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Neutraceutal Wild Plants of SemiArid East Shewa, Ethiopia: Contributions to Food and Healthcare Security of the Semiarid People

[1]Debela Hunde Feyssa, [2]Jesse T. Njoka, [2]M.M. Nyangito and [3]Zemede Asfaw
[1]Department of Land Resources and Agricultural Technology, College of Agriculture and Veterinary Sciences, University of Nairobi, Hom Institute Jimma University, Ethiopia
[2]Department of Land Resources and Agricultural Technology, College of Agriculture and Veterinary Sciences, University of Nairobi, Kenya
[3]Department of Biology, College of Natural Sciences, Addis Ababa University, Ethiopia

Corresponding Author: Debela Hunde Feyssa, Department of Land Resources and Agricultural Technology, College of Agriculture and Veterinary Sciences, University of Nairobi, Hom. Institute Jimma University, Ethiopia

ABSTRACT

Ethnobotanical study was conducted in six study sites of semi arid east Shewa, Ethiopia. The study has aimed to identify key nutraceutical wild plants and documents associated indigenous knowledge. It also analyzed local use and management practices and implications to food and health security of people living in semi arid areas. Data was obtained ethnobotanically by field observations, focus group discussions and interviews. Qualitatively data were described by narrating and quantitatively summarized in tables, percentages and ranking matrixs. Twenty nutraceutical plants were identified; 35% shrubs, 6% trees and 5% liana for human food, livestock feed and medicine. Transhumant pastoralists used (95%) nutraceuticals and settled farmers (65%). Twenty nutraceutical wild plants were used to treat 11(55%) human and 9(45%) livestock ailments/ health problems. There are a good number of nutraceutical plants which can be used for nutrition and healthcare system of semiarid people. Transhumant pastoralists were more intimate with nature and more knowledgeable. Hence, they adapt to climate change by using locally available nutraceuticals for themselves and their livestock. Climate change adaptation strategies can be built on this indigenous knowledge for sustainable use of nutracuticals for nutrition and health security.

Key words: Nuraceuticals, wild edible plants, climate change, adaptation, food security, healthcare, semiarid Ethiopia

INTRODUCTION

Wild food consumption is common in rural areas of Ethiopia. Wild plants are also important as a food supplement and means of survival during times of drought and famine (Bharucha and Pretty, 2010). In parts of southern Ethiopia, the consumption of wild food plants appears to be one of the most important local survival strategies and to have intensified due to the repeated climatic shocks hampering agricultural production, thus leading to food shortages (Guinand and Dechassa, 2000). The wild food plants are of special nutritional importance as sources of vitamins, minerals, trace elements, dietary fibre and protein. They contribute to improved local food security, augment people's income and help overcome some health problems associated with nutrient deficiency

(Asfaw, 2009). Those wild edible plants which are used for medicine and classified as nutraceuticals. Medicines for primary health care of over 80% of the population of Ethiopia are mainly derived from plant products. Among the illnesses that are most often treated with medicinal plants include, internal parasites, skin ailments, tapeworm infections, snake poisons, dog bites and diseases of liver.

Literatures explain that, nutraceuticals are a food or naturally occurring food supplements with beneficial effect on human and livestock health or a food with or believed to have medicinal properties (Bidlack, 1998; Gemedo-Dalle *et al*., 2005; Detwiler, 2007; Food and Culture Encyclopedia, 2010) defined nutraceuticals as natural ingredients that exist in foods and are considered the source of health benefits beyond their nutritional contribution. Identification of these foods will allow their incorporation into a more healthful diet and may enhance development of new food products. This implies that food contains nutrients that are dually essential to body functions and prevent or cure diseases thereby linking diet and health. Numerous phytochemicals (plant chemicals) that occur in fruits and vegetables are key issues of research and evidences exist regarding their health-promoting properties (Al-Fayad and Ajlouni, 2006).

Indigenous fruits and seeds of trees and shrubs are commonly consumed fresh in many parts of Ethiopia by children, herders and hunters. This helps to maintain their nutritional and medicinal content and value. Fentahun and Hager (2009) have reported that wild fruits contribute greatly to nutrition and health security of rural people because of many major food substances such as proteins, vitamins and minerals in them. Therefore, it is better to eat them fresh without changing their nutrient contents. Cooking the fruits mostly affects some parts or large parts of the nutrients which provide balanced nutrient and keep the body health. Fentahun and Hager (2009) explained that rural people of Ethiopia have knowledge of wild fruits useful in protection of diseases. But because of their greater interest in livestock and livestock products, their culture of using the fruits is limited. On the contrary, Europeans and Americans have highly developed their wild fruits and they have added value to their use. They have realized that, using wild food from plants is of greater value to protect their health and environment than industrial food (Detwiler, 2007; Gillman, 2008). Using fruits from trees both the wild and farms improve human blood circulation; prevent diabetics, obesity, cancer and chance of being affected by heart diseases (Jeambey *et al*., 2009). Research on sustainable utilization of these edible and medicinal wild plants is inadequate in Ethiopia. This is due to the fact that humans usually focused on cultivated plants and gave less attention to wild plants. Those ones that offered important flavors and sources of essential nutrients to the diet have declined in popularity with modernity (Guinad and Lemessa, 2000). This may have resulted in starvation of people in the midst of wild edible plants. The practice of nutraceutical plant use is not new in communities throughout the world. Little recognition is given in promoting local community's use and management of nutraceuticals wild plants. This negligence emanates from disregard of integrated use of indigenous nutritional and health management practices of the local people. Therefore, the objective of this work was to: (1) identify key nutraceutical wild plants of east Shewa, Ethiopia and document associated indigenous knowledge and (2) analyze the use and management practices of nutraceutical plants and their implications to food and health security of the semi arid people.

MATERIALS AND METHODS

Study area: The study was conducted in semi- arid zone of east Shewa in Fantalle and Boosat districts located between 7°12'-9°14' N latitudes and 38°57'-39°32' E longitudes in the northern part of the Great East African Rifty Valley in Ethiopia (Fig. 1). The climate of the area is hot with

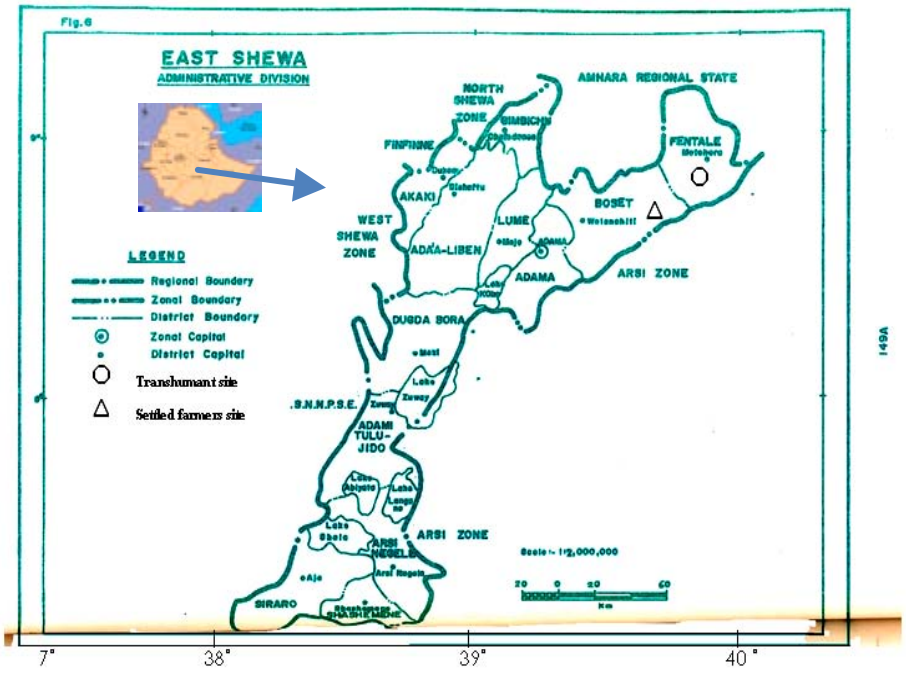

Fig. 1: Map of the study area showing fantalle and boosat districts of east shewa. Ethiopia

erratic, variable rainfall and unreliable for agricultural activities. Economic activities of the area are mostly livestock production but people in Boosat generally practice mixed agriculture consisting of livestock and crop production. In recent years people tended to intensify crop (cereal) agriculture due to population pressure and shortage of pasture land which aggravated land resources degradation enhanced the aridity due to climate change (FDFED, 2009). The vegetation of the area lies in the broad leaved vegetation category of the Somalia-Maasi center of endemism described by White (1983) and described as Acacia woodland vegetation by Demissew and Fiiris (2009). It harbors diversity of plants and wild animals including many wild edible plants. However, it is declining due to anthropogenic factors and climate change (FDFED, 2009). This has affected both natural resources and the food and health security of the area.

Methods: Ethnobotanical methods were conducted from October, 2009 and July, 2010 to identify nutraceutical wild plants, analyze their availability, uses and management. Following reconnaissance study three study sites from Fantalle (Galcha, Qobbo, Dheebiti) and three from Boosat (Xadacha, Trii Bireeti and Digalu Tiyo) districts were selected. Guided field inspection, with key informants, field observations along six transects laid in two districts of Fantalle and Boosat districts were used to identify nutraceutical plants, collect ethnobotanical information on their use and management (Martin, 1995; Cotton, 1996; Balemie and Kebebew, 2006). Information collected were verified by focus group discussions with key informants (14 transhumants and settled farmers) selected from each study site following methods of Hedberg (1993), Martin (1995) and IIRR (1996).

Field walks with key informants for identification of nuraceutical wild plants, voucher specimen collection and discussion were employed. These activities are standard ethnobotanical methods used by Martin (1995) and Cotton (1996). It involves walking in the study sites with knowledgeable key informants for *in situ* identification of nuraceutical wild plants. *In situ* identification was followed by plant specimen collection (voucher specimens) for botanical identification in Herbariums and laboratories. Direct observation and discussion with key informants during "walk in the woods" also conducted along the walking. Ethnobotanical information on plant use and management was gathered from semi-structured interview of 120 randomly selected households.

Data analysis: The data obtained through field observations, focus group discussions and semi-structured interviews were described and summarized in tables, percentages and ranking was done. Jaccard's coefficient of similarity was calculated for species use similarity between transhumant and settled farmers (Kent and Coker, 1992). The value of Jaccard's coefficient of similarity can be calculated for species use similarity between transhumnats and settled farmers communities in the study area. Higher values indicate the presence of many common species used by both communities and vice versa. JCS= c/c+b+a, where, a= number of species found only in habitat A (settled farmers), b = is number of species found only in habitat B (transhumant), c = number of species in habitat A and B. Finally, JCS was multiplied by 100 in order to obtain the percentage species composition similarity between the transhumant and settled farmers area following methods of Kent and Coker (1992) for habitat types (Ladio *et al*., 2007) comparison between cultures and used by Marsden and Pilgrim (2003) for diversity between habitats.

RESULTS

Edible and medicinal wild plants of semi arid east shewa, Ethiopia: A total of 20 nutraceutical plants (60%) trees, (35%) shrubs and (5%) liana) were identified. People of the study area use diverse nutraceutical wild plants for food, human and livestock medicine. Transhumant pastoralists use 95% of the species while settled farmers use 65% of the identified nutraceutical plants. Parts of plants used were also much greater for transhumants than those of settled farmers (Table 1).

The nutraceutical wild plants are distributed in 15 families and 20 genera. Tiliaceae with highest (4) followed by Rhamnaceae (3) and 13 families with 1 species each. Families and botanical names of each species are given in Annex 1.

Indigenous knowledge and use categories of nutraceutical wild plants: Major use categories of nutraceutical plants identified were food, medicine, livestock fodder and environmental services. The indigenous people of Fantalle district identified more plants indicating variation in

Table 1: Number of Habits and edible parts of nutraceutical wild plants

	Habit of nutraceutical plants					Edible parts of wild plants			
District	Tree	Shrub	Lianna	Herb	Fruit	Seed	Leaf and fruit	Fruit and bud	Gum
Boos	6	7	1	0	9	1	1	1	1
Fant	12	6	1	0	18	1	1	2	4
Total*	18	13	2	0	17	2	2	3	5

*The figures in total row indicate relative numbers not total nutraceutial plans as one plant can exist in both districts

indigenous knowledge between communities (Table 2). This was because of the lifestyle of transhumant pastoralists were more environmental friendly and better biological security than settled farmers' which was relatively degrading by expansion of agriculture and settlements. Hence, it has resulted in variation of nutraceutical wild plants species found in the districts. These variations in resource identification and categorizing can be used as an asset for diversifying livelihood sources to enhance resilience for coping and adaptation to climate change.

Jaccard's Similarity Coefficient (JCS) value indicated that transhumants know a greater number of human 30% and livestock 46.7% medicines than settled farmers (Table 2). This indicated that transhumant pastoralists' livelihoods were harmoniously integrated with the vegetation and animal resources of their surroundings. This can be foundation on which modern development can be built and upscaled.

Direct field observation in Fantalle and Boosat districts showed that wild plants are under threat by anthropogenic activities such as agricultural expansion and over harvesting exacerbated by climatic changes. People used more trees than herbs as the area is semi arid and the availability of herbs in semi arid areas is constrained by erratic and unreliable rainfall. Trees and shrubs are more adapted to drought in the study area.

Medicinal uses of Nutraceutical wild plants: The availability of good number of indigenous plants used to treat a number of human and livestock diseases have contributed to nutrition and healthcare system of transhumant and settled framers of east Shewa. These plants are given in Annex 1 with their complete information. The former use more number of parts of nutraceutical wild plants for treatment of human and livestock diseases. It implies that, relatively greater numbers of diseases were treated by transhumant using these plants than in the case of settled farmers (Table 3).

Key informants explained that, the gum from *Acacia mellifera* was edible by people of east Shewa. It was highly preferred by transhumant pastoralists as food and medicine for stomach ache and malaria. They also explained as it increases male sexual potency when fried gum is eaten with

Table 2: Species similarity between transhumant and settled farmers for nutraceutical wild plants use category and JCS

	Total No. of nutraceutical walid plants reported by:					
Categories of plants	Total No. of indentified	Transhumant	Settled farmer	Both	Jaccard's coefficient of similarity	Percentage similarity
Food plants	20	19	14	13	0.70	70
Human medicine.	20	19	14	13	0.65	65
Livestock medicine	15	15	8	8	0.53	53.33

Table 3: Parts of plants used for human and livestock medicine and diseases treated

	Plant parts used for medicine						No. of diseases treated					
District	Leaf	Fruit	Leaf and fruit	Gurm	Bark	Bark and stem	Fruit and bud	H. dis	Vr. Himan	dis	L.dIS	Vr L.dis
Boosat	5	1	1	1	1	2	1	0	9	2	6	1
Fantall	7	3	1	4	1	2	1	1	12	2	9	2
Total*	10	4	2	5	2	4	2	1	12	4	15	3

*Parts used repeat not indicating total plant in this case

milk or when taken as a soup with milk. Pounded wet barks of *Berchemia discolour* mixed with milk and allowed to curdle; it is known itichu in Oromo language. Full soup cup of the supernatant is served as a drink for 10 days. Key informants explained that, it rejuvenates human body by strengthening bones and muscles and which is similar action as gum of *Acacia senegal*. *Ziziphus spina-chrsti* and *B.aegyptiaca, G.villosa. G.bicolor X. americana* and *G. tenax* were nutraceutical plants of medicinal use both to human and livestock. Focus group discussion with key informants showed that, many wild edible plants are nutraceutical plants in nature indicating their multipurpose use to enhance semiarid people's health by nutrition and their medicinal properties. Nutraceutical wild plants of priority concern for east Shewa include, *X. americana, Z.spina-christi, B.aegyptiaca*, complete list of nutraceutical wild plants identified from vegetation of the study area are given in Annex 1. These plants can basis for further research and development work on nutraceutical wild plants.

Diseases treated using nutraceutical wild plants: Twenty of the identified nutraceutical wild plants were used to treat 11(55%) human and 9(45%) livestock diseases by local people. Twenty species were for human and fourteen for livestock primary healthcare system. Diseases treated by nutraceuticals include internal and external parasites, diseases of internal organs such as the liver and regenerating sick body of humans and livestock. Three species (*B. aegyptiaca, C. monica* and *G. flavescens)* were used for humans and two species (*B. discolor* and *G. flavescens)* for livestock to treat various diseases. No further specifications were possible to attain because some such specific aspect of indigenous knowledge are not made accessible for outsiders. Only members of family get access after oaths known as EBBA in Oromo language by father or mother or elder community leaders (Table 4).

Table 4: Diseases treated using nutraceutical plants of east Shewa

Diseases treated	Human No. of sp. boosat	No. of sp. fantalle	Livestock No. of sp. boosat	No. of sp. fantalle
Toothache	3	2	2	1
Toung infection	1	1		
Stomach diseases	5	4		
Amoeba	0	2		
Appetizer	0	1		
Antifungal(smoke milk container)	1	2		
Antifungal(smoke water container)		1		
Eye infection	1	1	2	2
Chest pain	0	1		
Wound	1	2	0	1
Fever	1	0		
Diahrrae			1	1
Expel placenta			2	3
Mastatities			0	1
Feed ruminants			0	1
Liver diseases			1	1
Back bone diseases in goats			0	1
Enhance digestion			1	1
Various diseases	3	2	1	2

Nutraceutical and poisonous wild edible plants: Plants such as *Grewia* species and *Lantana camara* are perceived by local people as edible with some poisonous effect if eaten in large quantities digestive system will protest forcefully causing stomach pain in children. An example of such plant in east Shewa is fruits of *Grewia* species identified in this study. When eaten in excess of tolerable amounts *Lantana camara* was also perceived as poisonous while still edible by children and currently by adults. *Lantana camara* is one of the exotic species that is invasive in drylands of Ethiopia. However, people are using it for food, medicine and other multiple purposes. Hence, in-depth investigation is essential to find out socioeconomic and environmental benefits. *Opunitia ficus- indica* is used for food as, medicine and environmental and other socioeconomic benefits. But the milky exudates of the leaves have an irritating effect on external body and can kill if internally taken without concocting to other farm crops.

Distribution of nutraceutical plants in the vegetation of the study area: Nutraceutical wild plants grow in all the study sites and some of them become rare and often found as part of agroforestry or hedges or live fences and on road sides. Evidence to this is *Z. spiina-christi, B. aegyptica, Berchemia discolour, Acacia mellifera* and very few shrubs such as *Grewia* spp. These "key plants" represent the core wild food flora of east Shewa. Some of them include: *Ziziphus spina-christi, X. americana, B. aegyptiaca, G. villosa, B. discolor, Debora glabera, Tamarindus indica*. Their availability varies from place to place and between species. Some of them are rare species in the study area. Nutraceutical wild plants were rare because of expansion of agriculture, settlements and overgrazing/browsing caused by population pressure. Forest were being squeezed to small and far from settlements and towns and nutrceutical wild plants like *Debera glabra, X. americana, Berchemia discolor, Grewia villosa* are already restricted on stony hill sides and park border closure and isolated areas. *Carisa spinarum* was found around plains and mountain, gorgy and secluded areas of Fantalle and Boosat districts.

Observed characteristics of *Z. spina-christi* is that it starts to give fruits after the rainy season around the end of November and becomes fully ripe up to end of December and continue to give fruits all over the year until the beginning of the main rainy season of June-September. It is highly drought resistant plant, can grow and produce fruits and leaves under stress climate consequences. This adaptation of the species is also shared by *B.aegyptiaca*. This is also abundant in the study area indicating that it is highly drought resistant nutraceutical wild plant. This characteristic is useful in sustainable provision of nutrition, medicine and multiple uses to semi arid people all round the year.

Habitats for collecting nutraceutical wild plants: Nutraceutical plants used by people of Fantalle and Boosat were collected from various habitats. Only very few were partly managed around and in household farms in case of settled farmers and near their settlements areas and maintained traditional closure pasture areas kalo in the case of transhumant pastoralists. They are distributed in woodlands, scrublands, rocky hillsides, degraded wood and pasturelands, roadsides, in ritually and spiritually protected areas as MUKA IRRECHA i.e. groves and trees where people praise GOD known as WAAQA in Oromo language and ask their needs concerning peace, health, production, good weather such as sufficient rain and reduced drought (Table 5).

Table 5: Habitats where people collect neutraceutical plants and their numbers (N =120)

	Number of respondent by district			
Habitats of WEPs	Boosat	Fantalle	Total	%
Forest and pasture land	10	47	57	47.5
Bush lands	3	3	6	5.0
Agroforestry	11	3	14	11.7
Live fences	5	0	5	4.2
Roadsides	1	0	1	0.8
(Grow in garden near homestead and forest)	1	0	1	0.8
Agroforestry and live fence	3	0	3	2.5
Garden , forest, agroforestry, live fence and roadsides	0	1	1	0.8
Forest and agroforestry	0	2	2	1.7
Garden , forest and agroforestry	7	3	10	8.3
Bush land and agroforestry	0	1	1	0.8
Live fence and road sides	2	0	2	1.7
Forest, live fence and broad sides	4	0	4	3.3
Gardens, live fence and roadsides	4	0	4	3.3
Agroforestry and roadsides	2	0	2	1.7
Bush lands and live fence	1	0	1	0.8
Agroforestry, live fence, hedge and roadsides	2	0	2	1.7
Garden, forest, agroforestry and live fence	4	0	4	3.3
Total	60	60	120	100.0

About 47.5% informants of two districts response expressed forest and pasture land were major habitats for nutraceutical wild plants, followed by agroforestry 11.7% and combination of garden, forest and agroforestry 8.3% (Table 5). The result indicated that nutraceuticals are harvested from natural vegetation. There is no domestication of these wild plants. Participant observation showed that, there is an emerging trend of traditional dryland agroforestry and existing pasture known as KALO systems in Oromo language to conserve nutraceutical wild plants. About 47 (39.17%) transhumants responded that, most of the nutraceutical wild plants were collected from woodlands, forests and pasturelands. It is an indication that these habitats are relatively less disturbed than that of the settled farmers land use system in Boosat district. Key informants from settled farmers have expressed that they collect from diversity of habitats including agroforestry and gardens to satisfy their needs as majority of natural habitats were severely disturbed than transhumant land (Table 5). This implies that the transhumant life style is relatively environmental friendly than settled farming. This diversity of habitat and knowledge of natural habitats of wild edible plants can be a base for their domestication and future utilization of nutraceutical wild plants.

Preferences and value ranking of the most preferred nutraceutical wild plants: Out of the 20 species identified ranking performed by semi structured interview and resulted in 5 key nutraceutals with community consensus as to their use for food (Table 6). Transhumant and settled farmers showed their preference in similar manner indicating that there is exchange of indigenous knowledge between the two life styles as they are neighbouring each other. Ranking based on key use categories identified by focus group discussion resulted in similar rank of the 5 nutraceutical plants (Table 7).

Table 6: Preference ranking of nuraceutical wild plants for family food (N =120)

	District of the respondent			
A preferred WEP	Boosat	Fantalle	Total	Rank
Zziphus spina-christi	53	44	97	1st
Balanities aegyptiaca	22	30	52	2nd
Ximenia americana	9	21	30	3rd
Berchemia discolor	14	12	26	4th
Grewia flavscense	9	8	17	5th

Table 7: Pooled Averaged Values given by local people FGD in two districts (N =84). (values scaled 0-5, 0 = for no use, 5 = the highest preference for the use category)

District	Wild plant spp	Food	H.medici	L. medicine	Fodder
Boosat	*Z. spina-*	5.00	4.67	2.67	5.00
	B. aegypti	5.00	4.33	4.67	4.00
	X. americana	5.00	4.33	2.33	3.67
	B. discolo	4.67	3.33	2.33	3.67
	G. flavesc	4.33	2.00	2.00	2.67
Fantalle	*Z. spina-*	5.00	4.00	5.00	5.00
	B. aegypti	5.00	3.00	4.33	4.67
	X. americana	5.00	4.67	4.67	5.00
	B. discolo	4.33	1.00	3.33	5.00
	G. flavesc	1.33	3.00	3.00	3.00

Threats to nutracutical plants and their habitats: The habitats of these valuable wild edible plants were increasingly threatened by continued destruction of indigenous vegetation. The fact that most nutraceutical wild plants have multipurpse uses, posed a big threat to their existence due to destruction of their habitats and overharvesting. It has resulted in rarity of majority of the nuraceutical wild plants. Information from key informants and field observation along landscapes have revealed that, wild edible plants such as *X. americana, Berchemia discolor, Dobora glabera* and *Carissa spinarum* are rarely encountered in the area. The future fate of nutraceutical plant species like *Z. spina-christi, B. aegyptiaca, A. tortolis, X. americana* and *Berchemia discolor* might be restricted to near settlement areas, in or borders of farms, in relic forests, rocky hillsides and at spiritually protected and secluded areas.

The availability of nutraceutical plants in these habitats was also influenced by seasonal variation. Some of the annual herbs such as *Amaranthus* sp. become scarce during the dry seasons and their spatial distribution is restricted to near shades of trees making their collection and use difficult. Elderly key informants' expressed their perceptions that; 25 to 40 years ago they have been using many wild edible plants for food, medicine and other uses. Collecting nutraceutical wild plants near by was very easy. In recent years, because of degradation by deforestation to expand agriculture and settlements, fire wood collection, and commercial charcoal production, encroachment by invasive- alien species, cutting trees for construction, overgrazing and browsing and other development activities; some nutraceuticals were not easily available and accessible.

Transhumants expressed their hope that if the GADA SYSTEM (Oromo traditional administration) will fully operate and people are willing to cooperate it is possible to protect nutraceutical plants in the nearby vegetation and generate income while still using them as forage for livestock (Table 8).

Table 8: Strategies of preventing threats to nutraceutical plants

	District of the respondent			
Strategies of preventing threats	Boosat	Fantalle	Total	%
Create awareness of indigenous people on better uses of nutraceutical plants	21	50	71	59.17
Value indigenous knowledge	0	2	2	1.17
Enhance participatory planning and implementation of projects	36	8	44	36.67
Did not give suggestions	3	0	3	2.50
Total	60	60	120	100

They have also indicated that free movement of their livestock also will give room for regeneration to vegetation which is much restricted in the last few years. This was partly, because of resource use conflict with neighbouring settled farmers. The threat factors were also exacerbated by climate variability and change in the region. Being in the arid region and fragile ecosystem, east Shewa cannot be free from climate variability and change consequences. Hence, all socioeconomic and environmental problems are exacerbated by climate change events. It is likely that as ecosystems change disease prevalence changes. Malaria is among the leading diseases in lowlands in terms of prevalence and impacts. They have medicine prepared from *X .americana* roots among others.

Strategies of preventing threats to nutraceutical plants: In spite of population pressure people of the study area have knowledge of preventing lasting threats to nutraceutical wild plants. Informants were asked "Are there ways of preventing the threats?" and 46.7% settled farmers and 50% transhumants asserted "yes" there are ways of preventing threats to nutraceutical wild plants and 3.33% settled farmers responded" No " there are no ways for preventing threats to nutarceutical plants. Local people also indicated ways of preventing. About 59.2% of them responded that they need to get support on how to better use nutraceutical wild plants and conserve them (Table 8). They also indicated the need of valuing their indigenous knowledge on use and management of resources.

DISCUSSION

Quantity of nutritional values in wild edible plants: The present study has identified 20 nutraceutical wild plants used by people of semi arid areas. Trees and shrubs contribute in many ways to combating malnutrition and improving diets in local communities and rural households. Various scientific literatures support the importance of nutraceutical wild plants human wellbeing. They provide protein for rural people (CAF, 2008; Asfaw, 2009). The leaves and roots of edible plants have a high nutritional value and can play an important role in the prevention of malnutrition in rural areas.

They do not only provide food and medicines to humans and livestock, but they also indirectly increase income and improve agricultural production, thereby improving access to food. Hunger and malnutrition would be significantly worse if it were not for the contribution of trees and shrubs to household food security and nutrition. Non-wood Forest Products (NWFPs) have attracted considerable global interest (Bharucha and Pretty, 2010). This is due to the increasing recognition that NWFPs can provide important community needs for improved rural livelihood; help to generate additional employment; offer opportunities for processing enterprises; contribute to foreign exchange earnings; and support biodiversity conservation and other environmental objectives (CAF, 2008; Asfaw, 2009).

These plants are diverse in terms of resources to be added into dryland agrobiodiversity and human health care in semi arid east Shewa. Guinad and Lemessa, (2000) and Addis *et al.* (2005) have reported some of these plants as wild edible plants of southern and selected districts of Northern Ethiopia. This can be additional evidence as to their nutritional uses. It is also true that if a plant is part of community's diet it is safer to be used as medicine than to use none edible ones. Grosskinsky (2000) noted that, the amount of vitamins, minerals and other nutrients in wild food sources on the average is greater in wild foods. He reported that, *B.aegyptiaca* provides 162.6 Kcal energy and Fe (13.5), Zn (1.2), Mn (3.4), Cu (0.61), Ca (2487), Mg (701), Cd (ND), Pb (0.20) nutrients in mg. This potential was poorly utilized by people of semiarid areas of Ethiopia where millions are health and food insecure.

Fruits of *Tamarindus indica, B. aegyptiaca, Z. spina-christi* were available over the whole year on the market, because of a high demand and their excellent storage capacity. They are sold in big cities like Khartoum. They are very important source of income for the rural population (Jens *et al.*, 2002). Oil is extracted from the dried and crushed kernels of *B. aegyptiaca* and was used for preparing food (Jens *et al.*, 2002). Drink was produced from reddish brown fruits of *Grewia tenax* for its rich iron for pregnant women. These are supporting evidences for high potential of wild plants in food and medicine not only in Ethiopia but also in all semi arid African continent.

Domesticated vegetables have been selectively bred for looks, production quantity, taste, length of storage and other qualities other than nutrition (FAO, 1999). The fruits and vegetables sold in the supermarket can be chemically fertilized; exposed to herbicides, pesticides, fungicides, and a variety of other chemicals and they may have been genetically modified and/or irradiated. The safety of eating such produce is of concern to many people. Wild foods for the most part, avoid those concerns. If wild edible plants are preferred to be gathered avoid taking them from along roadsides, lawns that have been treated with chemicals or any other areas that may have been treated (FAO, 1999). It really needs to learn to recognize a dozen high-calorie, abundant wild edible plants to be a lot safer in the wilderness, and to enjoy it more.

There is the possibility that supermarket food can be contaminated with pathogens. Dozens of diseases can be spread by an infected person handling food anywhere from the time it is harvested until it is put into grocery bag. Plants growing in the wild are relatively less frequently touched by human hands (Lewis, 2008).

Large scale potential of nutraceutical wild plants for semi arid people: Fruits of trees are eaten fresh by transhumant and settled farmers of east Shewa, Ethiopia .These are used mostly as table fruits without processing. Borena pastoralists of southern Ethiopia use diversity of wild plants as food and medicine and this has its socio cultural and economic reasons as described by Gemedo-Dalle *et al.* (2005).This indicates that other pastoralists and semiarid people can use the present indigenous knowledge of nutraceutical wild plants elsewhere. Wild edible plants are also used as medicine and food in many semiarid countries of Africa. Evidence from Kenya showed that fruit of *Dobera glabra* if boiled for, 3-4 h and seed cotyledons placed in water 4-6 times, ash or a salt extract from a type of soil ngeny is added to improve the taste for human consumption. Immature seeds of these plants are used as green peas (Maundu *et al.*, 1999; Ngugi, 2000). Similarly Afar people in eastern Ethiopia and transhumant people in the study area consume the seeds of the plant after cooking. Young leaves and seeds of *B. aegyptiaca* were boiled for 2-3 h, pounded then fried or fat added were used as vegetables by communities in the Rift Valley of Kenya as nutraceutical plants (Maundu *et al.*, 1999).

Interactions with residents to cross check the information obtained by focus group discussion rvealed that, *B. aegyptiaca* is medicine for various diseases. Some of them its uses include:1) when head part of cattle is not normally 'jinni' Oromo language fresh crushed root mixed with water, kept overnight and 4-5 litters served as drink in the morning. They also use for Black leg called ABBA GORBA in Oromo language, fresh crushed leaves with cold water, 4-5 litters served as a drink, (3) Ordinary sank and cobra's poison are treated by serving 1 glass of crushed root mixed with cold water for humans (4), it is also served as a medicine for lymphatic swelling, gastritis and infected eye in different traditional ways in the study area.

Strategies to reduce the threat to nutraceutical wild plants: Field inspection and focus group discussion showed that, reported *Grewia* were, *X.americana* are highly affected by livestock browsing and other multiple uses. With the existing climate change the chance of wild edible plants to be sustained need high management inputs and to be implemented on watersheds, promoting integrated production system. Policy directions that integrate the use of wild edible plants to development plans also determine the rate of sustainable use and management of nutraceutical wild edible plants. Enhancing their sustainable use as multipurpose species including medicinal uses will improve peoples concern on these plants (Namutebi and Akundabweni, 2010; Sharma and Singh, 2010).

Field observation records and discussion with key informants has shown that the last 10 years were much detrimental to natural vegetation of the area. Hence, the vegetation is degrading by anthropogenic factors. This was partly associated with the recent adoption of crop production by transhumant, population and livestock pressures. Following the change in land use, environmental degradation has been accelerated and this is further aggravated and reinforced by climate change. Key informants indicated that, increased fuel wood, and construction material collection cannot be stopped unless an alternative energy source is designed and put in action with appropriate technology. This will reduce the grave consequences of anthropogenic activities on nutraceutical wild plants and consequently maintain their abundance for food, medicine and other multipurpose uses. Wondimu *et al.* (2007) has similar concern for conservation of nutraceuticals in Arsi area of Ethiopia.

As a way of concluding the findings: People of the study area in east Shewa, Ethiopia use many nutraceutical wild plants. These wild plants have been contributing to the household nutrition and family healthcare system. Trees and shrubs contributed to the well-being of local populations by providing food, medicines and environmental services to humans and livestock.

Local people have diverse indigenous knowledge on the use and management of nutraceuticals. However, clearance of vegetation for crop production has threatened which were sources of livelihood for local people directly as medicine, human food, livestock fodder and climate change adaptation. Newly initiated crop production and the emerging practice of production of charcoal and fuel wood by transhumants for commerical purpose reported to have been spearheaded for the transhumant production system. This has adversely degraded the vegetation. Generations old indigenous environmentally friendly resource use and conservation practices and customs of transhumant pastoralists of east Shewa was also under erosion. The results also indicated that the nutraceutical wild plants are declining with declining natural vegetation of the area. Therefore, there is an urgent need for sustainable utilization, management, screening, testing

nutritional composition of these wild edible plants and add value to the traditional production system. Therefore, these newly initiated detrimental practices on natural vegetation of the area need to be reversed by appropriate policy measures involving community from its planning through its undertakings, monitoring and evaluation.

Nutraceutical wild plants such as *Debera glabra, X. americana, Berchemia discolor* were found mostly on watershed areas and around river sides. It is essential to conserve water catchments of connected plains and mountains of Boosat, Fantalle, Dheebiti, Halam, Lebaa in study districts to sustain these wild edible plants.

Nutraceutical wild plants such as *Z. spina-christi, B. aegyptiaca, Grewia sp.* were conserved with Acacia species which are useful for food/ forage, medicine and shade for livestock and humans in closure areas of transhumant and settled framers. It must be promoted by increasing the diversity of the vegetation enclosed and supported by appropriate extension services with parallel domestication for mass production. Such practice will maintain the availability and utilization of nutraceutical wild plants and enhance profitability. Importance of indigenous knowledge and indigenous food plants as life saving resources, usability and potential to be developed must be refocused in light of food and health security of people of semiarid areas. The priority nutraceutical wild species identified by the present work must be conserved in dryland agroforestry, closure areas, live fences and concurrently domesticate for improved utilization in human and livestock food and healthcare as an integral part of dryland agrobiodiversity and healthcare system of semi arid Ethiopia and Africa. A study by Namutebi and Akundabweni (2010) in Uganda and Kenya has policy concern for conservation of indigenous women's knowledge and nutraceutical plants.

CONCLUSION

In the present study, Twenty nutraceutical plants were identified; 35% shrubs, 6% trees and 5% liana for human food, livestock feed and medicine. Transhumant pastoralists used (95%) nutraceuticals and settled farmers (65%). Twenty nutraceutical wild plants were used to treat 11(55%) human and 9(45%) livestock ailments/ health problems. There are a good number of nutraceutical plants which can be used for nutrition and healthcare system of semiarid people. Transhumant pastoralists were more intimate with nature and more knowledgeable. Hence, they adapt to climate change by using locally available nutraceuticals for themselves and their livestock. Climate change adaptation strategies can be built on this indigenous knowledge for sustainable use of nutracuticals for nutrition and health security.

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Annex 1: Nutraceutical wild plants of east Shewa and their major uses

					Use categories of Nutarceutial wild plants			
District	Local oromo name	S. Name	Family	Habit	H. Medicine	L. Medecine	Part used as food	Part use as medicine
F	Amurji	*G. flavescens* A. Juss	Tiliaceae	Li	For various diseases	For various diseases	F	L and F
F	Mendhero	*Cordia ovalis* R.Br.ex G.Don.	Boraginaceae	S	Leaf of various diseases	Not applicable	F	L
F	Agamsa	*Carisa spairaun* L.	Appocynaceae	S	Tooth dieses	Not applicable	F	F
F	Dhaanago	*Rumex nervosus* Vhal	Polygonaceae	S	Toung infection	Not applicable	F	L. Standbud
F	Ogomdi	*Grewia villosa* Willd	Tiliceae	S	Swelling of stomach	Treat diarrhea	F	L
F	Haroressa*	*Grewia bicolor* Juss.	Tiliceae	S	stomach	Expel	Se	B
F	Rooqa	*Tamarindus indica*	Fabaceae	T	Stomach ache and amoeba, appetizer	Fruit for feeding ruminants	F	F
F	Jajjba	Berc	Rhamnaceae	T	For smoking milk container	For various disease	F	St
F	Qaru	*Sterculia africana* (Lour.) Fiori	Stecnliacea	T	Eye infection	eye infection	F	B
F	Hudha	*X. americana* L.	Olacaceae	T	stomach ache	Liver disease	F	B and St
F	Qilxu	*Ficus thonningii* Blume	Moracea	T	Cheats pain	Treat mammary Gland infaction	F	L
F	Aadee	*Debora glabra* (Forssk.) Poir.	Sal	T	wound	wound	F	L
F	Badanno	*B. aegyptiaca* (L.) Del	Balanatiaceae	T	For various diseases	eye infection	F and L	L
F	Hammmessa	*Commiphora africana* (A. Rich.) Engl	Na	T	stomach	Expelling	gum	gum
F	Wangayyoo	*Acacia etbaica* Schweinf	Fabaceae	T	smoking water container	Not applicable	gum	gum
F	Waccu	*Acaccia seyal* Del.	Fabaceae	T	smoking water container	Expel parasite	gum	gum
F	Qurqura mio*	*Z.spina-christi*	Rhamnaceae	T	Leaf for human wound	Leaf for enhancing digestion	F	L
F	Callanka	*Flueggea*	Rham	T	Amoeba	Expel placenta	gum	gum
F	Mudhugure**	*Grewia schweinfurthii* Burret	Tiliaceae	S	Fruit soup build sick body	Leaves infusion for goats Back born disease	F	L
B	Amurji	*G. flavescens* A. Juss.	Tiliaceae	Liana	For various diseases	For various diseases	F	L and F
B	Mendhero*	*Cordia monica* Roxb.	Boraginaceae	S	Leaf various medicine	Not applicable	F	L
B	Agamsa*	*Carisa spairanum* L.	Appocynaceae	S	tooth disease	Not applicable	F	F and L
B	Dhangago*	*Rumex nervosus* L.	Polygonaceae	S	Toung infection	Not applicable	F,	L
B	Ogomdi	*Grewia villosa* Willd.	Tiliaceae	S	Swelling of stomach	Treat diarrhea	F	L
B	Haroressa*	*Grewia bicolour* Juss.	Tiliaceae	S	Stomach ache	Expel placenta	Se	B
B	Jajjba	*Bercemia discolor* (klotzsch) Hemsl.	Rhamnaceae	T	For smoking milk container	Not applicable	F	St
B	Qarau	*Sterculia africana* (Lour.)Fiori	Sterculiaceae	T	Eye infection	Eye infection	F	B
B	Hudha	*X. americana* L.	Olacaceae	T	stomach ache	Liver disease	F	B and St
B	Badanno*	*B. aegyptiaca* (L.) Del.	Balanatiaceae	T	For various diseases	Eye infection	F and L	L
B	Hammessa	*Commiphora africana* (A.Rich.)Engl	Nactaginaceae	T	Stomach ache	Expelling placenta	Gum	Gum
B	Qurqura mio*	*Z. spina-christi* (L.) Desf.	Rhamnaceae	T	Leaf for human wound	Leaf for enhancing digestion	F	L
B	Midhan dubara ***	*Lantana camara* L.	Verbenaceae	S	Stem for fever andtoo ache	Not	F	St

Common species in both districts, **Species mentioned by Fantalle district only, ***Species identified in Boosat district only; F: Fantalle, B: Boosat districts, F: fruit, L: Leaf = Se: Seed, St: Stem, B: Bark

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