4 % and 14.64 % of women have animal source foods and vitamin A rich vegetables in their diet during the last 24 hour before the survey respectively.

6.4. WEPs – knowledge, perception and availability

When investigating the contribution of WEPs to diets, it is important to know what the study population thinks about WEPs and what kind of attitude is predominating. These aspects are integrated in the term “WEP perception”. The WEP perception of the participants can become very important when interpreting the study results.

When the respondents were asked for the WEPs they know, each respondent cited on average 8 WEPs. In total, the participants knew 130 WEPs. From these 162 WEPs 51 could be collected and identified as indicated above. Most of the wild vegetables are available during the rainy seasons while wild fruits are rather available during the dry seasons. Most of the wild tubers are available throughout the year. The vast majority of the women did not know

any wild spices. This explains the low numbers of respondents having knowledge and information about wild spices

When Mothers/Caregivers was asked about whether they or their children regularly consumed WEPs (Fruits, vegetables, Nuts, roots and spices) and their feeling after consumption 386 (87.7%) respond they have no experience/access of eating WEPs thus they don't know the feeling. Whereas 45 (10.1%) of the women respond they regularly consume WEPs in one of the aforementioned forms and they feel good. The remaining have no clue about WEPs consumption at household level.

When they asked about the consumption of WEPs during holidays or special occasions 378 (85.9%) responds they have no experience/accesses or habit of consuming WEPS during occasions. Only 52 (11.8%) of the respondents mention at least one WEP (Fruits, vegetables, Nuts, roots and spices) consumed during the holiday. Whereas the remaining didn't remember any WEP consumed during the holiday

When they asked about the importance of WEPs during difficult circumstances such as food shortage 234 (53.2%) respond they never consider the importance of WEPs during food shortage and 206(46.8%) indicated that WEPs play an important role to compensate shortages.

Regarding access to WEPs by males 196 (44.5%) of mothers respond since they are not going to the farm or forest with males we don't have a clue whether males consumed WEPs better than females or not . But 244 (55.5%) of the respondents believed males have a better access to WEPs than females as they usually go to the field and these WEPs are consumed uncooked.

When they are asked about the attitude of childrens towards the consumption of WEPs 313(71.1%) of mothers respond childrens specially elders who kept cattles have access to WEPs and they like to eat. Whereas 127 (28.9%) respond it is difficult to guess whether children like to eat WEPs or not.

Concerning the question of WEP availability has changed over the last years, 389 (88.4%) of respondents reported decreasing availability of WEPs (Fruits, vegetables, Nuts, roots and

spices) whereas the remaining 45 (10.2%) and 36 (8.2%) reported increasing and no change in availability of WEPs over the last year respectively.

The questionnaire went further into detail concerning the perception towards WEPs. The following paragraph presents attitudes towards different aspects of WEP perception (Healthy, tasty, important and nutritious) by using three categories of agreement (Agree, not agree and neutral. From the respondents, 288 (65.4%) agree that WEPs (Fruits, vegetables, Nuts, roots and spices) are important to them. It is remarkable that 60(13.6%) and 92 (20.9%) of the respondents disagree and neutral regarding the importance, tasty, nutritious and healthy nature of WEPs.The highest/strong agreement on perception was observed for fruits (309 (70.2%) and the lowest agreement on perception was observed for nuts (218 (49.5%)

When they are asked about whether those who can afford cultivated plants also consume WEPs or not , 191(43.4%) of the respondents agree that WEPs are also consumed by those can afford cultivated crops where as 136 (30.9%) disagree that WEPs are consumed by those who can't afford cultivated crops and 110 (25%) were neutral to about the question. Similarly 279 (63.4%) of the respondents disagree that consumption of WEPs is linked with wealth status where as 102 (23.2%) agree that WEPs are foods of the poor who can't afford the cultivated crops.

6.5. Limitations associated with WEPs

WEPs Availability

Concerning WEPs availability Only 61 (13.8%) of the women reported that WEPs are always available to them if needed. The distance from the forest to the house limiting WEPs access. This limitation was cited as one of the main reasons for unavailability along with seasonality.

WEPs quality

Concerning the quality of WEPs in general (Fruits, vegetables, Nuts, roots and spices), there are few Mothers 106(29.2%) considering WEPs of good or good than bad quality. Especially the quality of wild fruits is appreciated as 19.6 % of the respondents consider their quality as good, where as only 2.8 % of the respondents consider the quality of barks as good or acceptable. The detail results are presented in **Table 4**. The main quality criterion for WEPs mentioned by respondents was aspects of taste.

Table 4: WEPs Quality

Edible part	Good n (%)	Medium/Acceptable n (%)	Insufficient n (%)
Fruit	83(19.6%)	119(28.1%)	221(52.3%)
Vegetable	42(11.1%)	45(12%)	289(76.9%)
Bark and Nuts	9(2.9%)	17(5.4%)	289(91.7%)
Root and tubers	36 (19.6%)	80(22%)	247(68%)
Spices	36(9.9%)	63(18.6%)	239(70.7%)

When they asked about any problem encounters in preparation and consumption of WEPs in general (Fruits, vegetables, Nuts, roots and spices) 334 (75.9%) of the respondents said no problem faced during preparation of WEPs where as 75 (17.0%) of the respondents mentioned some problems faced during preparation of WEPs , among the frequently mentioned problem was lack of knowledge on how to prepare for consumption specially the vegetables, spices and root crops ,while as most fruits are consumed raw they didn't face problem as long as the fruits are available.

Concerning the postharvest handling practices to prevent spoilage of WEPs 355 (80.7%) of the respondents didn't practice any post harvest preservation as WEPs are rarely available and used immediately without further storage. Concerning any problem they faced during marketing of WEPs 345 (78.4%) of the respondents said when they are available we used for own consumption thus we don't know marketing related problem of WEPs. Whereas 11 (2.5%) of the respondents mentioned shortage of market as the fruits are ripen during a specific period of the year and there is no tradition of buying WEPs.

6.6. Key informant Interview & Focus Group Discussion

This chapter is divided into objectives to match the objectives, main findings and the questions used in the focus group discussion. .

Objective 1. ***Knowledge and practices related to feeding practices of U2 children and PLWs***

Generally most KI`s are aware of

- Malnutrition is very common among children and PLWs and are more vulnerable and susceptible to malnutrition than older children

- The importance of a balanced diet and the effect of U2 children and PLWs proper nutrition on a person's life.
- The diet of young children and PLWs is more important than older children or adults based on: their special needs , their being incapable of choosing for themselves
- The importance of adequate maternal feeding for the sake of the infant.
- Malnutrition among children is linked to the lack of awareness of mothers and concern for her children's diet/ health.

Objective 2*: *Cultural habits/Food taboos affecting child feeding practice of U2 children & PLWs

Most respondents (especially elders) named at least one food type that is not cultural acceptable to be given to infants and young children. Food types frequently linked with food taboo were cabbage, pepper and honey for infants and Chick pea, pea and bean for PLWs.

Objective 3*: *Community knowledge & perception about WEPs and contribution of WEPs to the diet of mothers and U2 children(Previous and current)

- The respondent both men and women, during interviews and focus group discussions, revealed a wide knowledge of the various WEPs including their multiple uses in community life.
- Especially elders participants revealed during their time WEPs were contributing a lot to the diet of children specially whn they were keeping cattles in most case they rely on WEPs
- Most woman KI`s stated that most wild plants are collected from the wild and thus accessed by males and cattle herders.
- They further suggest deliberate planting near homes to make the WEPs accessible for womens and children staying at home
- The respondent from agriculture office revealed that these can be potentially used in the control of malnutrition in local communities.
- Focus group discussion revealed that previously WEPs were also commercialized as fruits as source of income
- There was some trade in the various species in both rural and urban areas of the province, but this was very limited and currently not exist at all .

- Participants from office of Agriculture suggest they had potential to entrepreneurs in the informal sector who could engage in this trade specially when the nutrient content and preservation and processing aspect is improved

<u>Objective 4</u>: ***WEPs known to the community, their importance to food security and cultural traditions and preference ranking***

- The respondent mentioned more than 60 WEPs and they ranked a total of 16 previously widely used WEPs because of their taste and income generating ability for domestication
- On the advantages of WEPs participants revealed that WEPs re currently a scarcity and people relying mostly on domesticated foods.
- Most participants believed that WEPs are fully produced by nature, without any human, artificial intervention and thus they consider healthy .
- One priest participant stated that WEPs survive in drought seasons and represent the strongest of the species and the finest nutrition available
- Most respondents believe if domesticated WEPs could make a positive contribution to food -security because they are well adapted to harsh environmental conditions
- Participant from office of agriculture mentioned that WEPs also needed little or no input for growth and are less expensive to produce
- However ,all participants cry for that availability and utilization of WEPs was declining

<u>Objective 5</u>: ***What factors promote, restrict or endanger future use?***

- The cultural appreciation of WEPs is an important factor in their continued use
- The dual role of many WEPs in preventative and curative health care is a strong aspect of cultural identity that is likely to support continued use.
- Moreover, most participants believed that Agriculture tends to be of low productivity rarely producing surplus thus WEPs potentially can make up the deficit using wild harvested products
- Some participants also believe that beside providing for subsistence needs WEPs can play a large part in providing much needed income .
- All FGD participants mentioned , Demographic changes, intensive agricultural development, deforestation, as underlying causes of a decline in use of edible wild plants.

- The most frequently mentioned reasons for low contribution of WEPs to the diet of the community were inaccessibility, low knowledge & consumption frequency of WEPs.
- Beside participants from Office of agriculture mentioned lack of reliable data on the chemical composition of edible wild plants is a major constraint to ignore or underestimate the role of WEPs in agriculture programs focussed on food and nutrition security. They further suggested that as composition data often is lacking or unreliable, nutrient analysis or use of substitution values may be necessary.
- Another constraint mentioned by the participants regarding WEPs availability consumption is confinement to forests and remote inaccessible areas
- During FGD , there was general agreement that everyone uses WEPs in the area regardless of their income level .

6.7. Proximate composition of selected WEPs

The proximate composition of the selected 14 WEPs is summarized in Table 5. The analyzed WEPS have average energy value of 188kcal/100gm (61.1-358.8 kcal/100gm) where as the average percentage of carbohydrate, protein and fat was 37.8 (3.9-79.1%), 6.4 (2.7-10.8%), 1.3(0.3-2.6%) respectively. Detail result from the chemical analysis of 14 widely used WEPs species is present together with pictures of WEPs (Annex 1).

The energy value of some WEPs such as *Grewia ferruginea Siha(LN)*, Ababina (LN), *Diospyros mespiliformis* is comparable to the energy value of widely used cereals such as Barely (370kcal/100gm), Corn (376kcal/100gm), Wheat (379.7kcal/100gm) and teff (355.8 kcal/100gm) (Source: Food composition table used in Ethiopia). The result showed the potential contribution of the WEPs to supplement the energy requirement of the study area population.

The average protein content of the selected WEPs 6.4 % (2.7-10.8%) also revealed the potential of WEPS to supplement protein deficiency of the study area population known by cereal based diet.. *The study found the protein content of Diospyros mespiliformis , Tulisa(LN), Ficus carica* L Ababina (LN) and *Grewia ferruginea* equivalent with the protein content of widely used cereals namely, Barely (10.10gm/100gm), Corn (8.10gm/100gm), Wheat (12.7gm/100gm) and teff (9.0gm/100gm). Similarly the fat content of the analyzed WEPs such as *Sulina(LN), Ficus carica* L, *Ziziphus spina-christi* (L.), *Grewia ferrugine*am

Ficus vasta, Yebere Kolet(LN) was comparable with fat content of Barely (1.7gm/100gm), Corn (4.4gm/100gm), Wheat (2.50gm/100gm) and teff (2.70gm/100gm). (Source: Food composition table for use in used in Ethiopia Part III). This findings demonstrate the potential contribution of edible wild plants to macro nutrient requirement and source of energy to women and U2 children in all the study areas in a number of ways. The study illustrated that wild plants added considerably to the variety of food consumed and can used in parallel to the use of cultivated and commercial species. Beside comparison between the widely used cereals and analyzed WEPs demonstrated that the fiber content of WEPs except one (*Sulina(LN*) were 3-5 fold more than the fiber content of Barely (2.4gm/100gm), Corn (2.1gm/100gm), Wheat (2.50gm/100gm) and teff (2.70gm/100gm) (Source: Food composition table for use in used in Ethiopia Part III).This finding revealed an interesting and significant contribution of WEPs to the diet of pregnant women suffered from pregnancy related constipation and oxidative stress.

Table 5: Proximate composition and mineral content of Selected WEPs

LN=Local Name

All values are means of three measurements ± standard deviation (n=3)

WEPs Species	Energy Value (kcal/100gm)	Carbohydrate (%)	Protein (%)	Fat (%)	Moisture (%)	Ash (%)	Fiber (%)
Sulina(LN)*	61.1	3.9	5.6	2.6	86.3	1.5	1.4
Diospyros mespiliformis	339.0	72.5	10.1	1.0	12.0	4.4	11.1
Siha(LN)	358.8	79.1	7.2	1.5	10.7	1.5	14.2
Tulisa(LN)	73.4	8.6	9.7	0.0	87.5	3.2	2.7
Mimusops kummel	143.8	31.9	2.7	0.6	63.3	1.5	10.8
Ficus carica L	167.5	28.8	8.6	2.0	57.9	2.7	13.9
Ziziphus spina-christi	269.3	55.4	6.5	2.4	33.7	2.0	8.0
Gardenia ternifolia	118.7	22.3	5.1	1.0	66.5	5.1	9.5
Ababina (LN)	312.7	66.3	10.8	0.5	17.6	4.9	7.8
Grewia ferruginea	341.2	70.8	8.6	2.6	15.0	2.9	14.1
Physalis peruviana	77.7	14.6	4.0	0.4	80.5	0.5	8.6
Ficus vasta	90.0	13.6	4.7	1.9	74.4	5.4	3.3
Yebere Kolet(LN)	189.1	40.3	2.9	1.8	50.6	4.7	10.4
Ficus sycomorus	99.1	21.2	2.8	0.3	70.8	4.8	6.5

6.8. Mineral content, Anti-nutritional factors and Phytate:Minerals Molar ratio of WEPs

6.8.1. Mineral Content of WEPs

From the results presented in Table 6, the mineral composition of the WEPs revealed that the selected WEPS have on average 360 mg/100gm and 20mg/100gm of Ca^{+2}, Fe^{+3} acontent respectively. The highest Calcium contents (390$\pm$ 1.3) were observed in *Ficus sycomorus* L while lowest (330 + 0.4) in *Sulina(local name).Similarly the highest (*30$\pm$ 0.03) and the lowest (12.4 $\pm$ 0.01) iron content was measured from *Diospyros mespiliformis* and *Ficus sycomorus* respectively. Whereas the WEPs have average zinc content of 2mg/100gm (ranging from 0.9 $\pm$ 0.01 to 2 $\pm$ 0.03).

The study demonstrate a significant variation between WEPs and commonly used cereals with regard to some minerals. The average Ca^{+2} content of analysed WEPs (360 mg/100gm) is 13 times higher that the Ca^{+2} content of barely (28mg/100gm) where as it is 22, 30 & 4 times higher than the Ca^{+2} content of the other widely used cereals Corn (16mg/100gm), wheat (12mg/100gm) and *teff* (92.7mg/100gm). Similarly the average Fe^{+3} content of the studied WEPs (20mg/100gm) was by far higher than all the four cereals (Source: Food composition table for use in used in Ethiopia Part III).This study found WEPs may contribute significantly to the calcium and iron requirement of Children and Mothers in the study area where getting milk and heme iron from meat and meat products is a problem.

6.8.2. Anti-nutrient content

To be able to justify the overall nutritional value of the WEPs proper assessment of the type and concentration of their anti-nutrients is necessary The phytate and tannin content of the selected 14 WEPs is summarized in Table 6.

The tannin contents of the selected WEPs showed high level of variations in all samples of plant species and its contents ranged from 3.3+0.2 mg/10gm (*Sulina*) -120$\pm$3.5 mg/10gm (*Ficus vasta*). According to Arora (1991), anti-nutritional factors has the ability to control the nutritional and food qualities of leguminous plants. Sathe *et al*. (1984) has proved that protein digestibility by tannins have adverse effects due to the formation of complexes.

Phytate concentration varies from 60 ±5.7 -140 ± 5 mg/100gm. The highest phytate concentration is found in *Siha (Local name)* and the lowest in *Ziziphus spina-christi*. High concentration of phytate greatly lower bioavailability, a general term that refers to how well a nutrient can be absorbed and used by the body. Phytate is actually the organically bounded form of phosphorus. Phytate binds with various minerals such as magnesium, calcium, zinc and iron and thus cause increase in the mineral deficiency in digestive tract of animals (Bello *et al*., 2008). These results of tannin and phytate signify the importance of processing WEPs to reduce tannin and improve protein digestibility and bioavailability of minerals.

6.8.3. Bioavailability of Minerals.

Anti-nutritional components such as tannins and phytic acid present in plant foods are known to have adverse effects on human nutrition by inhibiting iron, zinc and calcium absorption. To make sense out of the relation between anti-nutrient and minerals interpreting the result as molar ratio between the anti-nutrients and the minerals (Proxy indicator of bioavailability of minerals in the human body) is suggested by most studies. The molar ratios along with the suggested critical values for predicting the bioavailability calcium, iron, and zinc are presented in Table 6.

6.8.3.1. Molar Ratio of Phytate to Zinc.

The calculated phytate/zinc molar ratios of the selected WEPs were within the range of 4.2–13.2, which were in the range of the suggested critical level (<15 regarded as desirable limit for zinc absorption). Ratios ≥15 are associated with low zinc bioavailability. According to WHO cut-offs phytic acid to zinc mole ratio ≥15, 5–15, and <5 is equal to zinc bioavailability as low (10–15%), moderate (30–35%), and high (50–55%), respectively. In this context among the 14 studied WEPs nine had moderate zinc bioavailability, whereas high zinc bioavailability could be achieved from five of the studied WEPs.

6.8.3.2. Molar Ratio of Phytate to Calcium

Phytate/ Calcium molar ratios of all the studied WEPs *were* within the desired critical level (<0.24) as indicated in Table 6, predicting that a good calcium bioavailability could be achieved from all the selected WEPs.

Table 6. Mineral , anti-nutrient content and phytate/Mineral ratio of WEPs

WEPs Species	Ca (mg/100g)	Fe mg/100g)	Zn (mg/100g)	Tannin (mg/100g)	Phytate (mg/100g)	Phytate:Fe	Phytate:Zn	Phytate:Ca
Sulina(LN)*	330 ± 0.4	28± 0.02	1.4 ± 0.01	3.3 ± 0.2	120 ± 20	0.4	8.4	0.02
Diospyros mespiliformis	340± 0.6	30± 0.03	2 ±0.02	19.2 ±0.3	115± 11	0.3	5.7	0.02
Siha(LN)	340± 0.3	16± 0.016	2 ±0.015	93 ±1.7	140 ± 5	0.7	6.9	0.024
Tulisa(LN)	350± 0.7	25± 0.017	2 ± 0.02	66 ± 1.5	86 ± 3.1	0.3	4.2	0.015
Mimusops kummel	355±0.75	24± 0.04	1.6 ± 0.01	37.6 ± 1	70 ± 1.2	0.3	4.3	0.012
Ficus carica L	360± 0.8	24± 0.035	2 ±0.03	111 ± 3.4	90 ± 1.3	0.3	4.4	0.015
Ziziphus spina-christi (L.)	363± 0.8	24± 0.04	1.2 ±0.01	104 ± 2.04	60 ±5.7	0.2	4.9	0.01
Gardenia ternifolia	370±1.1	24± 0.025	1.5 ± 0.01	8 ± 0.8	100 ±1.8	0.4	6.6	0.016
Ababina (LN)	375± 0.9	24± 0.03	2 ± 0.03	20 ± 5.7	111 ± 2.2	0.4	5.5	0.02
Grewia ferruginea	360± 0.9	15± 0.01	2 ± 0.01	86 ±0.5	120 ± 0.6	0.7	5.9	0.02
Physalis peruviana **L**	380±0.7	23 ± 0.03	0.9 ± 0.01	50.2 ± 1.65	121. ± 1.2	0.45	13.2	0.02
Ficus vasta	380±0.7	22 ± 0.04	1.3 ± 0.01	120±3.5	105 ± 0.9	0.4	7.9	0.02
Yebere Kolet(LN)	383± 1.2	22± 0.023	2 ± 0.018	100.2 ± 0.4	96.7 ± 1.5	0.373	4.8	0.015
Ficus sycomorus L.	390± 1..3	12.4 ± 0.01	2 ± 0.02	82.6 ± 1.25	113.8 ± 0.4	0.8	5.6	0.02
Critical Values						<1	<15	<0.24

6.8.3.3. Molar Ratio of Phytate to Iron.

As indicated in Table 6, phytate/iron molar ratios were <1 (indicative of better iron bioavailability) for all studied WEPs *may suggest all WEPs* could be a better source of bioavailable iron.

6.8.4. Potential of the Studied WEPs in Meeting Macro and micro nutrients RDA of U2 Children and Pregnant women's

Table 7 summarizes the potential of WEPs in meeting under two children and pregnant women's RDA of major Macro and Micro nutrients .

Table 7. Percentage of RDA from 100gm of WEPs

WEPs	% RDA from 100 gm													
	Energy (Kcal/d)		CHO (g/d)		Protein (g/d)		Fat (g/d)		Ca (mg/d)		Fe (mg/d)		Zn (g/d)	
	U2	Pw	U2	PW	U2	Pw	U2	Pw	U2	Pw	U2	Pw	U2	Pw
Sulina(LN)*	6.8	2.5	3.6	2.2	46.7	7.9	8.7	2.8	16.6	6.6	62.2	20.8	9.4	2.6
Diospyros mespiliformis	38.0	14.0	67.8	41.4	84.2	14.2	3.3	1.1	17	6.8	66.6	22.2	13.4	3.6
Siha(LN)	40.2	14.8	73.9	45.2	60.0	10.1	5.0	1.6	17	6.8	35.6	11.8	13.4	3.6
Tulisa(LN)	8.2	3.0	8.0	4.9	80.8	13.7	0.0	0.0	17.6	7	55.6	18.6	13.4	3.6
Mimusops kummel	16.1	5.9	29.8	18.2	22.5	3.8	2.0	0.6	17.8	7.2	53.4	17.8	10.6	3
Ficus carica L	18.8	6.9	26.9	16.5	71.7	12.1	6.7	2.1	18	7.2	53.4	17.8	13.4	3.6
Ziziphus spina-christi (L.)	30.2	11.1	51.8	31.7	54.2	9.2	8.0	2.6	18.2	7.2	53.4	17.8	8	2.2
Gardenia ternifolia	13.3	4.9	20.8	12.7	42.5	7.2	3.3	1.1	18.6	7.4	53.4	17.8	10	2.8
Ababina (LN)	35.1	12.9	62.0	37.9	90.0	15.2	1.7	0.5	18.8	7.6	53.4	17.8	13.4	3.6
Grewia ferruginea	38.3	14.1	66.2	40.5	71.7	12.1	8.7	2.8	18	7.2	33.4	11.2	13.4	3.6
Physalis peruviana	8.7	3.2	13.6	8.3	33.3	5.6	1.3	0.4	19	7.6	51.2	17	6	1.6
Ficus vasta	10.1	3.7	12.7	7.8	39.2	6.6	6.3	2.0	19	7.6	48.8	16.2	8.6	2.4
Yebere Kolet(LN)	21.2	7.8	37.7	23.0	24.2	4.1	6.0	1.9	19.2	7.6	48.8	16.2	13.4	3.6
Ficus sycomorus	11.1	4.1	19.8	12.1	23.3	3.9	1.0	0.3	19.6	7.8	27.6	9.2	13.4	3.6

NB: This RDA calculation did not consider the inhibitory effect of different antinutritional factors that affect the bioavailability of Macro and Micro nutrients.

6.9. Facts, Objectives and suggested strategies to advocate WEPs

This suggested strategies has been synthesized by the team through a wide consultation among participants of FGD & KII and from global experience.

6.9.1. Facts:

The following are the major reasons forwarded by the FGD participants for working on sustainable utilization and maximum potential exploitation of WEPs

- Ethnobotanic surveys and FGD confirm that hundreds of such crops are still to be found in CARE project areas , representing an enormous wealth of agro biodiversity that has the potential to contribute to improved incomes, food security & nutrition status of Women and children.
- ***Food security and better nutrition*** : Many neglected and underutilized species are nutritionally rich and are adapted to low input agriculture.
- ***Increased incomes for the rural poor***. Most of the FGD participants regrettably express the previous role WEPs play on income generation to the poor. Moreover there is a Growing demand from consumers for diversity and novelty in foods is creating new market niches for WEPs. These market opportunities can generate additional income.
- ***Ecosystem stability***. Elders participated in the FGD explain how WEPs survive Climate change like this year and the degradation of land and water resources . Globallly there is a growing interest in crops and species that are adapted to difficult environments such as poor soil, degraded vegetation, drought
- ***Cultural Identity***. One senior Religious leader disappointingly describe the status of WEPs by saying “Our children are disconnected from their ancestors because we don’t have story to tell our children regarding WEPs ,what I ate as a childhood”. From the FGDD the team learnt that the use of WEPs has long been an intimate part of local cultures and traditions and many WEPs are consumed during occasions and play a role in keeping cultural diversity alive.

6.9.2. Suggested objectives

To benefit the community from the aforementioned facts the team set out the following objective in advocating the exploitation of the potential of WEPs

1. Prioritize WEPs and help stakeholders for participatory research, development and conservation actions of potential WEPs to supplement PLWs and U2 children diet
2. Enhance the conservation, domestication and use of potential WEPs through complementary approaches from production to value addition and consumption.
3. Strengthen the efforts of other actors working on the documentation, evaluation, improvement, processing and marketing of potential WEPs targeting PLWs and U2 children diet

6.9.3. Suggested Strategies

From global lessons and observations during the study the team establish the following as approaches/strategies to achieve the above objectives.

1. **Gathering and sharing information.** Information plays a crucial role in enhancing the use of WEPs. Often, little is known about the extent of their cultivation, agronomic requirements, local uses and values, and contribution to local food and nutrition security.
   - The present study already made important contributions to documenting information on WEPs in CARE project areas and hopefully CARE will work to strengthen its work in this area.
2. **Priority setting**
   - Identification of the species with significant contribution to the diet of PLWs and U2 children and work with key stakeholders that may have a role at various points in the domestication ,processing, marketing and consumption.
   - Working together, using nutrition and gender-sensitive approaches, these stakeholders can define priorities and identify all relevant concerns.
3. **Promoting production and use.**
   - The laboratory analysis part of the study demonstrate the potential of WEPs to address malnutrition when they deployed widely effectively.
   - They constitute essential biological assets of the rural poor and can contribute to improving the well-being of urban population in turn PLWs and U2 children diet.
   - The present study establishes:

- ✓ Building on its work with communities on diversity management on farms and in home gardens, collaborate with partner institutions (local and INGO) on the enhancement and greater use of WEPs.
- ✓ The need to support work to assess and realize the nutritional, economic and environmental value of the species.
- ✓ Importance of working with communities to identify strengths and weaknesses within existing production systems.
- ✓ Importance of working to improve seed and input -supply systems and work on key bottlenecks such as seed production

4. Maintaining diversity.

- To benefit from the contribution of WEPs to food security and better nutrition of vulnerable groups safeguarding these resources from poor conservation and high level of genetic erosion call for coordinated effort.

5. Processing, value addition and Marketing.

- During the FGD women participants explained the role WEPs play in generating income managed by womens. Thus the team found **processing of selected WEPs and s**trengthened market systems are crucial to the promotion of neglected WEPs.
- Better commercialization translates into greater opportunities for income generation by the poor farmers and wome who cultivate these species inturn improve their nutrition status.
- To make this component effective this study suggest:
  - ✓ Strategic alliances with local and INGO that have experience in marketing, processing and product development of neglected species
  - ✓ Identifying opportunities to add value through improved preparation or processing methods and the development of low cost technologies; (ii) marketing activities
  - ✓ Identifying ways to ensure that the nutritional contributions of selected WEPs are recognized and integrated into national nutritional programmes
  - ✓ Developing public awareness activities for WEPs at local and national levels and integrating such work in development-related activities, for example in conservation and home gardens

6. Strengthening partnerships and capacities.

- Safeguarding the resource base of WEPs requires concerted actions among all stakeholders.
- Local people and farmers will be the most important actors in reversing the decline in use and arresting the genetic erosion of WEPs. However, they will need to be supported by others.
- Building capacities and partnerships among all the stakeholders at national and regional levels in both formal plants genetic will be a key element in utilizing the potential of WEPs.

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Annex 1: Selected 14 WEPs pictures with proximate composition and mineral content

Scientific name: *Diospyros mespiliformis*

Vernacular Name: Betre Mussie

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	10.1	84.2	14.2
Crude fat (%)	1.0	3.3	1.1
Carbohydrate (%)	72.5	67.8	41.4
Energy (kcal/100g)	339.2	38.0	14.0
Ca (mg/100g)	*340*	17	6.8
Fe (mg/100g)	*30*	66.6	22.2
Zn (mg/100g)	*2*	13.4	3.6

Scientific name.XXXXXXXX

Vernacular Name: Yebere Kolet

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	2.9	84.2	14.2
Crude fat (%)	1.8	3.3	1.1
Carbohydrate (%)	40.3	67.8	41.4
Energy (kcal/100g)	189.1	38.0	14.0
Ca (mg/100g)	383	17	6.8
Fe (mg/100g)	22	66.6	22.2
Zn (mg/100g)	2	13.4	3.6

Scientific name: *Ficus vasta*

Vernacular Name: Warka

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	4.7	39.2	6.6
Crude fat (%)	1.9	6.3	2.0
Carbohydrate (%)	13.6	12.7	7.8
Energy (kcal/100g)	90.9	10.1	3.7
Ca (mg/100g)	380	19	7.6
Fe (mg/100g)	22	48.8	16.2
Zn (mg/100g)	1.3	8.6	2.4

Scientific name: *Mimusops kummel*

Vernacular Name: *Esheh*

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	*2.7*	22.5	3.8
Crude fat (%)	*0.6*	2.0	0.6
Carbohydrate (%)	*31.9*	29.8	18.2
Energy (kcal/100g)	*143.8*	16.1	5.9
Ca (mg/100g)	*355*	17.8	7.2
Fe (mg/100g)	*24*	53.4	17.8
Zn (mg/100g)	*1.6*	10.6	3

Scientific name: *Ziziphus spina-christi* (L.)

Vernacular Name: Gava

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	6.5	54.2	9.2
Crude fat (%)	2.4	8.0	2.6
Carbohydrate (%)	55.4	51.8	31.7
Energy (kcal/100g)	269.3	30.2	11.1
Ca (mg/100g)	*363*	182	72
Fe (mg/100g)	*24*	534	178
Zn (mg/100g)	*1.2*	80	22

Scientific name: *Gardenia ternifolia*

Vernacular Name: Gambilo

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	*5.1*	42.5	7.2
Crude fat (%)	*1.0*	3.3	1.1
Carbohydrate (%)	*22.3*	20.8	12.7
Energy (kcal/100g)	*118.7*	13.3	4.9
Ca (mg/100g)	*370*	186	74
Fe (mg/100g)	*24*	534	178
Zn (mg/100g)	*1.5*	100	28

Scientific name: *Grewia ferruginea*

Vernacular Name: Lenquata

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	*8.6*	71.7	12.1
Crude fat (%)	*2.6*	8.7	2.8
Carbohydrate (%)	*70.8*	66.2	40.5
Energy (kcal/100g)	*341.2*	38.3	14.1
Ca (mg/100g)	*360*	180	72
Fe (mg/100g)	*15*	334	112
Zn (mg/100g)	*2*	134	36

Scientific name: *Ficus carica* L.

Vernacular Name:Beles

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	*8.6*	71.7	12.1
Crude fat (%)	*2.0*	6.7	2.1
Carbohydrate (%)	*28.8*	26.9	16.5
Energy (kcal/100g)	*167.5*	18.8	6.9
Ca (mg/100g)	*360*	180	72
Fe (mg/100g)	*24*	534	178
Zn (mg/100g)	*2*	134	36

Scientific name

Vernacular Name: Siha

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	7.2	60.0	10.1
Crude fat (%)	1.5	5.0	1.6
Carbohydrate (%)	79.1	73.9	45.2
Energy (kcal/100g)	358.8	40.2	14.8
Ca (mg/100g)	34	170	68
Fe (mg/100g)	1.6	356	118
Zn (mg/100g)	0.2	134	36

Scientific name: Physalis peruviana **L**

Vernacular Name:Komeydero

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	4.0	33.3	5.6
Crude fat (%)	0.4	1.3	0.4
Carbohydrate (%)	14.6	13.6	8.3
Energy (kcal/100g)	77.7	8.7	3.2
Ca (mg/100g)	*380*	190	76
Fe (mg/100g)	*23*	512	170
Zn (mg/100g)	*0.9*	60	16

Scientific name: *Ficus sycomorus* L.

Vernacular Name: Banba

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	*2.8*	23.3	3.9
Crude fat (%)	*0.3*	1.0	0.3
Carbohydrate (%)	*21.2*	19.8	12.1
Energy (kcal/100g)	*99.1*	11.1	4.1
Ca (mg/100g)	*390*	196	78
Fe (mg/100g)	*12.4*	276	92
Zn (mg/100g)	*2*	134	36

Scientific name. XXXXXXXXXXXXXXX

Vernacular Name: Tulisa

Nutrition Information		% RDA from 100 gm	
		U2	**PW**
Crude Protein (%)	9.7	80.8	13.7
Crude fat (%)	0.0	0.0	0.0
Carbohydrate (%)	8.6	8.0	4.9
Energy (kcal/100g)	73.4	8.2	3.0
Ca (mg/100g)	350	176	70
Fe (mg/100g)	25	556	186
Zn (mg/100g)	2	134	36

Scientific name xxxxxxxxxxxxxxxxx

Vernacular Name Albina

Nutrition Information		% RDA from 100gm	
		U2	PW
Crude Protein (%)	10.8	90.0	15.2
Crude fat (%)	0.3	1.7	0.5
Carbohydrate (%)	66.3	62.0	37.9
Energy (kcal/100g)	312.7	35.1	12.9
Ca (mg/100g)	375	188	76
Fe (mg/100g)	24	534	178
Zn (mg/100g)	2	134	36

Scientific name

Vernacular Name Albina

Nutrition Information		% RDA from 100gm	
		U2	PW
Crude Protein (%)	5.6	46.7	7.9
Crude fat (%)	1.4	8.7	2.8
Carbohydrate (%)	3.9	3.6	2.2
Energy (kcal/100g)	61.1	6.8	2.5
Ca (mg/100g)	330	166	66
Fe (mg/100g)	28	622	208
Zn (mg/100g)	1.4	94	26

Annex 2: Quantitative Questionnaire (Amharic)

የመጠይቅ መለያ ቁጥር:_____

በአ/ብ/ከ/መ ደቡብ ጎንደር (አብናትና ስማዳ ወረዳ) የህፃናት፣ ጨቅላ ህጻናት፣ የጎበሰጡናና የሚያጠቡ እናቶችን የምግብ ይዘትና ለምግብነት ሊውሉ ስለሚችሉ የጫካ እፅዋት የተዚጋጀ መጠይቅ

መረጃ መስጫና ፍቃድ መጠየቂያ ቅፅ

ውድ ተሳታፊ፣ እንደምን አደሩ/ምሱ? ከኔጋ ለመወያየት ፍቃደኛ በመሆና አመሰግናለሁ፡፡ እኔ _____ ስሆን፣ የህፃናት፣ ጨቅላ ህጻናት፣ የጎበሰጡናና የሚያጠቡ እናቶችን የምግብ ይዘትና ለምግብነት ሊውሉ ስለሚችሉ የጫካ እፅዋትለማጥናት ከባህርዳር ዩኒቨርስቲየመጣ የጥናት ቡድን አባል ነኝ፡፡ የዛሬው ጉብኝቴ ዋና አላማ ከላይ የተጠቀሰውን ጉዳይ በተመለከተ መረጃ ለመሰብሰብ ነው፡፡ በዚህ ጥናት ለመሳተፍ ፍቃደኛ ከሆኑ ከ20-30 ደቂቃ የሚወስድ ቃለ-መጠይቅ እደ ርጎሊታለሁ፡፡ መረጃ በምሰበስብበት ቅፅ ላይ ስም አይመዘገብም እንዲሁም ከማንኛውም አይነት የጥናቱ ግኝት ተያይዞ አይቀርብም፡፡ በመጠይቁ ጊዜ ለመመለስ የማይፈልጉት ጥያቄ ካለ ያለመመለስ መብት ያሎት ሲሆን ጥናቱንም በፈለጉት ጊዜ ማቋረጥ ይችላሉ፡፡ ሆናም የሚሰጡን እውነተኛና የተሟላ መልስ ከህፃናት፣ ጨቅላ ህጻናትና የጎበሰጡናና የሚያጠቡ እናቶች የአመጋገብ ስራዓት እና ለምግብነት ሊውሉ ስለሚችሉ የጫካ እፅዋት ጋር ተያያዥነት ያላቸውን ችግሮች ለመፍታት የራሱ የሆን አስተዋጽ ስለሚኖረው መሉ ተሳትፎዎን እጥብቀን እንሻለን፡፡

በጥናቱ ለመሳተፍ ፋቃደኛ ናት? ፍቃደኛ ነኝ ☐ ፍቃደኛ አይደለሁም ☐

የመረጃ ሰብሳቢው ፊርማ

ስም _____ ፊርማ _____ ቀን _____

1

1. ጥናቱ የሚከናወንበትን አከባቢ የተመለከቱ መሰረታዊ መረጃዎች			
ተ.ቁ	ጥያቄ	አማራጭ/ መልስ	ማስታወሻ
1.1.	ዞን		
1.2.	የወረዳው ስም	_____	
1.3	የአካባቢው የአዊ ጠባይ	1. ደጋ 2. ወይና ደጋ 3. ቆላ	
1.3	የቀበሌው ስም	_____	

2. ተሳታፊውን የተመለከቱ መሰረታዊ መረጃዎች			
2.1	የአናት/ተንከባካቢ እድሜ በአመት	_____ አመት	
2.2	ኃይማኖት	1. ኦርቶዶክስ 2. ፕሮቴስታንት 3. ሙስሊም 3. ካቶሊክ 4.የተለየ ከሆነ ይጠቀስ _____	
2.3	የስራ አይነት	1.ስራ አጥ 2. የኑልበት ሰራተኛ 3.ገበሬ (አልፎት አና/ወይም አንስሳት ልማት) 3. ጠላ፣ አረቄ፣ እንጀራ፣ ወዘተ መሸጥ 4. አንስተኛ ንግድ 5. የግል ስራ 7. የመንግስት ወይም መ ያ ድ. ተቀጣሪ 8. ጡረተኛ 9.የተለየ ከሆነ ይጠቀስ _____	
2.3	ከፍተኛ የትምህርት ደረጃ	1. ያልተማሩ 2.መደበኛ ያልሆነ ትምህርት (ማንበብ አና መፃፍ) 3. ከ 1-3 ከፍል የተማሩ 3. ከ 4-8 ከፍል የተማሩ 4. ከ 9-12 ከፍል የተማሩ 5. ከፍተኛ ትምህርት የተማሩ	
2.4	የጋብቻ ሁኔታ	1. ያገቡ/አብረው የሚኖሩ 2. ያላገቡ 3. የተፋቱ/የተለያዩ 3. ባለቤታቸው የሞተባቸው	

2.5	የባለቤትዎ ዋና የስራ ዓይነት ምንድን ነው	1.ስራ አጥ 2. የጉልበት ሰራተኛ 3.ገበሬ (አፅዋት እና/ወይም እንስሳት ልማት) 3. አልንስተኛ ንግድ 4. የግል ስራ 5. የመንግስት ወይም መ.ያ.ድ. ተቋጣሪ 7. ጡረተኛ 8.የተለየ ከሆነ ይጠቀስ _____	
2.7	የባለቤትዎ ከፍተኛ የትምህርት ደረጃ	1.ያልተማሩ 2.መደበኛ ያልሆነ ትምህርት (ማንበብ እና መቁጠር) 3. ከ 1-3 ክፍል የተማሩ 3. ከ 4-8 ክፍል የተማሩ 4. ከ 9-12 ክፍል የተማሩ 5. ከፍተኛ ትምህርት የተማሩ 7. አላውቅም	
2.8	ቤተሰብዎ የራሱ የሆነ ወይም የከራይ የአርሻ መሬት አለው?	1. አዎን (የቤተሰቡ መሬት) 2. አዎን (የከራይ መሬት) 3. የለም	
2.9	የመሬቱ መጠን በአከባቢው የልኬት ስያሜ ምን ያህል ይሆናል?	1.መጠኑ _____ መለኪያው _____ 2. አላውቅም/አርግጠኛ አይደለሁም	
2.10	ቤተሰቡ በዋንኛነት የሚያመርተው የአገዳና የብርዕ አህል አይነት ምንድን ነው? (መረጃ ሰብሳቢ፡ ከአንድ በላይ መልስ ሊኖር ይችላል፡፡)	1. ጤፍ 2. በቆሎ 3. ስንዴ 3. ማሽላ 4. ዘንጋዳ 5. እንሰት 7. የተለየ ከሆነ ይጠቀስ _____	
2.11	ቤተሰቡ በዋንኛነት የሚያመርተው የጥራጥሬ አይነት ምንድን ነው? (መረጃ ሰብሳቢ፡ ከአንድ በላይ መልስ ሊኖር ይችላል፡፡)	1. ባቄላ 2. አተር 3. ሽንብራ 3. አኩሪ አተር 4. ምስር 5. የተለየ ከሆነ ይጠቀስ _____	
2.12	ቤተሰቡ ካለው መሬት ምን ያህሉ የአገዳ፣ የብርዕ ፣ የጥራጥሬ አህሎች፣ አትክልትና ፍራፍሬ ለማምረት ይውላል	1. የአገዳና የብርዕ አህል———— % 2. የጥራጥሬ አህሎች ————% 3. አትክልትና ፍራፍሬ————%	

3

2.13	**አትክልትና ፍራፍሬ የሚያመርቱበት የጓሮ አርሻ አሉት?**	**1. አዎን** **2. የለም**	
2.13	ቤተሰቡ በዋነኛነት የሚያመርተው የጓሮ አትክልት አይነት ምንድን ነው? (መረጃ ሰብስቢ፡ ከአንድ በላይ መልስ ሊኖር ይችላል፡፡)		
2.14	**መልሶት አዎን ከሆነ ያመረቱትን አትክልትና ፍራፍሬ እንዴት ይጠቀማሉ?**	**1. ሁሉንም እሸጣለሁ** **2. በከፊል እሸጣለሁ** **3.ሁሉንም ለቤት እጠቀማለሁ** **3.የተለየ ከሆነ ይጠቀስ** _____	
2.15	የቤተሰቡ አባላት በቁጥር	_____	
2.17	ምን ያህል ከሁለት እመት በታች (ከ23 ወር በታች) የሆኑና አብረዎት የሚኖሩ ልጆች አሉዎት?	1. አንድ 2. ሁለት 3.የተለየ ከሆነ ይጠቀስ _____	
2.18	የተመረጠው ልጅ ስም ይመዝገብ፡፡	_____	
2.19	የልጅዎ እድሜ በወራት	_____ወር	
2.20	የልጅዎ የፆታ	1. ሴት 2. ወንድ	
ጋህፃናት እንዳይበሏቸው በባህል ስለተከለከሉ ምግቦች የተመለከቱ ጥያቄዎች?			
3.1	በአከባቢዎ ህፃናት እንዳይበሏቸው በተለምዶ/በባህል ምክንያት የሚከለከሉ የምግብ አይነቶች አሉን?	1.አዎን 2. የለም 3. አላውቅም/አርግጠኛአይደለሁም	
3.2	ካሉ ይጠቀሱ፡፡	_____ _____	
3.3	ምግቡ/ቦቹ ለህፃናት ምክከለከሉት ምክንያት ምንድን ነው? ለየትኞቹ አይነት ህፃናት ነው ምግቡ/ቦቹ የሚከለከሉት (በአድሜ፡ በፆታ፡ ወዘተ)?	_____ _____	
3.3	በአከባቢው የዚህ አይነት ባህል ካለ ለየትኞቹ አይነት ህፃናት ነው ምግቡ/ቦቹ የሚከለከሉት (በአድሜ፡ በፆታ፡ ወዘተ)?	_____ _____	
3.4	ልጅዎ ከላይ የተጠቀሱትን ምግብ/ቦች እንዳይበላ ተከልክሏል (ወይም ሊከለከሉት አቅደዋል)?	1. አዎን 2. የለም 3. አርግጠኛ አይደለሁም	

4

4. በተፈጥሮ የሚገኙ የሜካ የሚበሉ እፅዋት			
4.1.	በተፈጥሮ በሜካ ከሚገኙ ፍራፍሬዎች,አትክልቶች፣ ቅመማ ቅመም፣የስራስር ተክሎችና ምን ምን ያጠቃሉ?*	*የሚያውቋቸውን የሜካ የሚበሉ እፅዋቶች የአካባቢ መጠርያና እና ቋንቋውን ይመዝግቡ ለሲታዉሉ የምታዉቋትን ሁሉ ከሰንጠረዥ መዝግቡ **ማምቆ ማለት መጠቀም ማለት አይደለም	

ሰንጠረዥ. 4.2. & 4.3.ስለሚያወቋቸው የተፈጥሮ ሀገዉ የሚበሉ እፅዋት ይመልሱ

Nr. ተ.ቁ	(4.1) የተፈጥሮ ሀገዉ የሚበሉ እፅዋት የ አካባቢ መጠርያ	(4.1) ቋንቋ	(4.2)* የሚበላው የእፅዋት ክፍል	(4.3) እፅዋቱ የሚገኝበት ወራት
1				
2				
3				
3				
4				
5				
7				
8				
9				
10				

*የሚበላው የእፅዋት ክፍል (ፍራፍሬዎች,አትክልቶች፣ ቅመማ ቅመም፣ ስራስር ፣ ቅጠል ፣ ዘር ፣ቅርፊት፣ ግንድ፣ የእፅዋቱን የዉስጥ ክፍል እና ታዳጊ ቅጠላቅጠል

			ለኮበሰጡርና የሚያጠቡ እናቶች		ለህፃናትና ጨቅላ ህፃናት (ከ 2 ዓመት በታች)	
			አዎ (1)	አይደለም (0)	አዎ (1)	አይደለም (0)
4.3	የሚከተሉትን አዎ (1) ወይም አይደለም (0) በማለት ይመልሱ	1. የሜካ ፍራፍሬ ምግቦችን አዘዉትሬ አመገባለሁ፣ ጥሩ ስሜትም ይሰማኛል				
		2. የሜካ ቅጠላቅጠል ምግቦችን አዘዉትሬ አመገባለሁ፣ ጥሩ ስሜትም ይሰማኛል				
		3. የሜካ ቅርፊታቸዉ ጠንካራ የሆነ (ለዉዝ መሳይ) ምግቦችን አዘዉትሬ አመገባለሁ፣ ጥሩ ስሜትም ይሰማኛል				

5

		4. እኔ የጤና የስራስር ተክሎች(ጉሽርጥ) አዘጋትሬ እመገባለሁ፤ ጥሩ ስሜትም ይሰማኛል				
		5. የጤና ቅመማቅመም አዘጋትሬ እመገባለሁ፤ ጥሩ ስሜትም ይሰማኛል				
4.4	የሚከተሉትን እዎ (1) ወይም አይደለም (0) በማለት ይመልሱ		ለትክክለኛና የሚያጠቡ እናቶች		ለህፃናትና ጨቅላ ህፃናት (ከ 2 ዓመት በታች)	
			እዎ (1)	አይደለም (0)	እዎ (1)	አይደለም (0)
		1. የጤና ፍሪፍሬ በበየዓላት ወቅት እመገባለሁ				
		2. የጤና ቅጠላቅጠሎችን በበየዓላት ወቅት እመገባለሁ				
		3. የጤና ጠንካራ ቅርፍት ያላቸዉን(ሰዉዝ) በበዓላት ወቅት እመገባለሁ				
		4. የጤና ስራስሮችን በበየዓላት ወቅት እመገባለሁ				
		5. የጤና ቅመማቅመም ለበዓላት ምግብ ዝግጅት እጠቀማለሁ				
4.5	የሚከተሉትን እዎ (1) ወይም አይደለም (0) በማለት መልሱ		ለትክክለኛና የሚያጠቡ እናቶች		ለህፃናትና ጨቅላ ህፃናት (ከ 2 ዓመት በታች)	
			እዎ (1)	አይደለም (2)	እዎ (1)	አይደለም (2)
		1. የጤና ፍሪፍሬ በችግር ጊዜ ለምግብነት አስፈላጊ ናቸዉ				
		2. የጤና ቅጠላቅጠሎች በችግር ጊዜ ለምግብነት አስፈላጊ ናቸዉ				
		3 . የጤና ቅርፈታቸዉ ጠንካራ የሆነ (ሰዉዝ መሳይ) በችግር ጊዜ ለምግብነት አስፈላጊ ናቸዉ				
		4. የጤና ስራስር በችግር ጊዜ ለምግብነት አስፈላጊ ናቸዉ				
		5.የጤና ቅመማቅመም በችግር ጊዜ ለምግብነት አስፈላጊ ናቸዉ				

6

4.7	የሚከተሉትን አዎ (1) ወይም አይደለም (0) በማለት መልሱ		ለክለሰጠርና የሚያጠቡ እናቶች		
			አዎ (1)	አይደለም (2)	
		1. ወንዶች የጫካ ፍራፍሬዎችን ይመገባሉ			
		2. ወንዶች የጫካ ቅጠላቅጠል ይመገባሉ			
		3. ወንዶች የጫካ ቅርፊታቸዉ ጠንካራ የሆኑ (ለዉዝ መሳይ) ምግቦችን ይመገባሉ			
		4. ወንዶች የጫካ ስሪሐር ይመገባሉ			
		5. ወንዶች የጫካ ቆመማቆመምን ይመገባሉ			
4.8	የሚከተሉትን አዎ (1) ወይም አይደለም (0) በማለት መልሱ		ለክለሰጠርና የሚያጠቡ እናቶች		
			አዎ (1)	አይደለም (2)	
		1. ሴጆቻቸን የጫካ ፍራፍሬዎችን መመገብ ይወዳሉ			
		2. ሴጆቻቸን የጫካ ቅጠላቅጠል መመገብ ይወዳሉ			
		3. የጫካ ቅርፊታቸዉ ጠንካራ የሆኑ (ለዉዝ መሳይ) ምግቦችን መመገብ ይወዳሉ			
		4. ሴጆቻቸን የጫካ ስሪሐር መመገብ ይወዳሉ			
		5. ሴጆቻቸን የጫካ ቆመማቆመምን መመገብ ይወዳሉ			

7

4.9	፤ አሁን ያለዉ የጫኔ ፍሪፍሬ ምግቦች	1 = ከበፊቱ ጨምሯል 2 = ከበፊቱ ልዩነት የለዉም 3 = ከበፊቱ ቀንሷል
	2. አሁን ያለዉ የጫኔ ቅጠላቅጠል ምግቦች	1 = ከበፊቱ ጨምሯል 2 = ከበፊቱ ልዩነት የለዉም 3 = ከበፊቱ ቀንሷል
	3. አሁን ያለው ቅርፈታቸዉ ጠንካራ የሆኑ (ለዉዝ መሳይ) የጫኔ ምግቦች	1 = ከበፊቱ ጨምሯል 2 = ከበፊቱ ልዩነት የለዉም 3 = ከበፊቱ ቀንሷል
	4. አሁን ያለዉ የጫኔ የስሪስር ምግቦች	1 = ከበፊቱ ጨምሯል 2 = ከበፊቱ ልዩነት የለዉም 3 = ከበፊቱ ቀንሷል
	5. አሁን ያለዉ የጫኔ ቅመማ ቅመሞች	1 = ከበፊቱ ጨምሯል 2 = ከበፊቱ ልዩነት የለዉም 3 = ከበፊቱ ቀንሷል
4.10	፤ የጫኔ ፍሪፍሬ ምግቦች ለእኔ ጤና ተስማሚ፣የተመጣጠነና፣ጣፋጭ ናቸዉ	1=አስማማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል
	2. የጫኔ ቅጠላቅጠል ምግቦች ለኔ ጤና ተስማሚ፣የተመጣጠነና፣ጣፋጭ ናቸዉ	1=አስማማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል
	3. ቅርፈታቸዉ ጠንካራ የሆኑ (ለዉዝ መሳይ) ምግቦች ለእኔ ጤና ተስማሚ፣የተመጣጠነና፣ጣፋጭ ናቸዉ	1=አስማማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል
	4. የጫኔ ስሪስሮች ለእኔ ጤና ተስማሚ፣የተመጣጠነና፣ጣፋጭ ናቸዉ	1=አስማማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል
	5. የጫኔ ቅመማቅመም ለኔ ጤና ተስማሚ፣የተመጣጠነና፣ጣፋጭ ናቸዉ	1=አስማማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል

4.11.	የተመረቱ ፍሪጭሬዎችን፡ቅጠላቅጠሎችን፡ቅርፊት ያለቸዉን፡ስሪስርቸዉና ቅመሞችን የሚመገቡ ሰዎች በሜካ የሚገኙትን ተመሳሳይ ነገሮች ይመገባሉ	1=አስማምማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል
4.12.	የሜካ የሚበሉ ምግቦት የደህ ምግቦት ናቸዉ	1=አስማምማለሁ 2=አልስማማም 3=መስማማትም አለመስማማትም ይቸግረኛል
	5.የሜካ የሚበሉ ምግቦች ጨስንነቶች በተመለከተ	
5.1.	1. የሜካ ምግቦትን መመገብ ቢፈልጉ በቀላሉ ማግኘት ይቻላል?	1= አዎ 0=አይገኙም
	2. ካልተገኙ ምክንያቱን ይግለጹ	
	3. የሜካ ፍሪጭሬዎት ጥራት ምን ይመስላል	1= ዝቅተኛ 2=መካከለኛ 3= ጥሩ
	4. የተመለከታችሁት የጥራት መመዘኛዎት ምን ምን ናቸዉ	
	5. የሜካ ቅጠላቅጠል የጥራት መመዘኛዎች እነዴት ናቸዉ ናቸዉ	1= ዝቅተኛ 2=መካከለኛ 3= ጥሩ
	6. የተመለከታችሁት የጥራት መመዘኛዎች ምን ምን ናቸዉ	
	7. የሜካ ጠንካራ መሸፈኛ ያላቸዉ(ለዉዝ) ጥራት ምን ይመስላል	1= ዝቅተኛ 2=መካከለኛ 3= ጥሩ
	8. የተመለከታችሁት የጥራት መመዘኛዎት ምን ምን ናቸዉ	
	9. የሜካ ስሪስርቸት ጥራት ምን ይመስላል	1= ዝቅተኛ 2=መካከለኛ 3= ጥሩ
	10. የተመለከታችሁት የጥራት መመዘኛዎት ምን ምን ናቸዉ	

	11. የጫካ ቅመማቅቅም ጥራት ምን ይመስላል	1= ዝቅተኛ 2=መካከለኛ 3= ጥሩ
	12. የተመለከታችሁት የጥራት መመዘኛዎች ምን ምን ናቸዉ	
	13. የጫካ የሚበሉ ምግቦች በሚዘጋጁበት ጊዜ ወይም በሚመረቱበት ጊዜ ችግር ገጥሟችሁ ያዉቃል 1=አዎ 2= አልገጠመን 0=አይመለከተንም	አዎ ከሆን ይዘርዝሩ?
	14. የጫካ የሚበሉ ምግቦች እንዳይበላሹ ወይም በምታከቅምጡበት ጊዜ ችግር ገጥሟችሁ ያዉቃል 1=አዎ 2= አልገጠመን 0=አይመለከተንም	አዎ ከሆን ይዘርዝሩ?
	15. የጫካ የሚበሉ ምግቦችን የምትሸጡ ከሆን በገበያ ወቅት ችግር ገጥሟችሁ ያዉቃል 1=አዎ 2= አልገጠመን 0=አይመለከተንም	አዎ ከሆን ይዘርዝሩ?
	16. ከሚበሉ የጫካ ምግቦች ጋር በተያያዘ የገጠማችሁ ችግሮች አሉ ? 1=አዎ 2= አልገጠመን 0=አይመለከተንም	አዎ ከሆን ይዘርዝሩ?
5.2.	ለወደፊት በፕሮጀክቱ ለማምረት ብትፈልጉ የትኛዎቹን የጫካ ምግቦች ለማምረት ትመርጣላችሁ መረጃ ሰብሳቢዎች፡ ሁሉንም በመረጃ ስበሰባዉ ጊዜ የተሰበሰቡትን የጫካ ምግቦች እንብቡና አሳቹ	አምስት የጫካ ምግቦችን በመዘርዘር ምክንያቶቹን ጥቀሱ 1. 2. 3. 3. 4.

መጠይቁ ተጠናቋል፡፡ ለተሳትፎዎ ለሰጡን ጊዜ በእጅጉ እናመሰግናለን፡፡

10

Annex 3: Quantitative Questionnaire (English)

Annex 3: Quantitative questionnaire (English)

ID No of the Questionnaire: _____

Questioniare for Infant, young children, pregnant and lactating women feeding practice and Wild edible plants, CARE Project Areas of Amahara National Regional state (Ebinat and Simada Woredas)

Information and Consent

Dear respondent

Good morning/Good afternoon. Thank you for your interest to talk with me today. I am _____who is a member of a team from Bahir Dar University conducting a study to assess **Infant, young children, pregnant and lactating women feeding practice and Wild edible plants** in your locality. The purpose of my visit today is to take information from you on the aforementioned issue. If you are willing to participate in the study, I will ask you few questions for 20-30 minutes. Your name will not be written on this form and will never be used in connection with any of your information. You do not have to answer any question that you are not comfortable with, and you may end this task any time you want to. However, your honest answers to these questions will help us in better understanding of the child feeding practice in your locality, and will eventually help in designing and implementing appropriate interventions to alleviate related problems.

Hence we greatly appreciate your participation in the study.

Are you willing to participate in the study? Yes No

Signature of the data collector……..

Name _____ Signature _____ date _____

1

1. Background Information about the Area			
No	Questions	Choices or Answers	Remark
1.1.	Zone		
1.2.	Woreda	_____	
1.3	Agro-ecological character	1. Dega 2. Woina Dega 3. Kolla	
1.4	Kebele	_____	

2. Socio-Demographic Information			
2.1	Age of the mother/caregivers in completed years	_____ Years	
2.2	Religion	1. Orthodox 2. Protestant 3. Muslim 4. Catholic 5. Other _____	
2.3	What is your Occupation	1. Unemployed 2. Daily laborer 3. Farmer (crop and/or livestock) 4. Selling Enjera, , Kolo, Areke , Tella etc 5. Other petty trade 6. Privately owned business 7. Government/NGO employee 8. Pensioner 9. If other specify _____	
2.4	What is your highest educational attainment?	1. Illiterate 2. Can Read and/or Write (informal education) 3. Grade 1-4 4. Grade 5-8	

2

		5. Grade 9-12 6. Tertiary education	
2.5	What is your marital status?	1. Married/living together 2. Never married 3. Divorced/separated 4. Widowed	Skip to2.8
2.6	What is the occupation of your husband/partner?	1. Unemployed 2. Daily laborer 3. Farmer (crop and/or livestock) 4. Petty trade 5. Privately owned business 6. Government/NGO employee 7. Pensioner 8. If other specify	
2.7	What is the highet education attainment of your Husband/Partner	1. Illiterate 2. Can Read and/or Write (informal education) 3. Grade 1-4 4. Grade 5-8 5. Grade 9-12 6. Tertiary education	
2.8	Does your household owned or rented any land for agriculture?	1. Yes, owned land 2. Yes, rented land 3. No	Skip to 2.13
2.9	How many (local units) of agricultural land does the household	1. _____ Units 2. I don know /Not sure	

3

	owned/rented?		
2.10	What are the major cereals the household produced	1. Teff 2. Maize 3. Wheat 4. sorghum 5. Zengda 6. Enset 7. Other , specify _____	
2.11	What are the major legumes the household produced	1. Bean 2. Pea 3. Chick pea 4. Soya bean 5. Lentile 6. Other , specify _____	
2.12	Percentage of land covered by Cereals, legumes and fruit and vegetable	1. Cereal---------- % 2. Legumes ----------% 3. Fruit and vegetable----------%	
2.13	Do ypu have backyard farm to produce fruits and vegetables?	1. Yes 2. No	
2.14	What are the major vegetables and fruits you produce in backyard farm?		
2.15	If yes how do you use the produced vegetables and fruits ?	1. All for sell 2. Partly sell 3. all for own consumption 4.Other, specify _____	
2.16	Household size	_____	
2.17	How many under two years children (who are living with you) do you have?	1. One 2. Two 3. If other, specify _____	
2.18	Name of the selected child **(Data Collector: Select the child using simple random sampling technique)**	_____	
2.19	Age in completed months of	_____Months	
2.20	Gender of (NAME)	1. Female 2. Male	

3. Complimentary food preparation and feeding related Question			
3.1	At what months of age did you start to give additional food to (NAME)?	_____ Month	
3.2	What type of solid, semisolid, or soft foods do you most commonly feed to (NAME)? **(Data Collector: Multiple answers are possible)**	1. Cereal based Gruel 2. Cereal and legume based gruel 3. Cereal and legume based porridge 4. Cereal, legume and vegetable based gruel 5. Cereal, legume and vegetable based gruel 6. Cereal, legume and vegetable, meat or egg based gruel 7. Cereal, legume and vegetable, meat or egg based gruel 8. Enjera with wot 9. If other, specify _____	
3.3	How do you obtain the ingredients of the complementary foods that you fed to (NAME) yesterday?	1. Produced by the household 2. Purchased at the market 3. Some are purchased while others are produced 4. Food aid 5. Safety net 6. If other specify_____	
3.4	List all the ingredients with limited availability.	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____	
3.5	When such ingredients become unavailable, what coping Mechanisms do you employ? **(Data Collector: Probe on exhaustive list. For example: food aid, changing the ingredients, reducing the volume and frequency of feeding etc)**	_____ _____ _____ _____ _____	
4. Food Taboo to Young Children and Pregnant women			
4.1	In your locality is there any food that is not culturally allowed to be given to young children and pregnant women?	1. Yes 2. No → 3.Not sure/I don't know	Skip to 5.1
4.2	If yes, specify it/them.	----------	

5

		--	
4.3	If yes, what is the reason behind the food taboo?	---------- ---------- ---------- ----------	
4.4	If yes, to which specific group of young children (in terms of age, sex or any other character) the food item is precluded?		
4.5	Was (NAME) precluded (or planned to be precluded) from aforementioned food/s?	1. Yes 2. No 3.Not sure	
5. Wild Edible Plants (WEP)			
5.1.	What are the wild berries you know? *	*Note vernacular names and the respective language in the first column of the attached table *Knowing does not mean use, but we seek knowledge.	
	What are the wild vegetables you know? *		
	What are the nuts, spices, tubers or other wild food plants that you know? *		

Table. 5.2 – 5.3. Continue WEP plant by plant and ask the questions to 5.2. & 5.3. (See table).

Nr.	(5.1) Wild edible plants	(5.1) Language	(5.2)* Use part	(5.3) Time of year that the plant is available
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

*Part used (whole fruit, fruit skinless, seedless fruit, seed or almond, adult leaves, roots, bark, stem, sap, and young leaves

5.4	Repond yes (1)		Mother (PLWs)	Childrens (<2 years)

6

	or not (0) on the following assertion		Yes (1)	No (2)	Yes (1)	No (2)
		1. I regularly eat wild fruits & feeling good				
		2. I regularly eat wild vegetables & feeling good				
		3. I regularly eat wild edible nuts & feeling good				
		4. I regularly eat wild tubers & feeling good				
		5. I regularly eat wild spices & feeling good				
5.5	Repond yes (1) or not (0) on the following assertion		Mother (PLWs)		Childrens (<2 years)	
			Yes (1)	No (2)	Yes (1)	No (2)
		1. I eat wild fruits for special occasions				
		2. I prepare wild vegetables for special occasions				
		3. I eat wild edible nuts for special occasions				
		4. I prepare wild tubers for special occasions				
		5. I am preparing with wild spices for special occasions				
5.6	Repond yes (1) or not (0) on the following assertion		Mother (PLWs)		Childrens (<2 years)	
			Yes (1)	No (2)	Yes (1)	No (2)
		1. Wild fruits have an important contribution during difficult times				
		2. Wild vegetables have an important contribution during difficult times				
		3 Wild nuts are an important contribution during difficult times				
		4. Wild tubers have an important				

7

		contribution during difficult times				
		5. Wild spices have an important contribution during difficult times				
5.7	Respond yes (1) or not (0) on the following assertion		Mother (PLWs)		Childrens (<2 years)	
			Yes (1)	No (2)	Yes (1)	No (2)
		1. The men of my household consuming wild fruits				
		2. The men of my household consume wild vegetables				
		3. The men of my household consume wild nuts				
		4. The men of my household consume wild tubers				
		5. The men of my household consume wild spices				
5.8	Respond yes (1) or not (0) on the following assertion		Mother (PLWs)		Childrens (<2 years)	
			Yes (1)	No (2)	Yes (1)	No (2)
		1. Children like to eat wild fruits				
		2.Children like to eat wild vegetables				
		3. Children love eating wild nuts				
		4. Children love eating wild tubers				
		5. Children love eating wild spices				
5.9	1. The availability of wild fruits is:		1 = Greater than before; 2 = Does not change 3 = Smaller than before			
	2. The availability of wild vegetables is		1 = Greater than before; 2 = Does not change 3 = Smaller than before			
	3. The availability of wild nuts is		1 = Greater than before; 2 = Does not change 3 = Smaller than before			
	4. The availability of wild tubers is		1 = Greater than before; 2 = Does not change 3 = Smaller than before			
	5. The availability of wild spices is		1 = Greater than before;			

8

		2 = Does not change 3 = Smaller than before
5.10	1. Wild fruits are nutritious, Healthy, tasty and important to me	1=Agree 2=Not Agree 3. Neither agree nor against
	2. Wild vegetables are nutritious, Healthy, tasty and important to me	1=Agree 2=Not Agree 3. Neither agree nor against
	3.Wild nuts are nutritious, Healthy, tasty and important to me	1=Agree 2=Not Agree 3. Neither agree nor against
	4. Wild tubers are nutritious, Healthy, tasty and important to me	1=Agree 2=Not Agree 3. Neither agree nor against
	5. Wild Spices are nutritious, Healthy, tasty and important to me	1=Agree 2=Not Agree 3. Neither agree nor against
5.11.	Those who are able to afford the cultivated fruit, Vegetables, nuts, tubers and spices also eat wild fruit, Vegetables, nuts, tubers and spices	1=Agree 2=Not Agree 3. Neither agree nor against
5.12.	WEPs are the foods of the poor	1=Agree 2=Not Agree 3. Neither agree nor against
6. Constraints associated with WEP consumption		
6.1.	1. If you want to eat PAS, do they are available?	1= Yes 0=No
	2. If not, explain (what product, reason ...)	
	3. How is the quality of Wild fruit	1= Poor, 2=Medium , 3= Good
	What are the quality criteria you observe	
	4. How is the quality of Wild Vegetable	1= Poor, 2=Medium , 3= Good
	What are the quality criteria you observe	

9

	5. How is the quality of Wild Nuts	1= Poor, 2=Medium , 3= Good
	What are the quality criteria you observe	
	6. How is the quality of Wild Roots	1= Poor, 2=Medium , 3= Good
	What are the quality criteria you observe	
	7. How is the quality of Wild spices	1= Poor, 2=Medium , 3= Good
	What are the quality criteria you observe	
	8. Do you encounter problems during the preparation or processing of WEPs 1=Yes 0=No NA	If Yes which?
	9. Do you encounter problems during the preservation or storage of WEPs? 1=Yes 0=No NA	If Yes, which?
	10. If you make the sale, do encounter problems with respect to marketing? 1=Yes 0=No NA	If Yes, which?
	11. Do you still have other constraints linked with WEPs?	If Yes, which?
6.2.	In the future If we want to plant in the home garden, which WEPs You prefer? **Enumerator**: Read and show all the WEPs collected during the field survey	(Mention 5 and reason) 1. 2. 3. 4. 5.

Thank you for your participation

10

Annex 4: Qualitative guidelines/FGD Guide (English)

Focus Groups Discussion Form

1. Focus Group number:..... 2. Date of Focus Group:.....3. Meeting place:.....

4. Moderator's name.....

5. Note-taker's name .....

4. Participants' information:

S/N	Name	Age	Other information (Social position , having PL wife or U2 children

5._____ Start time: :

6._____ End time:

7. Topics to cover during the Focus Group Discussion:
   - Knowledge and practices related to feeding practices of children under 2 years
   - Maternal nutrition during pregnancy & lactation
   - Cultural habits/Food taboos affecting child feeding practice
   - Cultural habits affecting/Food taboos maternal nutrition during pregnancy & lactation
   - What is your Knowledge about WEPs
   - What are the fruits, vegetables nuts, spices, tubers or other wild food plants that you know?
   - How do you evaluate the contribution of WEPs to the diet of mothers (Previous and current)
   - How do you evaluate the contribution of WEPs to the diet of U2 Childrens
   - Do you/your families use WEPs
   - Do you/your families use WEPs
   - Among family members who use /has access for WEPs

- How do you judge the importance of WEPS in relation to health , nutrition, safety to your family specially for mothers and childrens ?
- Do you know the used part and mode of consumption of WEPs available in the kebele (Read the list)
- Determine importance of each used part to village (1-5)
  - ✓ Vegetables
  - ✓ Fruits
  - ✓ Nuts
  - ✓ Tubers/Root
  - ✓ Spices
    - How do you judge their importance?
    - What are the major preparation, Preservation and consumption methods practiced for each used part
- Mention if there is specific time to consume WEPs (Food availability, occasion and WEP consumption
- Mention where WEPs are harvested from (Tree, shrubs, grass land, closed canopy) Read the list
- Dependency of user category on product. Poor, middle , rich
  - ✓ How dependent is each user category on WEPs?
- What are the major barriers in accessing WEPs
- What are the major facilitators in accessing WEPs
- Are there some WEPs you know which may be toxic?
- Would you compare the consumption of WEPs today and in previous time
- Would you compare the availability of WEPs today and the previous time
- What social awareness strategy you think effective in advocating the use of WEPs
- Which stakeholders do you think play a role in in popularizing WEPs consumption
- What are your major 5 WEPs you think better contribute for Maternal and child nutrition

8. Observations and comments about Focus Group
   - Participation level
   - Group dynamics
   - Was the subject covered as planned?
   - Others

Matrix for analyzing Focus Group discussion output

Recommendation / Question	Knowledge, reasons, and attitudes

9. Final recommendations

The final (tested) recommendations should be listed in the matrix below.

Matrix for listing final recommendations

Final Recommendations

Annex 5. Edible wild plants and micronutrients: Dietary intake studies 1980's-1990's

Author	Title	Type of study/sample size/ target group	Methodology	Key findings	Comments
Campbell BM (1987)	The use of wild fruits in Zimbabwe	3 ecological areas, 225 households (hh) Adults, children pre-school and school-age	Questionnaire, 24-h recall with added questions on wild foods.	Most hh use wild fruits. Often the only type of fruits in diet. 24 h recall does not catch consumption of wild foods; additional questions needed. Reasons given for consumption: good vit C source Important for primary school children and for the rural poor people, protect fruit trees of preferred species, active marketing of wild fruits. Consumption has not decreased with deforestation	
Dettwyler KA (1986)	Infant feeding in Mali, West Africa: Variations in belief and practice	136 children	Repeated open ended interviews with mothers, 24 h recall	Focus on patterns of introduction of solids to infant diets. Casual mentioning of wild fruits to very young children and use of "less common vegetables" Mangoes and other wild fruits sometimes given to very young children	
Fleuret A (1993)	Dietary and therapeutic uses of fruit in three Taita communities	25 children 3-17 y, random sub sample of larger study	Child following, recorded intake 1 week, 3 seasons	97 species used regularly or seasonally, 77 wild. Over 50 % of school children ate only wild fruits during school days. Such snack foods eaten 3-7 times daily. Wild fruits added to children's diets from 3-4 months. Fruits in therapy mostly given to children.	The nutritional role of wild fruits is neglected as they are not seen as part of meals or as foods. Contradicts their central role in supplying some vitamins and minerals Roots and leaves from wild fruit trees used as home remedies
Gibson et al. (1991)	Food consumption patterns and trace element intakes of children from the Wosera, Papua New Guinea	67 children 6-10 years	24 h recall interactive analysis of vegetables: Ca, Cu, Mg, Zn	Some analysis of the role of 4 green leafy vegetables (cultivated and wild analysed together) Green leaves major source of Ca(67%), Fe (42%), Zn (21%), Mg (58%) Overall intake of Ca/Fe/Zn inadequate=2/3s of RDA in 43%/, 25%, 76% of children; low bioavailability due to high fibre intakes	
Herzog et al. (1994)	Consumption and composition of gathered wild fruits in the V-Baoule, Cote D'Ívoire	545 interviews with 40 adults and children	Monthly 24-h recalls for 1 year chemical analysis of 11 species of fruits	At least 50 % of all fruits eaten are wild. In addition many escapees, also people are familiar of another 22 species Macro and micronutrient data for the fruits include proximate analysis, Ca, Fe, Mg, K, Vit C, carotenoids, thiamin, riboflavin, niacin	

Hongo et al (1989)	Element intake of the Gidra in lowland Papua: Inter-village variation and the comparison with contemporary levels in developed countries	4 villages 6-8 households	Weighed food records before cooking for 14 days Estimates of intake of 17 elements	Focus on element intake of all foods eaten and water. Wild seeds noted as important for the high Fe intake. Wild cycads/lotus seeds contributed 32 % of total Fe intake. comparison of elemental intakes with data from Japan, USA and Europe	
Humphry et al (1993)	Food diversity and drought survival. The Hausa example	Integrated approach 2 villages with different geographical and botanical situations 112 households (29 men and 83 women)	One season, questionnaire survey, repeated interviews (2-3 times per hh), Identification of species, frequency of use, and consumption by hh, collection of samples, analysis of 21 species proximate analysis and 34 species re selected minerals	Comparing food procurement during drought and normal years. 84 wild dietary species identified, 93% hh collected wild foods regularly for own consumption, 39 eaten regularly by over 50% of hh, 19 % hh also sold wild plants for extra income. Chemical analysis of 34 popular plants including Ca, Fe, Cu, Zn, Mg, Mn	
Huss-Ashmore and Curry (1991, 1994)	Dietary intake among rural women in Swaziland	110 women in rural areas, + 24 h recall on pre-school children	24 h recall repeated monthly for one year; nutrient profile by analysis using combined data base from previous studies + USDA and South African food tables	Only 26 % of leafy vegetables used are cultivated. On average 15-90 g of wild veg are eaten daily. Diet adequate in iron, vit A vit C	Part of larger study on nutrition and crop production. Reconfirms that overall food pattern remains very similar to that of 50 years ago
Kunarattanapruk et al. (1998)	Yearly household record of food from the forest for home consumption by rural villagers in north east Thailand	7 households in 1 village 2 hh landless , 5 average economy	Weighed food records for 1 year	Species used, data provided by household including average weight of different types of forest foods, seasonal variations, food budget savings.	Combined with RRA see Somnasang et al. (1985)
McGregor, J (1995)	Gathered produce in Zimbabwe´s communal areas changing resource availability and use	3 villages, 44 households	24 h recall, focus on fruits and leafy vegetables	80 % of fruits eaten by poor hh are wild. Highly seasonal. Late dry season especially 39 species of leafy vegetables Important contribution to micro nutrients	Differential use by socio-economic group. Increased use of weeds on disturbed lands
Nordeide et al. (1996)	Nutrient composition and nutritional importance of green leaves and wild food resources in an agricultural district , Koutiala, in Southern Mali	2 cross-sectional surveys Random selection of household clusters 179 urban and 111 rural households	Food frequency + focus group discussions; analysis of 7 leafy vegetables (proximate, amino acids, minerals, carotenoids)	Wild foods important in both rural and urban hh but more so in rural. Data on %hh using different species in two seasons Rich in micro- nutrients Chemical analysis of 7 major species	Notes that Mali (like many poor countries) lacks national food composition tables
O´Dea et al. (1988)	An investigation of nutrition related risk factors in an isolated Aboriginal community in Northern Australia: advantages of a traditionally-oriented life-style	Australian Outstation Aboriginal group, 18 adults, 6 children	Food record 9 + 7 days, biochem. analysis, of several blood parameters including Hb, red-cell folate	Data on wild food consumption (animal and plants); only one case of anaemia, high folate intake	Study focus on type 2 diabetes with change in lifestyle.

Ogle BM and Grivetti LE (1985)	Legacy of the Chameleon: Dietary utilisation of wild plant resources in four ecological zones in rural Swaziland	Cross sectional study with rural households in 4 ecological zones +school children in same areas	Inventory of species;1 year-frequency recall + 24 h recall among 211 adults; 3 day food recording of 140 school children; analysis of 29 species (proximate and trace elements)	224 species of fruits and vegetables used. All hh consume wild plants; 39% hh use wild vegetables more than cultivated species; 56 % use wild vegetables throughout year	
Omori K and Greksa LP (1996)	Dietary patterns and dietary adequacy of Highland Pwo and Sgaw Karen of NW Thailand	Pre school children and their mothers 8 villages, 148 adults and 95 pre-school children	24 h recall and food frequency records within anthropological study 3 seasons sampled	All gathered vegetables and fruits in addition to home produce. Significant difference between villages in food diversity More diverse diet where more wild foods were used. Lower Kcal/vit A/Fe/Vit C in group with less diverse diets. Children's diets inadequate in all micronutrients except vit C	Illustrates difference in use of wild foods between villages in same area. Illustrates higher nutrient density in more diverse diets
Osuhor PC (1990)	Weaning practices amongst the Hausas, Nigeria	238 women interviewed on infant/child feeding		Focus on weaning and weaning foods. Mentions use of wild foods in relish which is served most days with staple foods. Some bitter leaves are also used to rub on nipple to stop child from breast feeding	
Rahman et al (1993)	Can infants and young children eat enough leafy vegetables from a single meal to meet their daily vitamin A requirement?	118 children, age 6-35 months	Interviews with mothers on food intake of child and perceptions on feeding leafy vegetables to infants and children	Feeding study using traditional leafy vegetables, which could be both cultivated and wild. 58%/73%/100% of children in age groups 6-11m/12-17m/18-35 m took over 75% of RDA in single meal. 87% ate spontaneously. Only two mothers did not want to feed traditional leafy vegetables to young children. Children ate 25-143 g in one meal	
Shrimpton R (1989)	Vitamin A deficiency in Brazil: Perspectives for food production oriented interventions	Analysis of national household expenditure survey data and regional food consumption figure with regards to vitamin A content	Calculates Vitamin A scores and groups foods accordingly Regional analysis of sources of vitamin A in diets	Notes that many native Brazilian fruits have high contents of carotenoids and high vitamin A scores. They are ignored in modern development, often destroyed with new developments and there is a trend that people also in areas where high carotenoid fruits are available, replace these by apples, pears and oranges which have higher status Calls for promotion of indigenous species	
Somnasang et al. (1985)	Natural foods Thailand	8 villages in 3 provinces in North Thailand, 13 households	Rapid Rural Appraisal	Up to 50% of all foods consumed by some villagers are natural. Includes vegetables growing naturally in rice fields and forests but also insects and small aquatic animals in rice fields. Gives chemical composition of 7 major vegetables. Notes that some wild vegetables thrive with use of pesticides and fertilisers others disappear. Notes that there are some restrictions in which plants pregnant women should use	Combined with weighed food records see Kunarattanapruk et al. (1998)

Uiso F and Jones T (1996)	Consumption patterns and nutritional contribution of Crotalaria brevidens (mittoo) in Tarime district, Tanzania	74 women in one district, recruited through women´s groups	7-day frequency recall 24h recall, quantified analysis of β-carotene in 2 samples	49% of vegetables consumed were wild; vegetables constitute 23% of all foods by frequency; 21 species of wild fruits; 16% of meals have wild veg; important source of vit A as few animal products in diet	
Villard L and Bates CJ (1987)	Dietary intake of vitamin A precursors by rural Gambian pregnant and lactating women	62 pregnant and 119 lactating women in one location and and 36 pregnant women in another location	Monitored for 1 year including assessment of vitamin A foods twice weekly, by weighing and recall, analysis of carotene and retinol content of representative food samples.	Major seasonal variations in vitamin A intake, mostly as carotenoids. Ripe mangoes and palmoil were important seasonal sources of carotenoids, as were leaf sauces. Few animal products used . Average intake of vitamin A below RDA and large individual variations in intake. No physiological signs of deficiency	
Zeitlin et al. (1992)	Mothers´ and children ´s intakes of vitamin A in rural Bangladesh	2 sites involving several villages each, 370 women and their young children (98% of all hh with children age 3-20 months)	7 month dietary study, monthly 24-h recalls	Dark green leaves were major source of vitamin A- the only one available in abundance. During two months mangoes were major supplier of carotenoids. Focus on traditional foods rather than wild. On average intake of vitamin A among women was 72% of RDA for lactating women. With breast milk included, intake of children came close to RDA. Concludes that traditional diets need protection and promotion.	
Zinyama et al. (1990)	The use of wild foods during periods of food shortage in rural Zimbabwe	7 villages small farm hh in low rainfall area	Questionnaire survey 194 hh (275 interviews)	Large variation between villages. In villages where wild plants are commonly used, 78/47/41 % of hh use these during drought as principle strategy to cope. Overall in all villages 14 % use wild foods as principle strategy of coping in drought. Wild vegetables and fruits also used in normal times. In drought, government assistance is a more important strategy but 57% of those with Govt assistance also used wild plants and 87% of those who gather also got Govt assistance during drought	

Annex 6: Edible wild plants and micronutrients: Integrated studies including chemical analysis of micro nutrients

Author	Title	Type of study/sample size/ target group	Methodology	Key findings	Comments
Booth et al. (1992)	Nutrient content of selected indigenous leafy vegetables consumed by the Kekchi people of Alta Verapaz, Guatemala	Integrated study	Chemical analysis of 13 leafy vegetables	Part of dietary study but only chemical analysis presented in this paper. Mineral analysis and carotenoids (AOAC and HPLC)	Uses FAO promotion of vegetables and homegardening to justify importance of study
Gibson et al. (1991)	Food consumption patterns and trace element intakes of children from the Wosera, Papua New Guinea	Integrated study Table 1a	Analysis of vegetables: Ca, Cu, Mg Zn	Some analysis of the role of 4 green leafy vegetables (cultivated and wild analysed together)	
Herzog F et al (1994)	Consumption and composition of gathered wild fruits in the V-Baoule, Cote D'Ivoire	Integrated study see Table 1a Chemical analysis of 11 species of fruits	Proximate analysis, vitamin A, thiamin, riboflavin, niacin vitamin C, Fe, Mg; K, Ca	Wild fruits make important contributions to nutrition, for variation and complementation. They are in danger of disappearing and this may be harmful to nutrition status	
Humphry et al (1993)	Food diversity and drought survival. The Hausa example	Integrated study see Table 1a Analysis of 34 species	Proximate analysis 21 species selected minerals of 34 species	Chemical analysis of 34 popular plants including Ca, Fe, Cu, Zn, Mg, Mn	
Malaisse and Parent (1985)	Edible wild vegetable products in the Zambezian woodland areas. A nutritional ecological approach	Integrated study 20 key informants	2 year inventory based on weekly surveys , interviews with key informants and chemical analysis of selected nutrients	Identification of 241 species. Samples and analysis of 184. Chemical analysis of 15 oil seeds/seeds, 11 roots, 11 flowers, 25 tubers/bulbs, 31 leafy vegetables, 91 fruits-including proximate analysis, Fe, Ca, P	
Nordeide et al. (1996)	Nutrient composition and nutritional importance of green leaves and wild food resources in an agricultural district , Koutiala, in Southern Mali	Integrated study see Table 1a	Analysis of seven leafy veg (proximate, amino acids, minerals, carotenoids)	Rich in micro- nutrients	Notes that Mali (like many poor countries) lacks national food composition tables
Ogle BM and Grivetti LE (1985)	Legacy of the Chameleon: Dietary utilisation of wild plant resources in four ecological zones in rural Swaziland	Integrated study Table 1 a Analysis of 29 species of vegetables	Proximate, calcium and 11 trace elements using x-ray flourescence techniques	Summary table and comparison with previously published data wild and some common cultivated vegetables and fruits	
Smith et al. (1996)	Mineral values of selected plant foods common to southern Burkina Faso and to Niamey, Niger, West Africa	Sites in 3 villages in 2 provinces with different botanical situations	Study period bridging dry and rainy season. Focus group interviews with villagers, identification of species used, sample collection for analysis. Samples collected around fields and purchased from local markets	36 wild foods and three local cultivated vegetables analysed re Cu, Fe, Mg, Mn, Zn. 36% of plants used in local diets were wild. In terms of volume, wild plants accounted for 20 % of all food items eaten Several wild vegetables had higher mineral values than available cultivated vegetables	

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Final Report Submitted to: CARE ETHIOPIA

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