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RESEARCH ARTICLE

ETHNO BOTANICAL STUDY OF MEDICINAL PLANTS IN ADOLA DISTRICT, SOUTHERN ETHIOPIA

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ABSTRACT

This study was conducted in Adola district to identify and document indigenous knowledge related to the use of medicinal plants and their contributions to household services in the district. The study was carried out between February and April 2019. Ethno botanical data were collected by interviewing 120 informants (92 males and 27 females) aged between 25-95 years. Both purposive and simple random sampling methods were employed to select key informants and general informants, respectively. Ethnobotanical knowledge of plants used for human and livestock ailments were addressed. The data were collected using structured and semi-structured interview through face to face interaction with the informants. The collected data were arranged and analyzed using SPSS software to identify the descriptive detail of demographic information on the knowledge of informants related to medicinal plants. One hundred thirty (130) species belonging to 113 genera and 66 families of medicinal plants were documented. Asteraceae families were the highest 10(15.2%) species followed by Euphorbiaceae and Lamiaceae with 7 (10.6%) for each plant species. Of the total number of medicinal plants 70 (53.8%) species for human, 53(40.8%) for human and livestock, and 7(5.4%) only for livestock ailments. The most habitat 79(70.5%) of plants were forests and most of their growth forms were tree. Sudden sickness and Diarrhea were the most common diseases recorded for human and livestock, respectively. In the district, Croton macrostachyus was the highest followed by Solanum in canum for treating highest number of ailments. Most of remedies were prepared from leaves 72(44.2%) by grinding 95(52.8%) in fresh form (95.5%) as well as common route of administration was by oral (57.4%) followed by dermal (20.7%). Agricultural expansion was the most threatening factor of medicinal plants. This study recommends raising awareness of young generation and educated person to avoid negative attitude towards traditional medicinal plants, detail study of phytochemical for common medicinal plants species for development of modern drugs and the cultivation and management of medicinal plants in home garden and farm land for further sustainable conservation for the future coming generations.

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INTRODUCTION

Ethnobotany is a broad term of word referring to the study of direct interrelations between humans and plants (Balick and Cox, 1996; Martin, 1995). This activity appeared when humans started and learned how to use plants (Posey, 1999). The ethno botanical knowledge is one of indigenous knowledge originated from local people, which has the potential to redress some of the shortcomings of contemporary Western knowledge (Berkes, 1999; Martin, 1995). It is a complex set of knowledge, skills and technologies existing and developed

around specific conditions of populations and communities indigenous to a specific geographic area (Ndangwa, 2007). This type of knowledge is stored in peoples' memories and shared in form of stories, songs, folklore, and proverbs and communicated orally by local language and that makes vary in quantity and quality between individuals in given area (Grenier, 1998). The traditional medical plant systems are generally based on the uses of natural, management of underutilized plant resources, and products which are commonly related to the people's perspective on the world and life (Toledo *et al.*, 2009). Such practices are still prevalent among rural and tribal communities in many parts of the world (Bhogaonkar *et al.*, 2010; Binu, 2010). This basic information pertaining to medicinal plant species is available from the local people who are the custodians of these resources and knowledge about them (Abraha Teklay *et al.*, 2013).

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About 85% of world population uses herbal medicines for prevention and treatment of diseases, and the demand is increasing in developed and developing countries (Abramov, 1996). The use of traditional medicine in developing countries contributes directly to the socio-economic status and wellbeing of the rural communities (Tabuti *et al.*, 2003). Indigenous peoples of different localities in the country have developed their own specific knowledge to use, manage and conserve plant resources (Pankhurst, 2001). It is also practiced by many countries in Africa, Asia and Latin America use traditional medicine to meet some of their primary health care needs. In Africa, up to 80% of the population uses traditional medicine for primary health care (WHO, 2003). From plants, human being can obtain food, pesticides, fuel, fodder, construction materials, tools, income and derives aesthetic and spiritual fulfillments. It also contains drugs that used for suppressing, preventing or curing many forms of diseases (Kokwaro, 1993). Ethiopia's traditional medicine similar to any other in Africa countries is faced with problems of continuity and sustainability (Ensermu Kelbessa *et al.*, 1992). The primary causes of this problem are loss of taxa, loss of habitats of medicinal plants and loss of indigenous knowledge. According to studies done by (Mirutse Giday *et al.*, 2009; Tesfaye Awas and Zemedu Asfaw, 1999) pointed that most of the medicinal plants utilized by Ethiopian people are harvested from wild habitats.

The healers collected the drugs mostly from natural substances and in descending order of frequency these contained plants, animals and minerals. Drugs are prepared in various dosage forms including liquids, powders and pills and different plants. It was administered using different routes and different antinodes were claimed to be used if side-effects of the medicine became severe in case of over dosage (Kebede Deribe *et al.*, 2006). Ethiopia is the place where medicinal plants play a significant role in supporting the country's primary healthcare system (Nugusse Shimelis *et al.*, 2012). For example research done in Bule Hora district adjacent to the study zone by Mersha Ashagre *et al.* (2016) reported a total of 106 medicinal plant species that used to treat both human and livestock ailments. The same as to elsewhere in Ethiopia, local communities living in Adola district have indigenous knowledge which they have accumulated for generations to cope up with both human and livestock ailments. But, no related study has been conducted and the knowledge uses of plants were in the hand of few elders, undocumented and transmitted orally from generation to generation. Therefore, this study is used to assess and document medicinal plants and its parts used to treat human and livestock ailments, to investigate the contribution of medicinal plants for income generation and factor threatening and their conservation technique of medicinal plants in Adola district.

MATERIALS AND METHODS

Description of the Study Area: This study was conducted in Adola district in Guji zone, Southern Oromia, which is located 468 km away from Addis Ababa to the South. The location of the district is between 5°44'10"N- 6° 12'38"N and 38° 45'10"E - 39° 12'37"E (Figure 1). It has a total area of about 1401 km². Most topography of the district is characterized by ups and down arrangement. Moreover, it has land surface with an elevation ranging from 1500 to over 2000 meters (Aschalew Shiferaw, 2014). The major soil of the district is Nitosols (red

basaltic soils) and Orthic Acrisols. The percentage coverage of the each soil is Red soils 80%, Brown soil 15% and Black 5% (Aschalew Emire and Zebene Asfaw, 2018). The district is characterized by three agro climatic zones, namely high land, midland and lowland, highland (locally known as Bada) and midland (locally known as Bada dare) lowland (locally known as Gamojji). The percentage coverage of each climate zones are highland (11% humid), midland (29% sub humid) and lowland (60% Dry arid) and the type of rainfall is bi-modal with longest rain season that has the maximum rainfalls which falls between 1200-1800mm annually and the shortest rainfalls records between 800- 1200mm with an erratic distribution patterns (Aschalew Emire and Zebene Asfaw, 2018). High forests, broad-leafed forests, woodland, bush and shrub land, grassland and plantation trees are available in the district. Wood land is the most common type of natural vegetation in the area. The most dominant tree species are *Ficusur*, *Ficusvast*, *Cordiaafricana*, *Crotonmacrostachyus*, *Abesziagummeferia*, *Mellitiafurridgeua* (Aschalew Emire and Zebene Asfaw, 2018). The total Population of district is 130, 492 (64152 females and 66340 Males) (CSA, 2007). Agriculture is the main economic activities of the peoples' living in the district and the majority of the rural peoples are engaged in crop cultivation and livestock rearing. The most widely cultivated crops in the district are Wheat (*Triticumaestivum*), Barley (*Hordeumvulgare*), Maize (*Zea mays*), Sorghum (*Sorghum bicolor*), fruits, and vegetables. One of the major cash crops produced in the district is coffee which is organic in nature, high quality coffee and supply to the central coffee market (Aschalew Emire and Zebene Asfaw, 2018).

Ethnobotanica Data collection: Ethnobotanical data were collected from January to March 2019. From the 28 kebeles in the district, depend on the information collected from agricultural office with the assistance of local administratives and elders, purposively three kebeles Maleka from high land, Anferera from midland, and Chambe from lowland were selected based on potential availability of medicinal plants and the availability of traditional healers for the best representative for obtaining the medicinal plants and related knowledge. The data were collected by interviewing 18 key informants and sample sizes of 102 household were calculated by using the formula (Espinosa *et al.*, 2012).

$$n = \frac{NP(1-P)}{N-1\left(\frac{d}{2\alpha/2}\right)^2 + P(1-P)}$$

and the survey of these households were employed by simple random sample by tossing the coin to select specific households (Martin, 1995) and collecting information was depending on 1) each household should have knowledge about plants, 2) household must have awareness about use and application of medicinal purposes, 3) household must be resident of the selected area. Both qualitative and quantitative data were collected through key informants 'semi-structured interviews, guided field walks, demonstrations, market survey and focus group discussions. The semi-structure interviews were delivered with the help of pre-prepared questionnaires in an English language and translated to Afaan Oromoo language. The specimen were collected and identified the plants that cited by informants and not identified in field were collected, numbered, pressed and dried for identification. Preliminary identification was done in the field and plants not identified in field were identified at an Ethiopian Biodiversity Institute.

Data Analysis: Both qualitative and quantitative analytical tools were used for data analysis. Percentage frequency method of data analysis was employed to summarize some of the descriptive ethno botanical data obtained from the interviews on the surveyed medicinal plants and associated knowledge. Microsoft Excel 2007 spread sheet was employed for organizing some ethno botanical data and socioeconomic data were analyzed by SPSS software package. Preference ranking was performed and analyzed most popular ailments, common plants, and threatening factor by using preferring ranking, direct matrix ranking, Pair wise comparison and fidelity level index of specific plants.

RESULTS AND DISCUSSION

Comparison of Knowledge of Medicinal Plant among Different Social Groups: The respondents included in this study are characterized as 69.2% (N=120) males and 30.8% females (Table 1). About seventy six percent (76%) of the households were above 45 years old. With regard to education level, about(46%) of the respondents were illiterate (Table 1).The Significant differences at ($P < 0.05$) were obtained by in dependent sample t test between healers and general household on the number of medicinal plant species. This showed that the key informants were found to be more knowledgeable than the general household respondents(Table 1).The medicinal plants collected by age group of respondents results showed that the elder respondents have the ability to mention more plants than young respondents and there were the significance differences at($p<0.05$)between age differences of elder and young respondents on the number of medicinal plant species(Table 1).

Depending on education level illiterate respondents reported more number of medicinal plants than literate respondents. There is significant differences in dependent sample t test between two groups at ($P < 0.05$) for the average number of medicinal plants reported by literate and illiterate respondents (Table 1). But the result revealed that there was no significant difference at ($P > 0.05$) for the average number of medicinal plants reported between the male and female. As a matter of evidence, local communities have a proverb to compare their health with beauty. The proverb says in local language (Afan Oromo) that "Fayyaanofiifaayadha", which roughly translated as 'health worths much more than any beauty'. The research done elsewhere in Ethiopia by (Getnet Chekole, 2017; Melese Maryo *et al.*, 2015) showed that there is positive correlation between key informant and general respondents and also with age of respondents (TsfayeAwas and Sebsebe Demissew, 2009).But there is negative correlation between illiterate and literate respondents. But this finding disagrees with (Melese Maryo *et al.*, 2015; Tsfaye Awas and Sebsebe Demissew, 2009) which obtained as there were difference of knowledge of traditional medicinal plants between male and female.

Diversity and Distribution of Medicinal plants: A total of 130 medicinal plants representing 113 genera and 67 families were used to treat human and livestock ailments. The majorities (53.8%) of reported medicinal plants were for treatment of human diseases while about 40.8% were used to treat livestock ailments and only 5.4% used for both human and livestock ailments. This is a good evidence to show that the local communities of Adola district, like local people in

other parts of Ethiopia also use more medicinal plants to treat human diseases than those to treating livestock ailments (Moa Megersa *et al.*, 2013; HaileYineger *et al.* 2008). Asteraceae families were the highest 10 plant species followed by Euphorbiaceae and Lamiaceae with 7 of each plant species. The result was similar with the study of different researchers in different area, for example, in Wollo by (Getnet Chekole, 2017); in Jeldu by (Zewdie Kassa, 2009); in Benishangul Gumuz by (Tsfaye Awas *et al.*, 19997); in Kambata ethnic group by (Melese Maryo *et al.*, 2015); in Bale zone Gololcha district by Mokonin Abebe (2013) reported Asteraceae families represented by highest number of medicinal plant species. The highest number of families Asteraceae could probably be attributed to the overall species richness of families. In the book of Flora of Ethiopia and Eritrea stated as one of largest dicot families and it has about 23,000 plants species throughout the world (Ryding, 2006).It has many small flowers which densely grouped together to resemble a single flower and fruit with many seeds (Tewolde Berhan Gebre Egzibher and Edwards, 1997).

Parts Used and Remedy Preparation: The result of this study revealed that maximum number 44.2% of the remedies were prepared from the leaves and followed by barks 25.8% of the reported medicinal plants parts (Figure 2). The most frequent use of leaves by the local people could partly related to timely availability of plant part; it could be collected from perennial trees and shrubs. Another factor could be the relatively easily preparation of remedies and may be the presence of active constituents. The report from research done in Nepalese Himalayas expressed that leaves are the highest part used and contain more active chemicals in comparison to fruits, seeds, bark and latex (Bhattarai *et al.*, 2006). Using the leaves and bark of plants parts were important for minimum destruction of plants by comparing to other parts used. But using the root may be series problem for sustainable conservation when comparing with leaf and roots. This study in line with study of elsewhere of Ethiopia in Dale district Sidama zone by (Gonfakewessa *et al.*, 2015) who reported the use in order of used leaves (50%) > bark (33.3%)> root (16.7%). Another study which under taken in Libokemkem district by Getnet Chekole (2015) reported that (31.2%) of the reported plant part was leaves.

Habit of Medicinal Plants in the Study Area: The finding revealed that most growth forms of plants in the study area were Trees 31 % followed by Herbs 25 % and the least growth form of plants were lianas 1% (Figure 3). Trees are the most habit of medicinal plants in the study area indicated the dominance of natural vegetation. According to research done in Dheeraa" town, Arsi Zone by (Tigist Wondimu *et al.*, 2006) tree provide the highest services for peoples' interms of medicine; another research done in French by Julia *et al.* (2015) stated that most utilized habits were trees followed by shrubs. But, this results disagree with the study of (Mohammed Adefa and Berhanu Abraha, 2011; Reta Regassa, 2013) pointed that herbs are the highest growth form of medicinal plants. The dissimilarity of the work relatively understandable, the local communities at the study area uses more trees by collecting from the natural vegetation instead of finding herbs and trees are easily visual and the live span of plants. Tree/shrub and herbs/shrub results showed that the medicinal plants used for medicinal purpose naturally occurred either of the two forms of plants.

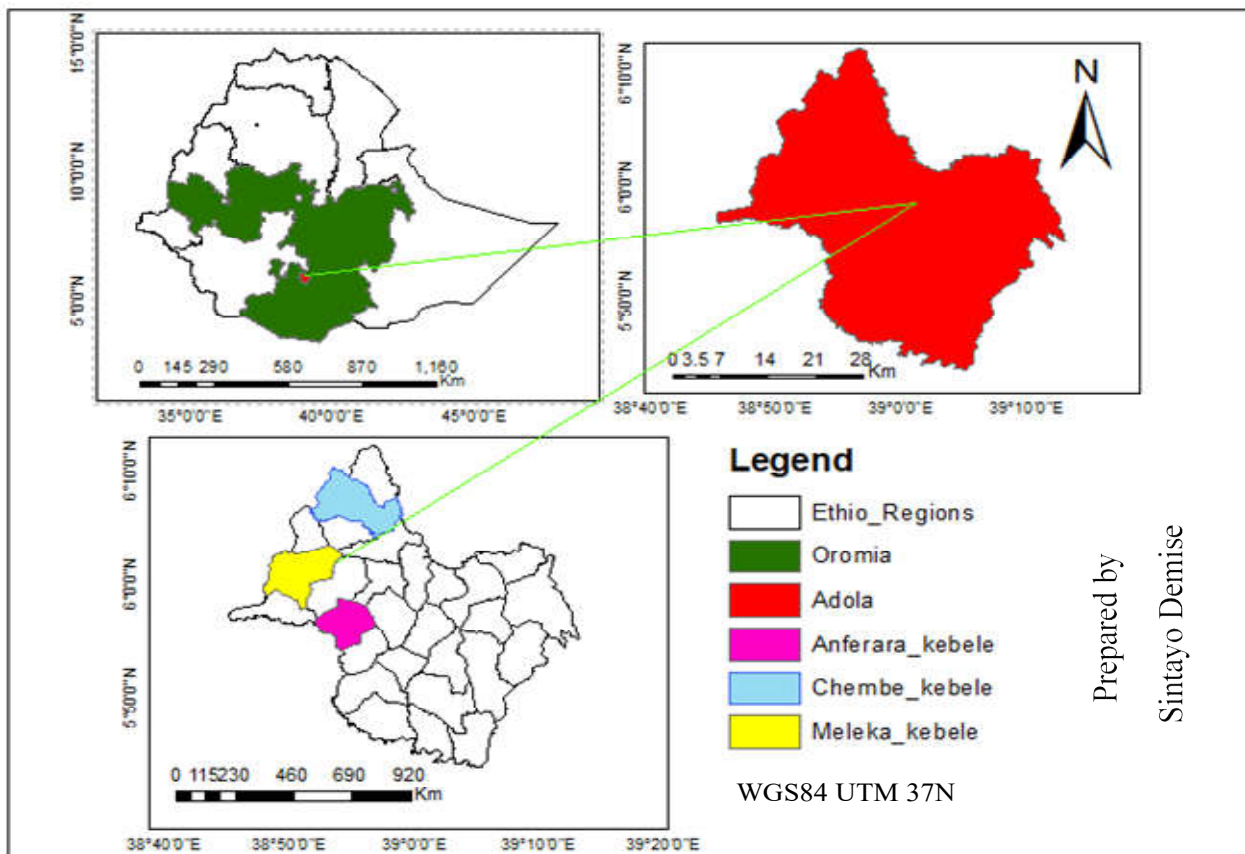


Figure 1. Map showing Adola district and study kebeles

Table 1. Statistical Test Independent t Test on the Number of Medicinal Plants Mentioned by Different Informant Groups in Adola District

Parameters	Groups	N	MP	Mean	t-value	P-value
Informants	key informant	18	279	15.5	2.3	0.021 *
	general	102	928	9.1		
Sex	Male	83	825	9.9	0.65	0.536 ns
	Female	37	382	10.3		
Age	25-45	29	269	9.3	3.98	0.00*
	>45	91	938	10.3		
Education level	Illiterate	55	553	10.1	-3.1	0.002*
	literate	65	654	9.9		

*=Significant difference ($P < 0.05$), N= number of respondents, Mp=medicinal plants, ns=non significant difference

Table 2 Results of Preference Ranking of Five Medicinal Plants Reported for Sudden Sickness.

Plant species	Informant (I ₁ -I ₁₀)										Total	Rank
	I ₁	I ₂	I ₃	I ₄	I ₅	I ₆	I ₇	I ₈	I ₉	I ₁₀		
<i>Solanumincanum</i>	5	5	4	5	5	4	5	5	4	5	47	1 st
<i>Viscumturberculatum</i>	4	4	5	4	3	5	4	5	3	4	41	2 nd
<i>Crabbeavelutina</i> S. Moore	1	3	2	5	4	1	3	3	5	2	29	3 rd
<i>Maesalanceolata</i>	2	3	3	2	2	3	3	4	2	3	27	4 th
<i>Carissa edulis</i>	4	2	1	4	2	2	2	4	1	3	25	5 th

Table 3. Results of Preference Ranking of Five Medicinal Plants Reported for Treating Diarrhea for Livestock Ailments

Medicinal plants	Informant (I ₁ -I ₁₀)										Total	Rank
	I ₁	I ₂	I ₃	I ₄	I ₅	I ₆	I ₇	I ₈	I ₉	I ₁₀		
<i>Croton macrostachyus</i>	5	4	5	4	5	5	5	4	5	4	46	1st
<i>Tecleanobilis</i>	4	5	2	5	4	4	5	4	5	3	41	2nd
<i>Phytolaccadodecandra</i>	3	2	3	3	2	3	4	3	2	3	28	3rd
<i>Lagenariaabyssinica</i>	3	2	2	3	2	2	4	2	3	4	27	4 th
<i>Crabbeavelutina</i> S. Moore	2	3	3	2	4	1	3	3	3	2	26	5 th

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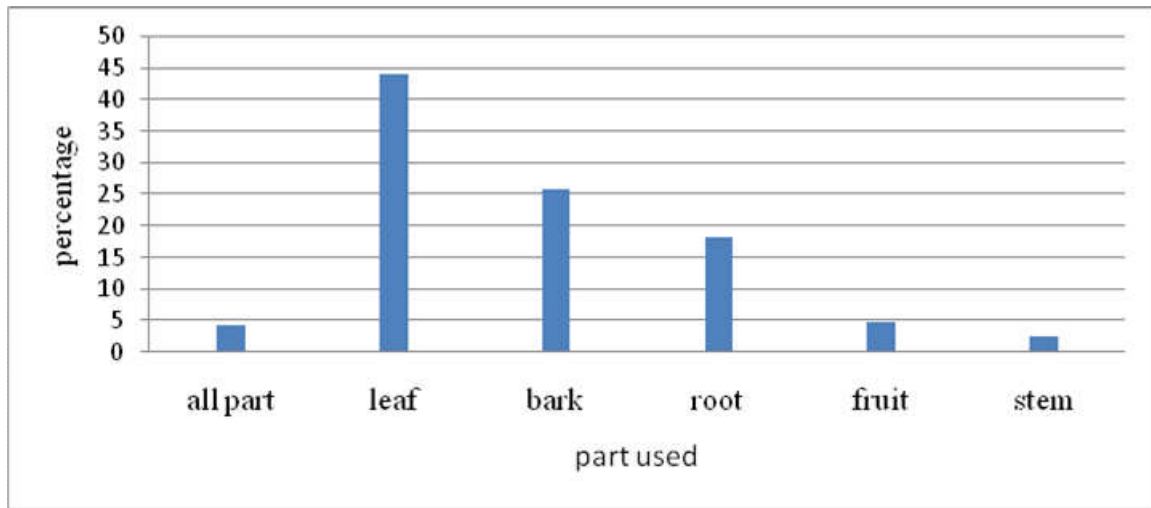


Figure 2 Plant Parts Used (%) for Remedy Preparartion to Treat Human and Livestock Ailments in Adola District.

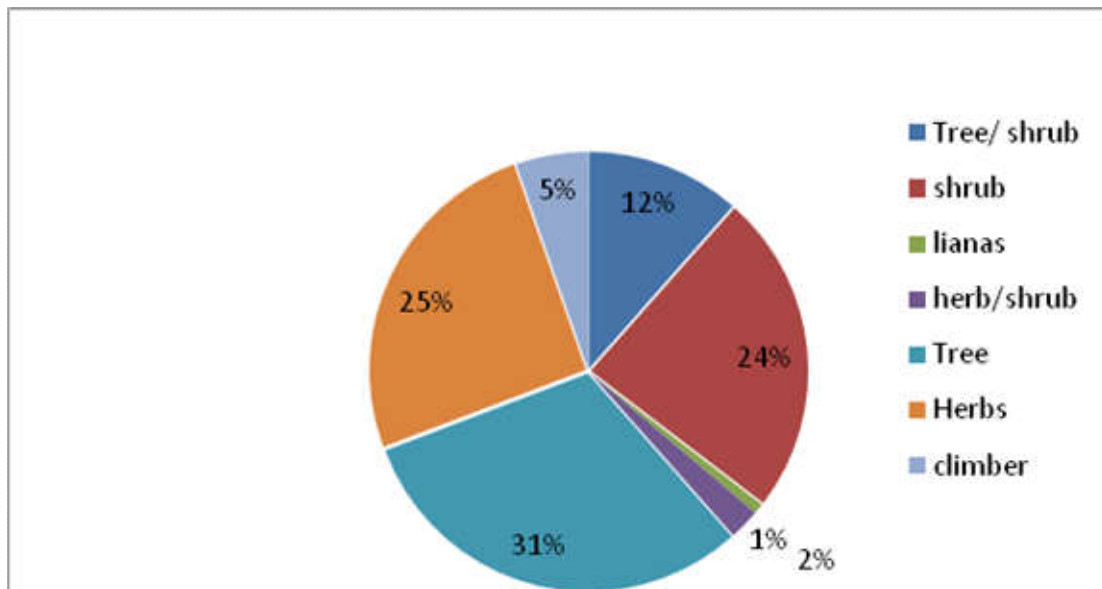
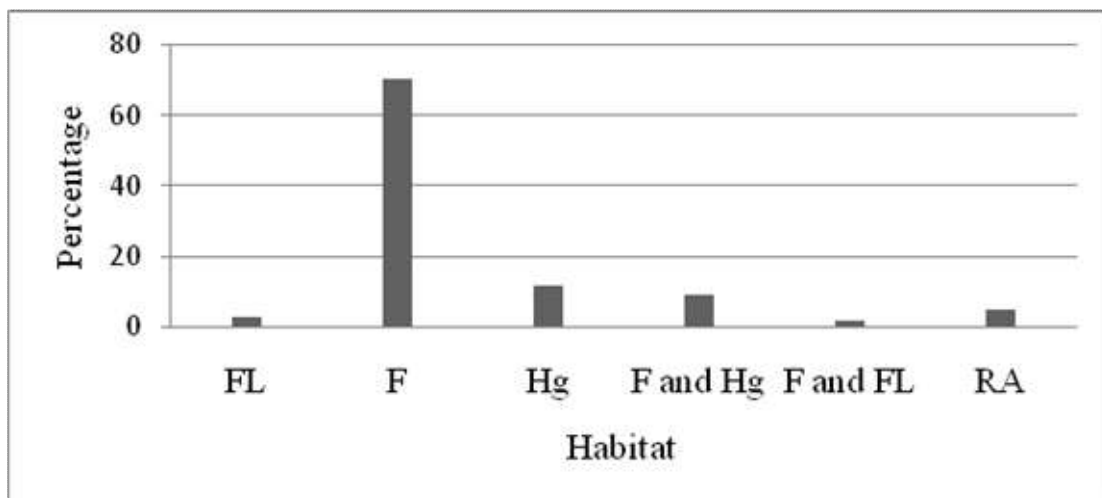


Figure 3. Type of Growth Form of Identified Medicinal Plants in Study Site



FL=farmland; F=forest; Hg=homegarden; F and Hg= forest and homegarden; F and FL= forest and farm land; RA=Rock area

Figure 4. Habitats of Medicinal Plants and Its Percentage at the Study Site.

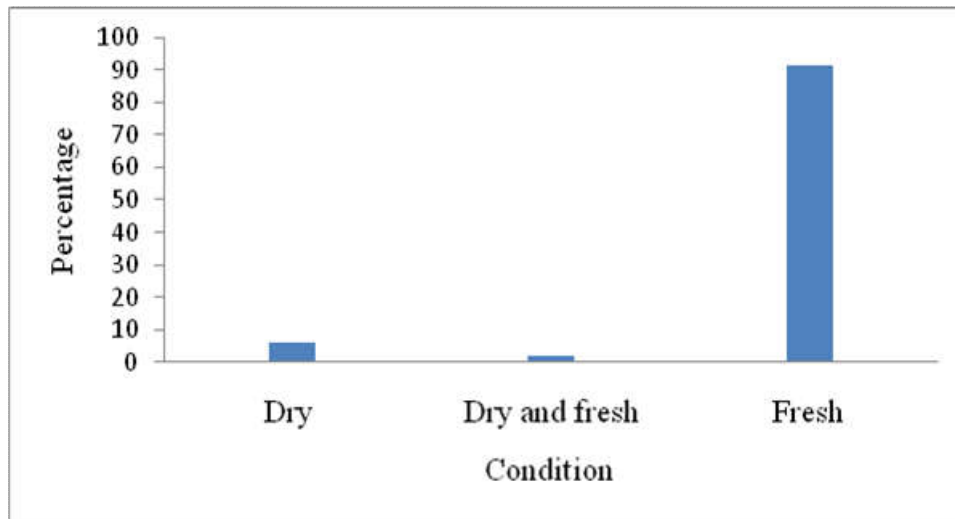


Figure 5. Condition (%) of Remedy Preparation of Medicinal Plants in Adola district

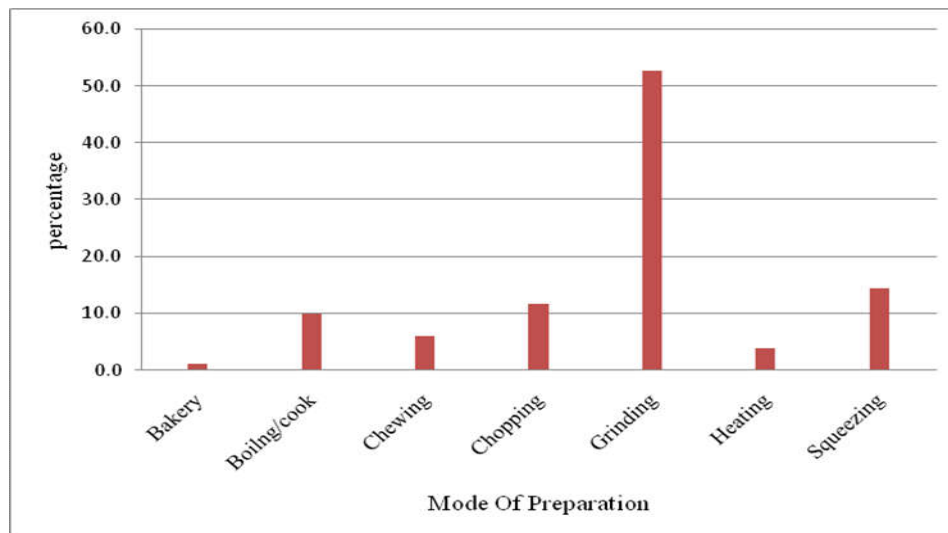


Figure 6. Mode of Preparation of Traditional Medicinal Plants in the Study Site

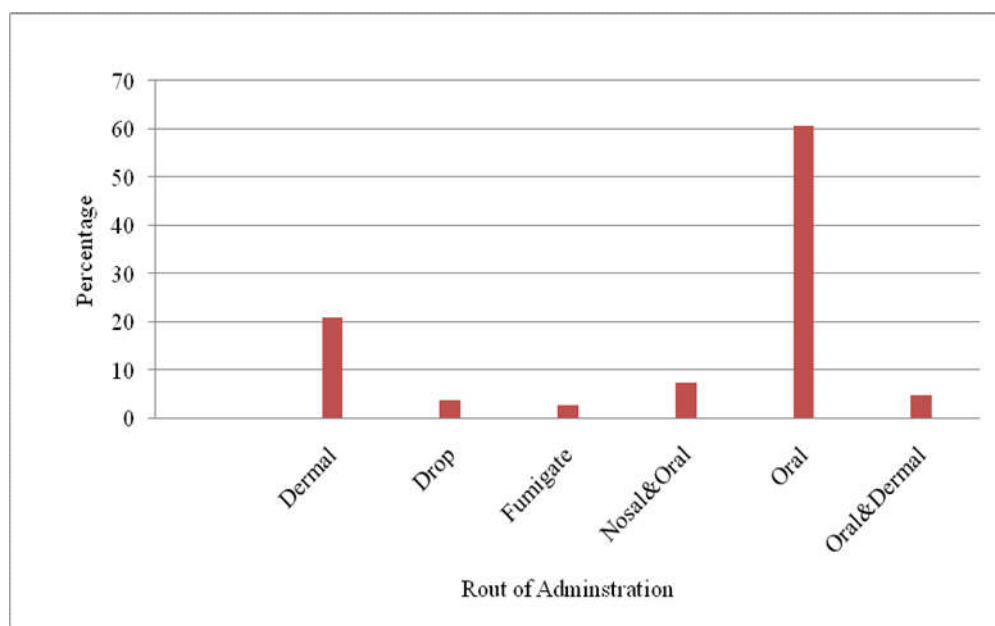


Figure 7. Routes of Administration (%) of Identified Medicinal Plants in Adola District



Source: Photo taken during market survey, Sintayo Demise, 2019.

Figure 8. Vender Selling Medicinal Plants During Market Survey of Adola District

Table 4. Eight Common Ailments and Results of Informant Consensus Factors

Disease treated	Nuc	Ns	ICF	rank
sudden sickness	98	24	0.76	1 st
Eryblastis	56	18	0.69	2 nd
Gonorrhoea	56	19	0.67	3 rd
Rabies	40	18	0.56	4 th
Diarrhea	27	12	0.58	5 th
Rheumatism	25	12	0.54	6 th
Tissue Cancer	35	17	0.53	7 th
Homeoroide	23	13	0.45	8 th

Nuc =the number of use citations for a specific ailment Ns = the number of species used to treat the ailment, ICF= Informants Consensus Factor

Table 5. Pair Wise Ranking of Five Medicinal Plants Used to Treat Gonorrhoea Disease

Score	Rank		<i>Solanumincanum</i>	<i>Rumexnervosus</i>	<i>Croton macrostachyus.</i>	<i>Crabbeavelutina</i>	<i>Carissa spinarum</i>
0	5 th	<i>Carissa spinarum</i>	<i>Solanumincanum</i>	<i>Rumexnervosus</i>	<i>Croton macrostachyus</i>	<i>Crabbeavelutina</i>	
3	2 nd	<i>Crabbeavelutina</i>	<i>Crabbeavultina</i>	<i>Crabbeavultina</i>	<i>Croton macrostachyus</i>		
4	1 st	<i>Croton macrostachyus</i>	<i>Croton macrostachyus</i>	<i>Croton macrostachyus</i>			
1	4 th	<i>Rumexnervosus</i>	<i>Solanumincanum</i>				
2	3 rd	<i>Solanumincanum</i>					

Table 6. Direct Matrix Ranking of Nine Medicinal Plants Based on Their General Use Values

Medicinal Plant	Categorical uses								
	Medicinal	Firewood	Construction	Food	Charcoal	Fencing	Fodder	Total	Rank
<i>Croton macrostachyus</i> Del.	5	3	2	0	3	4	3	20	5 th
<i>Syzygium guineense</i>	3	4	3	5	4	3	4	26	1 st
<i>Crabbeavelutina</i> S. Moore	5	5	4	0	3	3	2	22	3 rd
<i>Vernonia auriculifera</i>	3	3	2	3	1	3	3	18	7 th
<i>Maytenus senegalensis</i>	3	4	3	0	3	3	5	21	4 th
<i>Podocarpus falcatus</i>	4	4	5	0	3	3	0	19	6 th
<i>Carissa spinarum</i>	3	3	0	3	1	4	3	17	8 th
<i>Cordia africana</i> Lam.	3	4	5	4	3	2	2	23	2 nd
<i>Ehretia cymosa</i> var.	3	3	3	0	3	3	1	16	9 th
Total	32	33	27	15	24	28	23	182	
Rank	2 nd	1 st	4 th	7 th	5 th	3 rd	6 th		

Table 7. Result Show the Fidelity Level Index on Medicinal Plants to Treat Some Specific Human Aliments.

Plant species	Therapeutic use	Informants FLI%			
			I _u	I _p	
<i>Phytolaccadodecandra</i>	rabies		8	8	100.0
<i>Maesalanceolata</i>	Rheumatism		7	5	71.4
<i>Croton macrostachyus</i> Del.	Gonorrhoea		10	10	100.0
<i>Rumex nervosus</i>	Fibril illness		8	6	75.0
<i>Solanum incanum</i>	sudden sickness		10	9	90.0
<i>Vernonia amygdalina</i> Del.	Diarrhoea,		7	6	86
<i>Cladostigmahildebrandtioides</i>	Erythroblasts		8	7	87.5
<i>Crabbeavelutina</i> S. Moore	Stomach problem		9	7	77.8
<i>Vernonia auriculifera</i> Hiern	blood clot		8	5	62.5
<i>Carissa edulis</i>	cancer		9	8	88.9

I_p = is the number of informants who mentioned the use of a particular species for a particular purpose and I_u = is the total number of informants who mentioned the plant for any uses

Table 8. Result of Threats to Medicinal Plants Based on Their Degree of Destructiveness.

Threat factors	Informants (I1-I10)										Total	Rank
	I ₁	I ₂	I ₃	I ₄	I ₅	I ₆	I ₇	I ₈	I ₉	I ₁₀		
Agricultural Expansion	5	4	5	5	4	5	3	4	5	5	45	1 st
Fuel wood and charcoal	4	5	3	4	3	4	4	4	3	4	38	2 nd
Drought	3	3	4	4	5	3	2	5	4	2	35	3 rd
Over Grazing	3	4	3	2	3	2	2	3	4	5	31	4 th
Tools and Construction	2	3	2	3	4	4	3	3	2	3	29	5 th
Mining	1	2	1	1	2	2	2	4	1	1	17	6 th

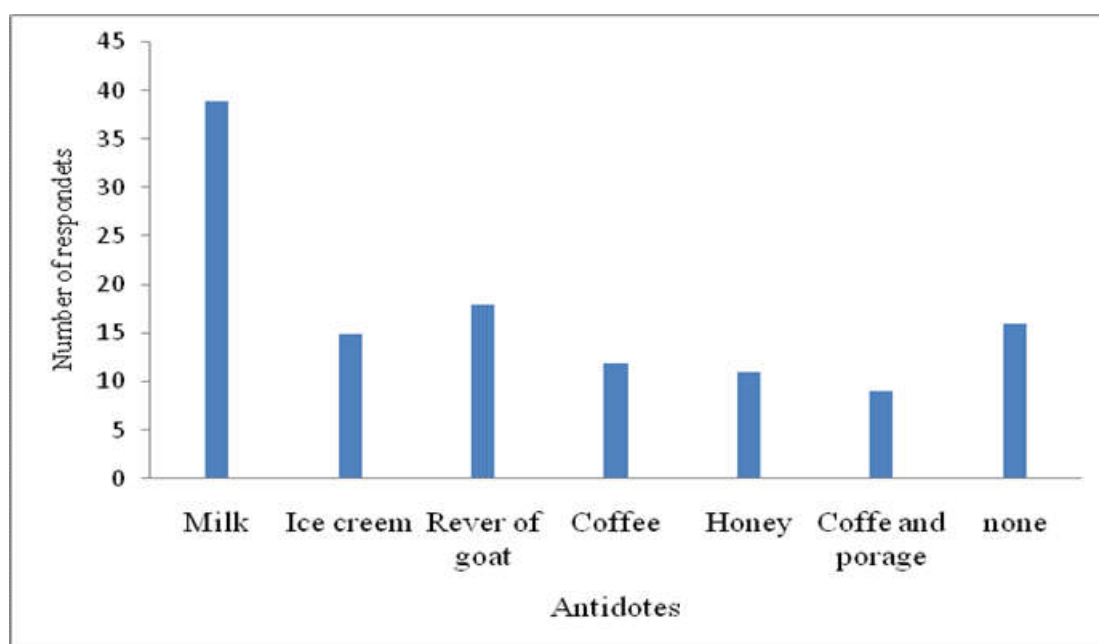


Figure 9. Type of Antidotes Used and Frequency of Respondants in Study Site

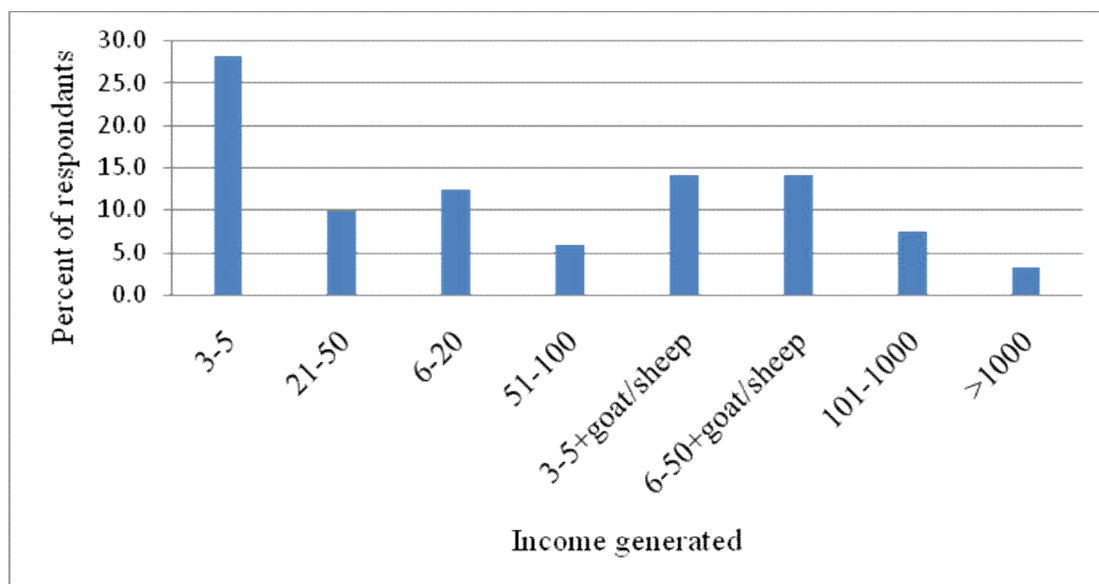


Figure 10. Income from Medicine per Person and Percentage of the Respondents in Adola District

Habitat of Medicinal Plants Used in the Study Area: The highest number of medicinal plants were collected from forests (70.5%) and followed by homegarden (11.6%) of plants species were collected (Figure 4). The study district has been known by having large coverage of natural forests which might contribute easy access to collect high number of medicinal plants. Another study done in Debrelibanos Wereda by Seyoum Getaneh and Zerihun Girma (2014) reported that about (75%) medicinal plants utilized by local people were collected from forests and only (25%) were harvested from home garden. According to Moa Megersa (2013) 68% of the remedies prepared for human and livestock ailments were collected from forests. But in Dale district, where natural forest is not dominant vegetation, highest numbers of medicinal plants were collected from home gardens (59.5%) and least (4.8%) was from patch natural forests (GonfaKewessa *et al.*, 2015).

Condition of Preparation of Medicinal Plants: The conditions of medicinal plants used in the district were fresh, dry, and fresh or dry. From the identified medicinal plants in the district the majority (N=130; 92%) of them are used in fresh form followed by dry (6%) (Figure 5). Plants like *Maesalanceolata*, *Cucurbitapepo* L, *Ocimumlamiifolium* Hochst are used in fresh while *Polysciasferruginea* is used fresh or dry. This indicates majority of the local people are highly dependent on fresh remedies preparation. This could put medicinal plants under serious threat, since there are no alternative plant parts for emergency uses. The high proportion of leaf form uses are reported by other scholars, e.g.(Getaneh Gebeyehu, 2016; Gonfakewessa *et al.*, 2015; MershaAshagre *et al.*, 2016; Reta Regassa, 2013; SeyoumGetaneh and Zerihun Girma, 2014). Local communities employ several mode of preparation for medicinal plant uses. Of the methods grinding (52.8%) was the highest mode of preparation followed by squeezing (14.4%) (Figure 6). It is helped to easily addressing the medicine to affected area through route of administration. Plants like *Tinosporacordifolia*, *Vernoniaamygdalina* Delused by grinding for curing Diarrhea and vomiting disease while *Rumexnervosus*, *Ocimumlamiifolium* Hochst used by squeezing by hand for fibril illness.

The research done in Tigray, Gemeda district showed majority of traditional medicine are prepared by grinding (Kalayu Mesfin *et al.*, 2013).

Route of administration: The result revealed that from the route of administration about (60.7%) was oral followed by (20.7%) dermal (washing, creaming, tying or putting) and the least route was fumigation (2.5%) (Figure 7). The choice of oral administration is related to the use of some solvents that were commonly believed to serve as a vehicle to transport the medicine and easily interact with disease. Almost similar route of administration were reported by other scholars e.g.in Fentalle area Kebu Balemie *et al.* (2004); in Gololcha District, Mekonnen Abebe (2013); in West Gojam, Mecha district Getaneh Gebeyehu (2016); in Goma district by Behailu Etana (2010); in Zegie Peninsula district Tilahun Teklehayma not and Miruste Giday (2007) in whole study site oral administration dominates over others routes of administration.

Marketability: The survey was carried out in each kebele two consecutive market (chembe (Monday and Thursday), Maleka (Friday and Monday), Anferera (Saturday and Thursday) undertaken. In the district, selling of the medicine plants in the market were not common but some medicinal plants sold by drying in the form of spice in powder, fruit and make bundle form and measured by Tin and full of cork. Some Medicinal plants sold in district were *oleawelwitschii*, fruit of *Eucalyptus globulus*, *Allium sativum*, *Echinopskebericho* were marketable (Figure 8).

Preference ranking of medicinal plants: Preference ranking of 5 medicinal plant species that were reported as effective for treating Sadden sickness was conducted after selecting 10 key informants. *Solanumincanum* stood first among the five plant species were the most effective medicinal plant to treat Sadden sickness followed by *Viscumtuberculatum* where as *Carissa edulis* was found to be the least preferred species (Table 2). This indicates that people have an alternative plant species to treat a given disease; they do have preference to one over the other based on their long time experience on the relative curative power of the plants.

Traditionally *Solanumincanum* was popular remedy for treatment of different ailments. This plant is also known as a rich source of phytochemicals, vitamins and minerals that might be medicinally important and/or nutritionally valuable (Demisse Dakone and Awoke Guadie, 2016). *Solanumincanum* could be reported and preferred in case of a widespread herb of distributed at altitudes from 1400 to 2500m and in addition to sudden sickness it is also used against intestinal complaints and wound dressing (Azene Bekele, 1993). The study related to preference ranking of different medicinal plants species were undertaken by different researchers for different human and livestock ailments. This evidence (ZewdieKassa, 2009) reported *Allium sativum* ranked against stomach ache; in Goma Woreda by (Behailu Etana, 2010) pointed that for treat tonsillitis *Acmellacaulirhiza* ranked first. In other way one plants ranked first to treat one ailment may be ranked in others. For example *Solanumincanum* was second rank to treat tonsillitis (BehailuEtana, 2010).

Preference Ranking of Livestock Ailments: Preference ranking of selected 5 medicinal plant species that were reported as effective for treating Diarrhea was conducted after selecting 10 key informants. *Croton macrostachyus* stood first among the five plant species that were the most effective medicinal plant to treat Diarrhea followed by *Tecleanobilis* Del where as *Crabbeavelutina* S. Moore was found to be the least preferred species (Table 3). This indicates the people have alternative plant species to treat a given disease; they do have preference to one over the other based on their long time experience on the relative curative power of the plants. *Croton macrostachyus* Del may be in relatively more used by local communities it grown in all ecology (Dry, Moist and Wet Weyna Dega, and Dega) in between 1,100-2,500 m a.s.l. and fairly fast growing on good sites and the whole parts of the *Croton macrostachyus* used for medicine were sap, leaves, roots, and bark (AzeneBekele, 1993). The research done else where in Ethiopia (Endalew Amenu, 2007; Mulugeta Kuma, 2014; Tebkew Mekuanent *et al*, 2015) reported that *Croton macrostachyus* used for different ailments. It pharmacological antibacterial, antimycobacterial, antidiarrhoeal, antifungal, anticonvulsant and sedative, antidiabetic, anti-inflammatory, antioxidant, and cytotoxicity activities of the different extracts and compounds isolated from *Croton macrostachyus* (Alfred Maroyi, 2017)

Informants consensus factor of common disease in the study area: Diseases in the study area are grouped into different categories and informant consensus factors (ICF) were computed. Hence, Sudden sickness and Eryblastis scored the highest ICF value (0.76) followed by dermal diseases (0.69) (Table 4). Sudden sickness was also the top recorded health problems in Adola district; the healers were treated with *Solanumincanum*, *Crabbeavelutina* while *Polysciasferruginea*, *Ehretiacymosa* var, *Maytenussenegalensis*, and *Cladostigmahildebrandtioides* were used for the treatment of Eryblastis.

Pair Wise Comparison of Medicinal Plants Used for Gonorrhoea Disease Treatment: The present result revealed that *Croton macrostachyus* ranked first followed by *Crabbeavelutina* (Table 5). It expresses that even if all of them were used to treat the gonorrhoea the preference of the trees different when comparing each other. The study made in other part of Ethiopia in Jabitehnan Woreda by Abiyot Berhanu

(2002) quantitatively pair wise ranking showing *Allium sativum* plant was the most preferred antimalarial and also research done by Endalew Amenu (2007) in Chelya district obtained *Pterolobiumstellatum* the best one to treat evil eye diseases.

Direct Matrix Ranking of Medicinal plants in Adola District: The scores obtained from each key informant for each species were summed up and ranked. Accordingly the result showed that *Syzygiumguineense* was first ranked followed by *Cordiaafricana* by having diverse purposes (Table 6). Another analytical results showed that the local communities harvest the nine multipurpose plant species mainly for firewood followed by medicinal purpose. The multipurpose plant species selected by local communities needed better conservation to keep from endangered the plants. The study done elsewhere in Ethiopia in Chelya district by Endalew Amenu (2007) revealed the same result in which *Syzygiumguineense* had the highest use value and all the identified plants were used for firewood.

Fidelity Level Index (FLI) of Medicinal Plants: Fidelity levels of different ten top ranking of medicinal plants *Croton macrostachyus* (100%) and *Phytolaccadodecandra* (100%) were scored having highest FL values, followed by *Solanumincanum* (90%) and *Vernoniaauriculifera* (62.5%) scored the least fidelity level index (Table 7). The result showed whole the respondents are agreed *Phytolaccadodecandra* was used for treating rabies and *Croton macrostachyus* was used for Gonorrhoea disease. The research done elsewhere in Ethiopia by Mirutse Giday *et al*. (2010) obtained *Phytolaccadodecandra* with high fidelity level index under treat rabies.

Dosages, Side effect and Antidote of traditional medicinal plants: The dosages of the medicinal plants were based on age, physical appearance, and duration of illness, strength of the disease and diagnosis and experience of individual healer. Almost all the healers were used similar materials to measure the dosage of medicine such as cup of coffee, glass, cork and cup of soft drink or mineral bottle and small to large can for livestock. Even if local healers have special care for pregnant and physically weakness persons and livestock there is a real drawback in traditional medicine system mostly arising from lack of precision in dosage. This findings are inline with the study done (Getachew Alebie *et al.*, 2017) who reported dose of plant parts were prescribed depending on age, physical strength and health status of patients and usually estimated by using different locally available materials.

The side effects are generally due to an over dose uses of the remedies. Plants like *Hageniaabyssinica* for Tapwarm and Erythroblasts, *Cladostigmahildebrandtioides* for Homeoroide treating were burning the body when they are taken over dose. The result showed 57 % of respondent reported no side effect of the medicine while 43 % of the respondents reported as there were side effects of the traditional medicine. According to GetachewAlebie *et al*. (2017) improper dosing, toxic plant chemicals, toxic metabolic by products are some side effect of medicinal plants. But the side effects from over doze of the traditional medicinal plants are not general truth for whole plants. The evidences (AREbulssa, 2015) obtained 49 (46%) of plants which had side effects while others had no side effects. The antidote of side effects of traditional medicine used in the district were milk, coffee, honey, ice cream, coffee and

porridge and rever of goats was the most common antidote when the side effect of the medicine has been occurred. From the identified antidotes milk (32.5%) the highest followed by rever of goat (15%) (Figure 9). This finding almost similar with the study of (Yeshambel Berhanu, 2017) reported milk; curdle milk and coffee were recommend as antidotes for any adverse effect of traditional medicinal plants. Another evidence mentioned by different researcher and summarized by Getachew Alebie *et al.* (2017) the major antidotes used in Ethiopia are Teffinjera and porridge, Shirowot, coffee, milk and milk products, honey, Shoforo, Tela, barley soup and juice.

Contribution of Medicinal Plants and InCOME for Households in Adola District: Most of the identified medicinal plants in Adola district provide multiple uses in addition to their medicinal values such as food, construction, fence, fuel wood, charcoal, farm tools and household implements, fodder, timber, shade and soil and water conservation. The evidences elsewhere in Ethiopia (Gidey Yirga, 2010; Haile Yineger *et al.*, 2008) reported multi-purpose roles of medicinal plants. In Adola district medicinal plants like *Syzygium uineense*, *Carissa edulis* and *ficussur* are used for food while *Cordiaa fricana* is the best for timber in addition to other uses.

Medicinal plants are used as source of income for local communities. All key informants were asked to tell income they obtained per sick person. The result revealed 28.3% of respondents get 3-5 Birr per sick person followed 14.2% of respondents get 3-5 Birr+goat/sheep. Generally, the money for medicines was different from healer to healer and medicine to medicine. For example the money taken for Erythroblasts and rabies are more than for blood clot. Firstly healer take the money when give the medicine for sick person. After the sick person totally cured from the disease, a Goat or a Sheep should be given for the healer with thanks (Figure 10). The local communities culturize that if they do not do just way the sick person could be sick again. This amount of Birr taking was came from their family with the knowledge of medicine and it could not be changed with time, because when the amount of money is changed the curing potential of the medicine is decreased or not work properly. This finding similar with the study of Arebu Issa (2015) who reported the price of the medicine ranges from 2 Birr for the most common to 40 Birr. Another study done by (Olsen and Helles, 2009) pointed the average daily incomes from traditional medicine are competitive with other income generating activities.

Conservation of Medicinal Plants at Study Site: The management practice encourages them to conserve plants of medicinal value with indigenous practices. There were different techniques of managements to conserve traditional medicinal plants. Of the management techniques 40.1% of the respondents were used both In situ and Ex-situ conservation and followed by In situ conservation (25.8%), Ex-situ conservation (19.2%) while (14.2%) of the respondents mention as no need of conservation of medicinal plants and freely use without any management techniques. The evidences reported by Endalew Amenu (2007) expressed by relating with single person which an individual are not harvested by an individual which has contribution to insitu conservation activities. Other scholars also reported for sustainable utilization of medicinal plant species it should be practiced

through awareness raising and conscious protection of in situ and ex situ conservation (Getnet Chekole, 2017).

Conclusion and Recommendation

The communities of Adola district have their own ways of managing resources as they are endowed with specific culture, tradition and ethical norms. This showed that communities have different depth and width of knowledge of natural resources in general and medicinal plants in particular. The communities living in district are partly dependent on medicinal plants to fulfill their day to day health care needs and for another purposes by having the knowledge when, where and how to use these plant resources. Asteraceae is the highest plant species. Trees were the highest habit of medicinal plants and most medicinal plants were collected from wild vegetation. In the district, more than half of the plants were used for human ailments that prepared from leaves and from single plants in fresh form. The most prepared medicine has been taken orally which helps to permit rapid physiological reaction with pathogens and increase the curative power. Out of the recorded ailments Sudden sickness and Diarrhea were the most common disease of human and livestock ailments respectively. *Croton macrostachyus* was the most common plant species used by local community for treating many ailments. The medicines have been used for a long period of time and given based on age, physical appearance, and health conditions by material used for other purposes. The knowledge was transferred within families to their son or daughters who ordered for their families. Agricultural activities were the most threatened factors in connection with population growth. Therefore, the study recommends the people should be encouraged by awareness creation to preserving indigenous knowledge, sustainable utilization and cultivates medicinal plants in their home gardens and Phytochemical and toxicological studies need to be carried out on medicinal plants used to treat common disease.

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