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Ethnobotanical Use and Conservation of Plants Biodiversity by the Local Community of Welkait Wereda, Western Tigray, Ethiopia

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Abstract
An ethonobotanical study is important from the standpoint of conservation and sustainable use of community based knowledge plant biodiversity. A survey to identify and document local community knowledge and a conservation status of the plant biodiversity was conducted in welkait wereda, western Tigray, Ethiopia. A reconnaissance survey, plant interview and different ranking methods were applied to gather primary ethnobotanical data collection. Respondents from the age of 15-80 years old were selected with the help of Wereda and Tabia agricultural experts and local elders. Data was analyzed using ranks, percentages and SPSS version 20. Nearly 97 plant species serve for different ethnobotanical use that belongs to 52 families and 86 genera were identified from welkait wereda. The growth patern of the plant species were 39% tree, 31% herb, 28% shrub and 2% climbers. 41% of the remedy prepared from the leaves, 16% from root, 19 % stem, 15% fruit, and the remaining is another part of the plant species. The habitat of the identified medicinal plant was 90% wild and 10 % domesticated. Agricultural expansion, firewood collection and free grazing were the three most threats to medicinal plants as described by the informants. Anogeissus leiocarpa, Terminalia brownie and Securidaca longipedunculata were the most threatened medicinal plants based on the score given by the key informants. Education and age of the informants positively correlate ($p<0.001$, $p<0.005$ respecively) with number of medicinal plants mentioned. Community based awareness creation and insitu and exsitu conservation method need to be implemented for sustainable utilization of plant biodiversity.
Keywords: Adi remets, Welkait, medicinal, Conservation, threats
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INTRODUCTION

Forests are indispensable for human existence and well-being as well as for survival of two thirds of all terrestrial animals and plant species (Lal and Junior, 2011). They provide us with food, oxygen, shelter, recreation, spiritual sustenance and they are the source for over 5,000 commercially traded products, ranging from pharmaceuticals to timber and clothing (SCBD, 2010). Accordingly, ethnobotanical researches and applications are mostly done around natural ecosystems (Sebukeera, 2010) such as forests, grasslands, woodlands, and wetlands as well as in many other micro-habitats**,** from where the prosperity of ethnobotanical knowledge is retrieved. Forest are used in the manufacture of a great many medicinal plant products and pharmaceuticals as well as nutritional supplements, while these products were obtained through a systematic ethnobotanical research. In addition, (Hanazaki et al., 2006) point out the main aspect investigated from forest ethnobotany is the use and investigations of numerous medicinal plants as well as development of ethnopharmacological studies. (Ibrar et al., 2007, Colfer et al., 2006) added that a forest is a constant source of maintaining genetic diversity of plants and animals and these resources are available to humans, from which ethnobotanical researches would be applicable. Farmers and forest dwelling people possess a great deal of indigenous knowledge arising from their utilization of forest resources. Forests are the source of many hidden treasures and a fertile ground for scientific research (Sebukeera, 2010). Furthermore; forests serve as both a classroom and a source of raw materials for local health practitioners (Balick and Cox, 1996)**.** As (Thomas et al, 1989) Specified that forest and the benefits they afford in the form of wood, food, income, and watershed protection has an important and critical role in facilitating people to secure a stable and adequate food supply. Accordingly, ethnobotanical studies and applications were done on accumulated people's experiences on these different use categories of different plant biodiversity resources**.**

The Assessment of woody species for timber, medicine and other uses in the forests showed that the species richness of medicinal species was highest (Hanazaki et al., 2006, Bisht and Badoni, 2009). These medicinal richness circumstances are very important for the concentration of ethnobotanical research and applications about their values. Furthermore, forests have been increasingly seen as serving multiple functions (Hamilton et al, 2003). for example, forests and woodlands of Ethiopia act as sources of raw materials for wood-based energy (70% from the total energy needed), construction, wood-based industries, farm implements, fuel-wood and employment opportunities and other non-timber forest products such as coffee, spices, honey medicinal products,

animal fodder, wild-edible plants (fruits, seeds, leaves, roots, tubers) etc. From these manifold use values of forest biodiversity resources, different types of ethnobotanical useful values of plants in different parts of the country, Ethiopia, have been taking place although it is not in all places. In the absence of forests, ethnobotanical research as well as application might not be available (Demel Teketay, 2001). Systematic study and application of indigenous knowledge is important for sustainable use of resources and sustainable development (Thomas, 1995). Biodiversity and traditional knowledge of its various properties and uses have long provided and continue to provide vital resources for medicine discovery and health care (SCBD, 2010). Recent information indicates that limited ethnobotanical studies have been conducted in the catchment area of the Mekelle biodiversity center, particularly Tigray region to document the use of medicinal plants. However, no such study has so far been conducted in welkait wereda. Therefore, the protection, documentation of forest and rangeland plants biodiversity and associated community knowledge are compulsory, and it is on the basis of this gap that the present study was undertaken. More ever, the main objective of this survey was to study an ethnobotanical use and management practice of medicinal plants and the associated indigenous knowledge in the study wereda. Specifically, this study aims to;

- Identify types of plant species used for different use by community of the study wereda
- Pinpoint the habits and habitat distribution plant species in the study wereda.
- Recognize threats to medicinal plants and management practice in the study wereda
- Determine the dependency of the local community in plant biodiversity resource

Material and method

Description of the Study Area

Welkait wereda administration is found in the western zone of Tigray regional state northwestern Ethiopia. It is bordered to the north by Kafta Himora and to the south by Tsegede; it is also bordered on the east by the weredas of Tahtay Adiyabo and Asgede Tsimbla, to the northeast, on the other side Tekeze River, and Tselemti is to the east. Adi Remets is the administrative center of the wereda figure 1. Based on the census conducted by the Central Statistical Agency of Ethiopia (CSA, 2007), Welkait wereda has a total population of 138,926, of whom 70,504 are men and 68,422 women; 10,758 or 7.74% are urban residents. With an area of 3,374.52 km^2, Welkait has a population density of 41.17 people/km^2. A total of 30,375 households were counted in this wereda, resulting in an average of 4.57 persons in a household, and 29,336 housing units. The majority of the inhabitants (97.28%) practiced Ethiopian Orthodox Christianity, with reporting that as their religion, while 2.71% of the populations were Muslim (CSA, 2007).

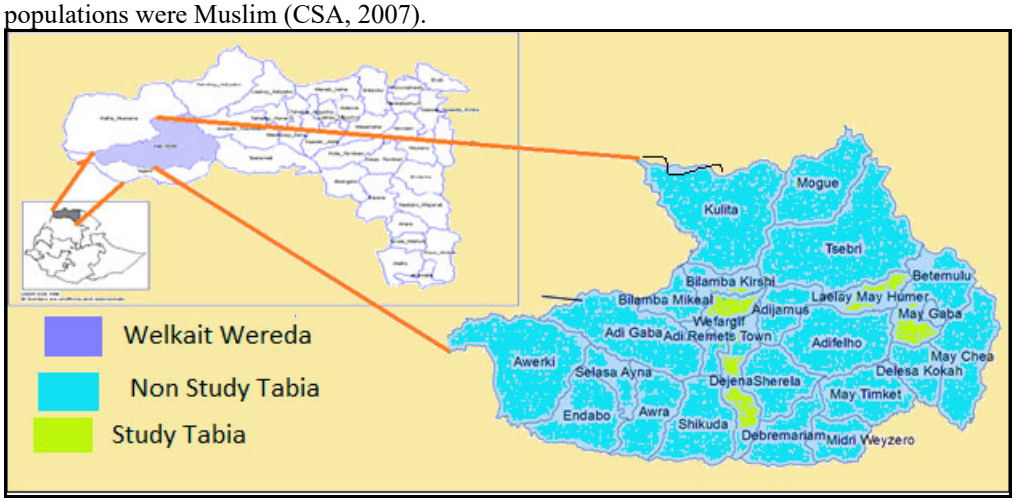

Figure 1: Map of Welkait Wereda

Design and Site Selection

Rapid ethnobotanical appraisal approach (REA) design was employed to conduct an ethnobothanical study of plants in welkayt wereda. By using this research design, small sample size and area was taken to sketch out how the community acts as a whole. A reconnaissance survey of the study area was conducted in May, 2019. A total of 5 Tabias was selected for ethnobotanical data collection based on availability of traditional healers identified with the assistance of local authorities, elders and knowledgeable persons.

Selection of Informants

Selection of informants was done following (Martin, 1995) which indicated that when recording indigenous knowledge held by knowledgably traditional healers or by certain social groups the choice of key informant is critical. The age of informants was grouped into less than 30, 30-40 and greater than 40 intervals. From each site

of Kebele, 3-4 individual key informants was purposely selected from each study sites by using information and recommendations from the Wereda agricultural office officials, local kebele administrators and kebele agricultural officials, knowledgeable elders and religious leaders as well as the local community.

Ethnobotanical Data Collection

Ethnobotanical data were collected by the method semi-structured interview following (Martin, 1995) and (Cotton, 1996), field observation and group discussion. Most of the interviews and discussions were conducted in the local language of the Wereda (Tigrigna), which is a common language in the study area and the Tigrai region as well. The necessary information about the plants such as habit, habitat, were recorded.

Plant Identification

The identification works of some common and well known species were made in the field. Further identification was performed by using the Natural Data base for Africa (NDA, 2008) software, illustrations and taxonomic keys and published volumes of the Flora of Ethiopia and Eritrea (Hedberg and Edwards, 1989, Edwars et al., 1995, Edwars et al, 2000, Hedberg et al., 2003,). Besides, plant interview method was used in order to confirm the emic classification (classification of the local community) of the informants with the ethic classification (scientific classification) system as shown in Picture 1

Picture 1; plant interview method at Dejena field with key informant (photo by Fitsumbirhan T.)

The key informants were asked to show the local name given for each plant species as well as for what type of use can it serve. Besides, when we got plant species which is not mentioned by the respondents during discussion, we asked them to tell the ethnobotanical use of those plants.

Informant Consensus

In order to evaluate the reliability of information recorded during the interview, informants were communicated at least two times for the same ideas and the legitimacy of the information was proved and recorded. Later, if the thought of the informant digresses from the original information, it was excluded since it was reflected inapt gen. Only the relevant ones were taken into account and statistically analyzed.

Preference Ranking

Following (Martin, 1995), preference ranking was made for five medicinal plants for the most frequently encountered disease in the study area and for which they have several alternative plants as readily. Ten preferentially selected key informants were participated in this exercise. The informants were gave the plants and ask to arrange the five medicinal plants based on their personal preference of effectiveness. The medicinal plant that was believed to be the most effective were gave the highest value i.e. 5, and the one with the least effectiveness received the lowest value i.e. 1. Based on the total score of each species the rank were determined, and this helped to indicate the most effective medicinal plants used by the community to treat commonly occurred illness.

Direct Matrix Ranking

Direct matrix ranking were conducted following (Cotton, 1996) for 7 multiuse medicinal plants commonly report by informants. Based on the relative benefits obtained from each plant, 10 informants were favorably selected and asked to give value to each characteristic. The list of attributes included medicinal, fire wood, building (construction), charcoal, furniture, edible fruits and fence. The scores were add in order to compare use values of

medicinal plants and help to identify the main causes of over harvesting of the medicinal plants so that to pinpoint recommended conservation measure for sustainability of that species.

Ranking of Threats to Plants Resource

Ranking of threats to medicinal plants report by most of the informants in the study area were accompanied using 10 selected key informants as defined by (Martin, 1995, Alexiades, 1996). Furthermore, five main threats were select and the informants were ask to give seven for the most threatening factor and one for the least threatening factor based on their personal thought in the study area. This information was used to determine the highest threats to traditional medicinal plants in the area and helps to propose the necessary appropriate conservation measures, and for sustainably use of forest and range land plants biodiversity.

Ranking of Threatened Plants Resource

Using the method applied by (Martin, 1995), ranking of five medicinal plants that report by the informants as threatened in the study area were conduct with ten key informants (knowledgeable traditional healers). The preferentially selected informants were give the names of five traditional medicinal plant species considered threatened in the study area and arrange the plants based on the degree of threat /scarcity by assigning 5 for the most threatened and 1 for the least threatened plant species. Finally, the scores of each species were summed and ranked. This information was help to identify the most threatened species so that appropriate conservation measures would suggest.

Data Analysis

Ethnobotanical information collected using different ethnobotanical methods such as questionnaire survey and interviews, along with the data in the form of scores were organize, enter and analyze in Microsoft Excel. Data was subject to expressive analysis and percentages were generated. The data from ranking methods (direct matrix ranking, preference/priority ranking) were present in the form of ranks. Ranks were determined based on the total scores under each trait.

Result and discussion

Demographic back ground of informants

The demographic condition of the informants was assessed using the terminology age group, educational level and gender. Accordingly most of the informants (69%) were male informants and the remaining (31%) were from female informants. Besides, the age of respondents were grouped in to three categories. The highest percent of the informants were from the middle age group (from30-40). The other demographic condition assessed during the study in the area was the educational status of the informants. Moreover, Most of the informants, 64% were those that didn't able to read and write. Very few respondents scored secondary educational level (9-12) and the remaining was scored primary (1-8) level of education as shown in the following figure 2.

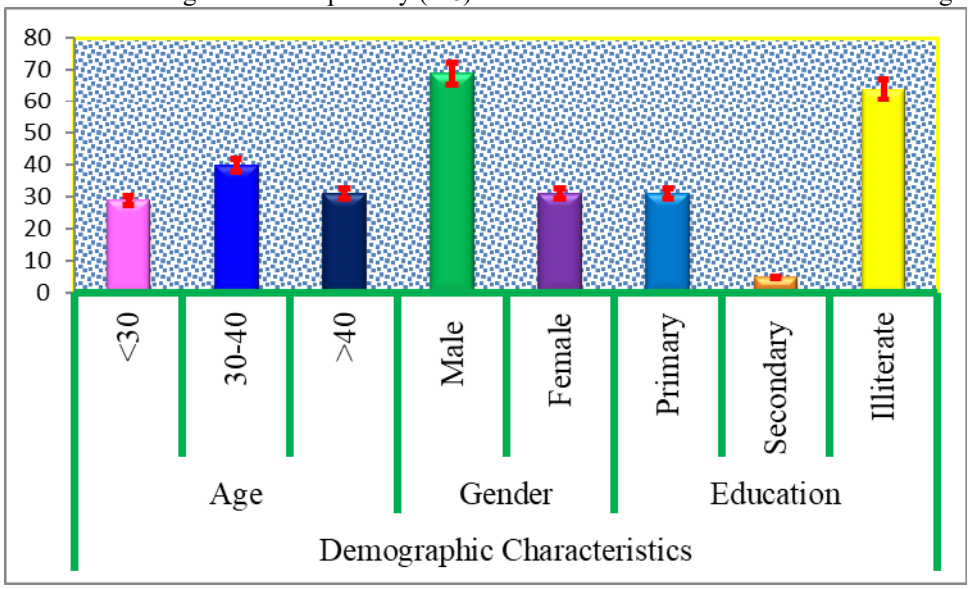

Figure 2; Demographic Status of informants

Floristic diversity of medicinal plant

A total of 97 medicinal plant biodiversity resources belonging to 52 families and 86 genera were documented

from Welkait Wereda, Western Tigray region of Ethiopia. Fabaceae is the leading family from the ethnobothanicaly useful plants mentioned by the local community in the study area. This is a good indicator of the fact that, the people of the study district highly dependent in plant biodiversity resource utilization since the ancient time for different use values. In line with this finding, other researchers reported that Fabaceae is the leading family with the highest number of medicinal plants in various diseases treatment in Ethiopia and somewhere in the world (Buzuneh et al., 2018, Alfred, 2011, Rahman, 2013, Andarge et al., 2015, Lulekal et al., 2008, Regassa, 2013). Similarly, (Lulekal et al., 2008) noted that Asteraceae is the dominant one among others. The growth form of the plants includes 39% tree, 31 % herb 28 % shrub and 2% climbers. Similar results were reported by (Chekole, 2017, Gidey et al., 2015, Kebede, 2016, Mesfin et al., 2009, Hailemariam et al., 2009, Eskedar Abebe .2011) as trees were the most dominant growth form. The part of the plant that used for different use value includes 41% leave, 16% root, 15% stem, 15% fruit, and the remaining belong to other parts as revealed in table 1 below. Other studies conducted elsewhere in Ethiopia also showed (Mersha, 2011, Tamene, 2011, Ashagre, 2011, Asnake et al., 2016, Chekole et al., 2015, Maryo et al., 2015) leaves was the major plant part used for remedy preparations.

Ecological status of the plants

The habitat distribution of the medicinal plants in Welkait wereda show more than 90 % are wild habitat and the remaining 10% only is cultivated. This entails that the majority of plants of medical importance are not yet cultivated properly by traditional healers or other concerned bodies. Thus, the high dependency on medicinal plants which are collected from the wild habitats may have a significant impact on the forthcoming accessibility of these resources and it likely account for their susceptibility to being overexploited (Andarge et al, 2015). Based on the informants' perception, most plant species was used to treat for human disease than livestock. This study also agrees with the finding of (Assegid and Tesfaye, 2014, and Abiyu et al., 2014) in which most species were used to treat human ailments than livestock ailments. This result indicates that the local communities mostly used medicinal plants to treat human ailments than livestock ailments. It is an indication of high prevalence of human disease than livestock in the area .The ecological status of the mentioned medicinal plants in study area was, 52 % found rarely, 40 % moderately and 8% in an abundant condition. In terms of the condition used a remedy for medication fresh, dry and both dry and fresh were the dominant method of preparation respectively as indicated in the following figure below. The use of fresh material is more curative than dry as suggested by (Abera, 2014, Mesfin et al., 2014, Kefalew et al., 2015, Lamorde et al., 2010).

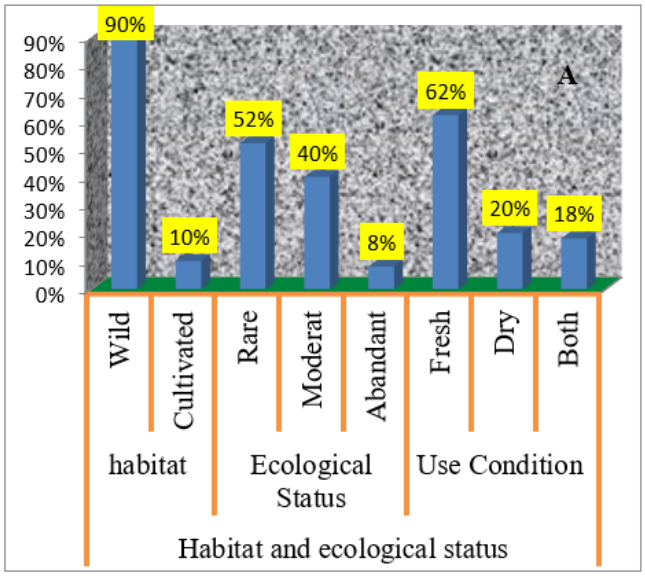

Figure 3; A=Habitat and Ecological Status of Medicinal Plants, B=web photo of Welkait wereda

Route of administration and application

For every remedy it has its own way of application and route of administration. Based on this inkling, the respondents in the study district asked to mention which route of administration and application were used for each type of remedy preparations. Accordingly, oral ranked as the highest route of remedy administration followed by dermal by route of administration respectively as shown in the following figure 4 below. This result was similar to the findings of previous investigators (Teklehaymanot and Giday, 2007) reported as oral application was the dominant route of administration.

The prepared traditional medicines were applied in a number of methods, among which drinking (45%),

eating (25%), smearing (5%), smoking (7%), and others (18%) were mentioned the dominant meted of application. In this study, drinking and eating application account for the largest percentage.

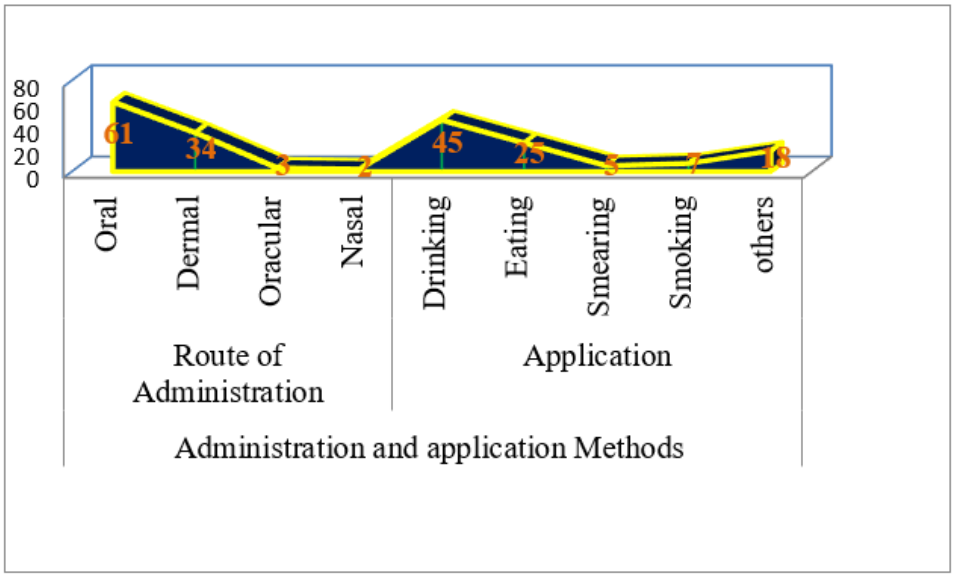

Figure 3; Route of application and administration

Table 1; Floristic Diversity and use value of Plants from Welkait Wereda

Plant scientific name	Family name	local name	Habit	Use part	*Disease treated/ use*	Condition	Method
Diospyros mespiliformis Hochst. ex A. DC.	Ebenaceae	Aye	T	Fruit Stem Stem	Food Bloating* Ornamental	F D D	Pounding, drinking
Grewia ferruginea Hochst. ex A. Rich.	Malvaceae	Tsinquayt	S	Leave	Fire burn	F	Smearing
Agave sisalana	Agavaceae	Eka	H	Latex	Ear defect	F	Squeezing
Allium sativum L.	Alliaceae	Tsaeda shigurti/etse pprie	H	Bulb	Impotence	F	Crushing & smearing
Lannea fruticosa (Hochst. ex A. Rich.) Eng	Anacardiaceae	Dugdugunga	T	bark	Evil eye	B	Smoking
Rhus natalensis	Anacardiaceae	Swarya/Tetaele	S	leaves stem	Fishing Tooth brush	F F	Decoction
Schinus molle	Anacardiaceae	Tikur berbere	T	Leaves	insect repellant	F	Decoction
Anethum graveolens L.	Apiaceae	Shilan	H	Whole	Asthma	B	Crushing & drinking
Acokanthera schimperi (A. DC.) Schweinf.	Apocynaceae	Mebtie	S	Fruit latex	Wart	F	Cramming
Calotropis procera (Aiton) W.T. Aiton	Apocynaceae	Gindae	S	stem /root	Haemoredin	F	Crushing & and cramming
Carissa spinarum L.	Apocynaceae	Agam	S	Latex	Wound healing	F	Cramming the latex
Tagetes minuta L.	Asteracea	Etsefarus	H	Whole	Evil eye	B	Fumigate
Artemisia afra Jacq. ex willd.	Asteraceae	Tsihtet	H	leaf	Evil eye	B	Smelling
Echinops Kebericho Mesfin	Asteraceae	Dander	S	Whole	Evil eye	D	Fumigating
Lactuca sativa L.	Asteraceae	Selata	H	Leave	Night blindness	F	Crushing & eating
Pluchea dioscoridis (L.) DC.	Asteraceae	Shitene	S	Leave	Anti-vomit	F	Pounding & smelling
Stereospermum kunthianum Cham.	Bignoniaceae	Argzana	T	Bark	wound healing	F	Crushing and decoction the paste
Adansonia digitata L.	Bombacaceae	Dima	T	Fruit	Stomach ache	D	Grounding
Cordia africana Lam.	Boroginaceae	Akui	T	Stem Fruit Fruit	Construction Food Amoeba	D F F	Grinding & swallowing
Brassica rapa L.	Brassicaceae	Hamli adri	H	Leaves	wound	F	Crushing & Tie

Plant scientific name	Family name	local name	Habit	Use part	*Disease treated/ use*	Condition	Method
Lepidium sativum L.	Brassicaceae	Shinfae	H	Seed	Dysentery**	B	Orally drinking
Boswellia papyrifera (Del.) Hochst.	Burseraceae	Meker	T	Latex	Wound	D	Smearing
Boscia angustifolia A. Rich	Capparidaceae	Kermed	S	Leaves	Livestock ticks	F	Decoction
Boscia senegalensis (Pers.) Lam. ex Poir.	Capparidaceae	Hamta	S	Bark	water purification	D	Grounded
Capparis tomentosa Lam.	Capparidaceae	Andel	S	Root	Fibril illness	F	Fumigating & inhaling of the smoke
Maerua angolensis DC.	Capparidaceae	Keremo	T	Stem	Milk flavor & curdle	B	Smoking
Carica papaya L.	Caricaceae	Papaya	H	Leaves	Wound*	F	Crushing and smearing
Maytenus arbutifolia (A. Rich.) Wilczek	Celastraceae	Atat	S	Root	itching/scabies	F	Boil and wash.
Maytenus senegalensis (Lam.) Exell	Celastraceae	Argudi	T	Bark	Stomach pain	F	Grinding & drink
Cissus petiolata	Chenopodiaceae	Alke	H	Stem	Fibril illness	B	Tie in the neck
Anogeissus leiocarpa (DC.) Guill. & Perr.	Combretaceae	Hanse	T	Bark Branches Stem Stem Leave	-Abdominal Pain -Fence -Firewood -Construction -Forage	F B D D F	-Crushing & drinking
Combretum molle R.Br. ex G.Don	Combretaceae	Akuma	T	Stem	Fumigation	D	Smoking
Terminalia brownii Fresen.	Combretaceae	Weyba	T	-Stem -Stem	-Fibril illness -Butterfly	D	Vaporization Fumigating
Vernonia amygdalina Delile	Asteraceae	Gzawa	S	Root	abdominal pain	D	Pounding & drinking
Cucumis dipsaceus Ehrenb.	Cucurbitaceae	Hafaflo	H	Root	Abdominal pain	F	Decoction
Cucumis pustulatus Hook. f.	Cucurbitaceae	Lemin bayta	H	Root	Abdominal cramp	F	Grinding &eating
Cucurbita pepo L.	Cucurbitaceae	Hamham	H	Fruit	Evil eye	D	Fumigating
Sansevieria erythraeae Mattei	Dracenaceae	Trm eka	H	Leaf	Ear defect	F	Squeezing & taking oracularlly based
Euclea divinorum Hiern.	Ebenaceae	etse patos /gibara	S	Fruit	evil sprite	F	Fumigating
Tragia uncinata M. Gilbert	Euphorbiacea	Amae	H	Root	Blood clotting	F	Squeezing & cramming
Croton macrostachyus Del.	Euphorbiaceae	Tambok	T	Leaves	Scabies	B	Crushing
Euphorbia tirucalli L.	Euphorbiaceae	Qinchib	T	Latex	Warts	F	Cramming with butter
Flueggia virosa	Euphorbiaceae	Harmazo	S	Leaf	Bloating*	F	decoction
Parkinsonia aculeate L.	Fabacea	Shewit hagay	T	Leaves	Bloating in goat	F	eating
Acacia polyacantha Willd.	Fabaceae	Gumero	T	Bark Stem Branches Stem Leaves	-bladder pain -Construction -Fence -Timber -Forage	B	Crushing, squeezing and drinking the liquid
Acacia seyal Del.	Fabaceae	Keyh chea	T	Gum	Fibril illness	D	Tie in the neck as a necklace
Calpurnia aurea (Aiton) Benth.	Fabaceae	Hitsawtsi	S	Leave	Parasite	F	Crushing, squeezing & spraying
Desmodium barbatum (L.) Benth.	Fabaceae	Balenga qolu'	T	Leaf	Arthritis	F	Crushing &covering
Dichrostachys cinerea Wight et Arn.	Fabaceae	Goneq	T	Stem	Sprain	F	Tie
Faidherbia albida (Delile) A. Chev.	Fabaceae	Momona	T	Leave	Anti dandruff	F	Crushing and smearing
Ficus ovate Vahl	Moraceae	Beles adgi	S	Latex	Wound*	F	Cramming

Plant scientific name	Family name	local name	Habit	Use part	*Disease treated/ use*	Condition	Method
Trigonella foenum-graecum L	Fabaceae	Abaake	H	Seed	Abdominal pain	F	grounded
Becium grandiflorum var. obovatum	Lamiaceae	Tebeb	H	Leaves	Wound healing	F	crushed
Clerodendrum myricoides (Hochst.) R. Br. Ex Vatke	Lamiaceae	Surbetri	S	Leaves	Epilepsy	F	Crush, squeeze and drink
Salvia nilotica Jacq.	Lamiaceae	Cheguri awald	H	Root	Snake bite	F	Crushing & drinking
Linum usitatissimum L.	Linaceae	Entatie	H	Seed	Constipation	D	Decoction &powdering drinking
Buddleia polystachya	Loganiaceae	Metere	T	Leaves	Fire burn	F	Cramming the paste
Sida ovata Forssk	Malvaceae	Deqi daero	H	Root	Wound	F	Crushing & Cramming
Azadirachta indica A. Juss.	Meliaceae	Nim	T	Leave	poultry parasite	F	Crushing and squeezing and drink the liquid
Albizia amara (Roxb.) Boiv.	Fabaceae	Chigono	T	Bark	Arthritis	F	Decoction
Ficus sycomorus L.	Moraceae	Sagla	T	Fruit Leaves Stem Bark	Edible fire burn Firewood Fiber	F F D F	Crushing & cramming
Ficus thonningii Blume	Moraceae	shibaka	T	Bark leave	Abdominal Fodder	F F	Crushing
Ficus vasta Forssk.	Moraceae	Daero	T	Fruit Latex	Edible wart	D F	Smearing
Eucalyptus globules Labill	Myrtaceae	Tsaeda kalamit os	T	Leaves	Evil spirit, cough	F	Boil it in water and inhale its vapor.
Syzygium guineense (Willd.) DC	Myrtaceae	Liham	T	Fruit	Intestinal blooding	F	Grinding and swallowing
Ximenia americana L.	Olacaceae	Mlo	T	-Fruit -Fruit	Intestinal parasite -Food	-F -F	Crushing, squeezing and drinking
Jasminum abyssinicum Hochst. ex DC.	Oleaceae	shaferro	T	Leaves	Abdominal pain	F	Grinding and drinking
Argemone mexicana L.	Pappavaraceae	Eshok/ dander	H	Latex	Wound *	F	Cramming
Sesbania quadrata	Pedaliaceae	Saspanya	H	leaves	Cattle disease*	F	Pounding and eating
Phytolacca dodecandra L'Hér.	Phytolaccaceae	Shibtie	C	Leave	Rabies	F	Drinking
Plumbago zeylanica L	Plumbaginaceae	Aftuh	S	-Root	-Swelling -Abdominal pain	F F	Crushing and smearing
Premna oligotricha Baker	Lamiaceae	Sasa	C	Leaves	Bloating	F	Pounding, and smearing
Securidaca longipedunculata Fresen.	Polygalaceae	Shitera	S	Stem Bark Bark Root Stem Root	-Fibril illness -Abdominal pain -evil eye -evil sprit - snake bite -Mosquito replant	F F F B F D	-Fumigating -Grinding Decoction Pounding Crushing &smearing Fumigating
Rumex abyssinicus Jacq.	Polygonaceae	Moqmoqo	H	Root	Blood pressure	D	Grounded & taking with spices orally
Rumex nervosus Vahl.	Polygonaceae	hehot	S	Leafy stem	Food & amoebic	F	Grinding &eating
Rhamnus prinoides L'Herit.	Rhamnaceae	Ghesho	S	Leaves	Tonsil	F	Grinding
Ziziphus abyssinica	Rhamnaceae	Gaba-agdi	T	Leaves	Anti dandruff	F	Crushing & decoction
Ziziphus spina-christi (L.) Desf.	Rhamnaceae	Gaba	T	-Fruit -leaves	-Food -Dandruff	D	Pounding & cramming
Rosa abyssinica	Rosaceae	roz	S	Fruit	against hookworm	F	Decoction
Spermacoce sphaerostigma	Rubiaceae	Tinigita	H	Whole	Evil sprit	F	Pounding & smearing

Plant scientific name	Family name	local name	Habit	Use part	*Disease treated/ use*	Condition	Method
Citrus limon (L.) Burm.f.	Rutaceae	Lemin	T	Fruit	evil eye/evil sprit	F	fumigating
Ruta chalepensis L.	Rutaceae	Chena adam	H	Leaves	Milk flavor	F	Crushing
Dodonaea angustifolia L. f.	Sapindaceae	Tahses	S	Leaves	Sore *	B	Crushing and cramming
Mimusops kummel Bruce ex A.DC	Sapotaceae	Kummel	T	-Fruit -Fruit	-Abdominal pain -Food	-F -F	Crushing, mix with better and eat with Injera
Pennisetum villosum	Scrophulariaceae	Chira kurkur	H	Root	Eye disease	F	Cooking & allow to the vapor
Verbascum sinaiticum Benth.	Scrophulariaceae	Trnake	T	Root	Evil sprite	B	Fumigating
Capsicum annuum	Solanaceae	Shirba/berbere	H	Fruit	Intestinal parasite	F	Grinding & eating
Lycopersicon esculentum Mill.	Solanaceae	Tsebhi awun	H	Leaves	Anti leech	F	Crushing & allow to drink
Solanum incanum L.	Solanaceae	Engule	S	Root	Amoeba	B	Crushing &eating with enjera honey
Withania somnifera (L.) Dunal	Solanaceae	Agol	S	Leave Stem	Headache Fibril illness	B	Crushing & drinking decoction
Datura innoxia	Solanaceae	Absho	H	Stem	Poultry disease*	F	Pounding with salt
Datura stramonium L.	solanaceae	Astenagr/mezrbae	H	Seed	Teeth ache	D	Roasting & inhalation of the smoke
Dombeya torrida	Sterculiaceae	Buwak	T	Root	Skin wound	D	pounding
Grewia flavescens	Tiliaceae	Mosoqua	S	Bark	Anti-leech	F	decoction
Heteromorpha arborescens	Umbelliferae	Murkus zbi	S	Whole	Common cold	B	inhalation
Cyphostema adenocaule (Steud. ex A.Rich.) Desc. ex Wild & R.B.Drumm.	Vitaceae	Etse zeway	T	Stem/Root	Snake bite	F	Crushing and smearing the paste
Balanites aegyptiacus (L.) Delile	Xygophyllaceae	Mekie	T	Fruit Stem Leaves Fruits Branches Leaves Leaves Leaves Stem	-Abdominal -Firewood -Shading -Food -Fence -washing -detergent -Fishing -Forage	F F F F B F F F	Crushing, cramming and squeezing

Where T=tree, S= shrub, H= herb, C=Climber, F=fresh, D=dry, B, Both *= for animal use only, **= for both animal human us

Threats to medicinal plants

Five threats were selected and ten informants were ask to give five for the most threatening factor and one for the least threatening factor in the study area individually based on their thought and observation in their surrounding area. This information was used to determine the highest threats to plants resources in the area. Accordingly Agricultural expansion stood first, and firewood collection free grazing stood second and third respectively as a plant threating factor in Welkait wereda as shown in table2.

Table 2; threats to medicinal plants in the study district

Threats	Informant (Threat factors put 1for least threat and 5 for the most threat chronologically based on their severity)										Total	Rank
	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10		
Free grazing	4	1	4	4	1	3	4	1	4	4	30	3
Agricultural	5	5	1	2	5	5	3	2	5	5	38	1
Firewood	2	4	5	5	3	4	2	3	3	2	33	2
Building	1	2	3	3	4	2	5	4	2	1	27	4
Drought	3	3	2	1	2	1	1	5	1	3	22	5

Threatened medicinal plants

Ranking of five medicinal plants that report by the informants as threatened in the study area were conduct with

ten key informants The preferentially selected informants were give the names of five traditional medicinal plant species considered threatened by the community and arrange the plants based on the degree of threat /scarcity by giving 5 for the most threatened and 1 for the least threatened plant species in the study area. More ever, Anogeissus leiocarpa, Terminalia brownie and Securidaca longipedunculata were the three most threatened medicinal plants based on the score given by the informants in table 3 below.

Table 3; Threatened medicinal plants in Welkait wereda

Threatened medicinal plants	Informant (put 1for least threatened and 5 for the most threatened chronologically based on their severity)										Total	Rank
	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10		
Acokanthera schimperi	4	2	1	1	2	3	3	1	1	4	22	5
Boswellia papyrifera (Del.) Hochst.	5	1	3	3	3	2	1	3	3	2	26	4
Securidaca longipedunculata Fresen	1	4	4	4	1	4	4	4	4	1	31	3
Terminalia brownii Fresen.	3	3	2	2	4	5	5	2	2	5	33	2
Anogeissus leiocarpa (DC.) Guill. & Perr.	2	5	5	5	5	1	2	5	5	3	38	1

I= informant

Preference ranking

Preference ranking were made for five medicinal plants for the most frequently encountered disease (abdominal pain) in the study area and for which they have several alternative plants as readily. Ten favorably selected key informants were shared their knowledge in this exercise. The informants were gave the plants and ask to arrange the five medicinal plants based on their personal preference of usefulness. The medicinal plant that was believed to be the most effective were gave the highest value. Based on that, Solanum incanum is the most preferentially used medicinal plants in threating abdominal pain in the study area as indicated in table 4. The second and third importantly mentioned medicinal plants in healing the most frequently occurred disease, abdominal pain, are Balanites aegyptiacus and Cucumis dipsaceus respectively.

Table 4; preference ranking of medicinal plants

plants name	Informant (put 1for least important and 5 for the most important chronologically based on their curative level)										T	R
	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10		
Anogeissus leiocarpa	1	1	4	4	1	4	4	4	4	1	28	4
Tamarindus indica	4	2	1	1	2	3	3	1	1	5	23	5
Balanites aegyptiacus	2	3	2	5	5	1	5	4	3	4	34	2
Cucumis dipsaceus	3	5	3	2	4	2	2	3	5	2	31	3
Solanum incanum	5	4	5	3	3	5	1	2	4	3	35	1

Matrix ranking

Based on the relative benefits obtained from each plant, 10 informants were preferentially selected and asked to give value to each attribute on their personal experience and information they have. The list of attributes included medicinal, fire wood, building (construction), charcoal, furniture, edible fruits and fence. The scores were added in order to compare use values of medicinal plants. Matrix ranking of plants used to identify the most multipurpose and the cause for over harvesting of plants. Consequently, Balanites aegyptiacus, Anogeissus leiocarpa and Securidaca longipedunculata were ranked first, second and third most important plant resources in the study district respectively as revealed in the following table 5.

Table 5; Matrix ranking of medicinal plants

Use value	Informant(put 1for least important use value and 5 for the most important use value chronologically based on usefulness)				
	Balanites aegyptiacus	Anogeissus leiocarpa	Securidaca longipedunculata	Acacia polyacantha	Ficus sycomorus
Medicinal	7	6	7	2	7
Firewood and charcoal	5	4	1	4	3
Building	3	4	3	4	5
Charcoal	7	7	2	6	3
Furniture	2	1	6	7	4
Edible	6	5	4	3	1
Fence	4	3	5	1	2
Total	34	30	28	27	25
Rank	1	2	3	4	5

Conservation and sustainable use of plant related remedy

According the information obtained from the participated respondents the highest source of traditional medicinal knowledge of plant were from their parents (65%), and their relatives (20%), from religious books (10%) and 5% from others sources as indicated in the following figure below. The commitments of the healers to transfer their knowledge to the next generation were assessed. Consequently, 18% of the respondents were willing to transfer either of their sons or daughters while 52 % of the respondents willing to transfer their knowledge to any of their parent member, 10% to their relatives and 5% were not willing to transfer their knowledge to any of their parent member because of anthropological case related with traditional medication system as signposted in figure 4 below. The knockback of the healers to convey their knowledge to the next generation is another controversy for sustainable use and conservation of plant based local community knowledge.

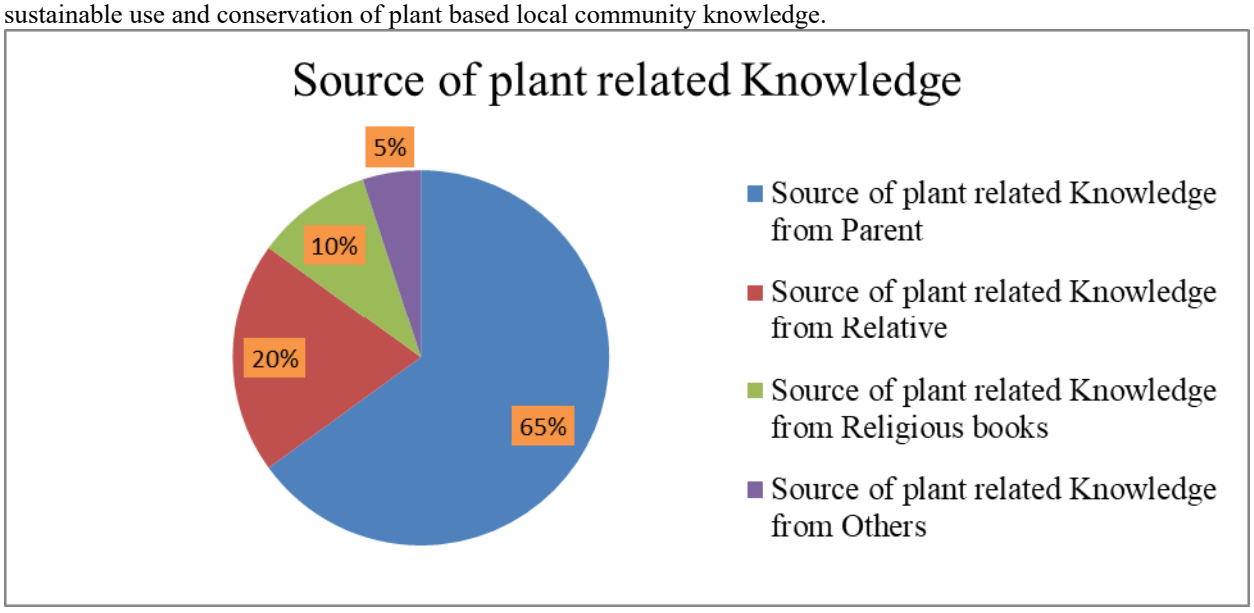

Figure 4; source of plant related Knowledge

Correlation of medicinal plant knowledge

The correlation of age and medicinal plant knowledge was computed to examine the relationships. Consequently, positively significant correlations were observed between age ($p<0.001$) and educational level ($p<0.005$) of the informants with the number of medicinal plants knowledge by which the informants mentioned. More ever, informants at higher age with no educational level mentioned more medicinal plants than those at lower age and higher educational level as shown in the following correlation table 6 below. The existence of such correlation makes for the continuity of the local community knowledge in remarkable condition.

Table 6; Correlation of age, gender and educational knowledge of the informants

Correlations				
		Age	Gender	Educational level
Medicinal plant knowledge of the informants	Pearson Correlation	.418**	.122	.339*
	Sig. (2-tailed)	.004	.425	.023
	N	45	45	45
**. Correlation is significant at the 0.01 level (2-tailed) &*. At the 0.05 level (2-tailed).				

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