

*Full Length Research Paper*

# Plants used in traditional management of human ailments at Bale Mountains National Park, Southeastern Ethiopia

Haile Yiniger<sup>1\*</sup>, Ensermu Kelbessa<sup>2</sup>, Tamrat Bekele<sup>2</sup> and Ermias Lulekal<sup>3</sup>

<sup>1</sup>Department of Biology, Jimma University, P. O. Box 5195, Jimma, Ethiopia.

<sup>2</sup>National Herbarium, Addis Ababa University, P.O. Box 3434, Addis Ababa, Ethiopia.

<sup>3</sup>Department of Biology, Debre Berhan University, P. O. Box 445, Debre Berhan, Ethiopia.

Accepted 13 June 2008

Though the majority of people in Ethiopia at large, and at Bale Mountains National Park in particular, rely on ethnomedicinal plant species to manage human ailments, the indigenous knowledge largely remains undocumented. Therefore, an ethnobotanical study was conducted on medicinal plant species used to manage human ailments at Bale Mountains National Park, Southeastern Ethiopia. Observations and semi-structured interviews were used to gather ethnobotanical data. Altogether, 56 ailments were reported to be managed using 101 different ethnomedicinal plant species. Consensus of traditional healers was high in managing eczema (ICF = 0.58), tinea versicolor (ICF = 0.50), rheumatism (ICF = 0.43), haemorrhoids (ICF = 0.33), earache (ICF = 0.33) and gonorrhoea (ICF = 0.27). The mean number of plant species used by each healer showed significant difference with district. Most medicinal plant species reported in this study were found to be under threat and this calls for urgent conservation measures so as to maximize the sustainable use of these vital resources in the study area.

**Key words:** Ethnobotany, ethnomedicine, indigenous knowledge, medicinal plant, traditional medicine, traditional healer, Bale, Ethiopia.

## INTRODUCTION

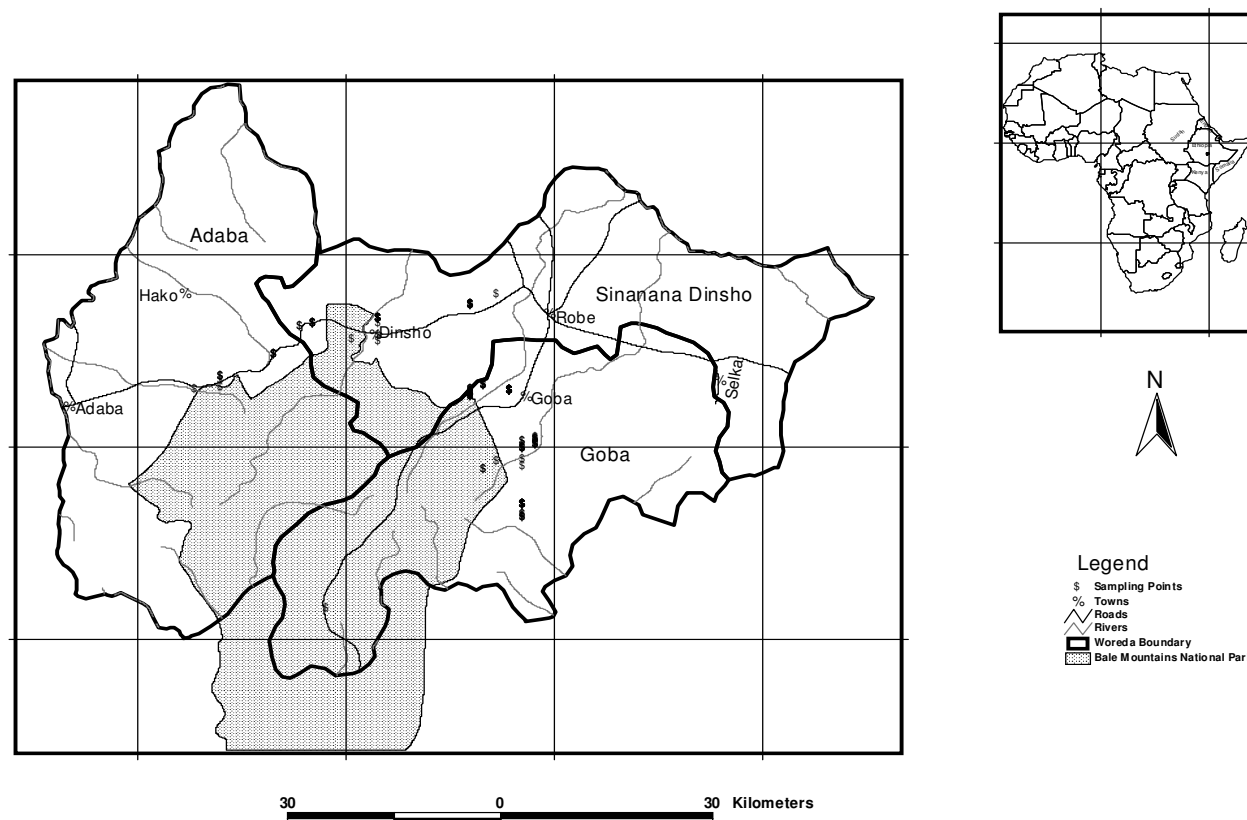
Ethiopia is an eastern African country with a total surface area of 1,127,127 Sq. Km and an estimated population size of 74,777,981. The birth rate of the country is 37.98 births per 1000 population while the death rate is 14.86 deaths per 1000 population (The World Fact book, 2007). Available information regarding the burden of diseases showed that the highest number of deaths occur due to communicable, maternal and prenatal problems (Fantahun and Degu, 2004; CSA Ethiopia and ORC Macro, 2006; WHO, 2006). The ten top causes of death among all age groups in 2002 for instance were lower respiratory infections, HIV/AIDS, prenatal conditions, diarrhoeal diseases, tuberculosis, measles, cerebrovascular disease, ischaemic heart disease, malaria and syphilis (WHO, 2006). The population of the country at large is also at a very high risk of major infectious

diseases such as food or waterborne (bacterial and protozoal diarrhoea, hepatitis A, typhoid fever, and hepatitis E), vector borne (malaria and cutaneous leishmaniasis), respiratory (meningococcal meningitis), animal contact (rabies) and water contact (schistosomiasis) diseases (The World Fact book, 2007).

Like any other developing and least developed nations, the available modern healthcare services of the country are not only insufficient but also inaccessible and unaffordable to the majority. This problem along with the rapidly increasing human population and cultural resistances towards the use of modern medicines means that the majority of the people in Ethiopia are dependent on traditional medicines of mainly plant origins so as to manage various human ailments (Abebe, 2001). As the country is known to have diverse socio-economic, ethnic, linguistics and cultural landscapes, the existence of rich indigenous medicinal plant use knowledge and practices in managing human ailments might reasonably be expected.

However, ethnomedicinal plant knowledge and use in Ethiopia is largely undocumented and research in this

\*Corresponding author. E-mail: [haile\\_mulu@yahoo.com](mailto:haile_mulu@yahoo.com). Tel: +251911389802.



**Figure 1.** Map showing location of study area and sampling points.

field has been very recent activity (Tadesse and Demissew, 1992), as it was neglected and considered irrelevant in earlier times (Abebe and Ayehu, 1993). In fact, some early visitors have made inventory of medicinal plants in some areas of the country but the information has not been easily accessible to most researchers (Abebe, 1986). Moreover, most of the studies made to date are more general and do not focus on a specific ethnic group or agro-ecological zone of the country. Of course, there have been a number of such ethnomedicinal studies, especially recently (Addis et al., 2001; Fassil, 2003; Giday et al., 2003; Fassil, 2005; Giday et al., 2007; Teklehaymanot et al., 2007; Teklehaymanot and Giday, 2007; Wondimu et al., 2007; Yineger et al., 2007; Yineger and Yewhalaw, 2007; Yineger et al., 2008a; Yineger et al., 2008b; Lulekal et al., 2008). Documentation of medicinal plants and the associated indigenous knowledge of each ethnic group or agro-ecological zone of the country is thus far from complete. This holds true especially in the case of Bale Mountains National Park and adjacent areas where, to the best of our knowledge there were no previous studies on ethnomedicinal plant species used to manage human ailments. Therefore, the current study was conducted with the aim of documenting the traditional knowledge on the use of ethnomedicinal plant species by traditional healers within

the study area.

## MATERIALS AND METHODS

### Study area

The study was conducted in 16 selected *Kebeles* (the smallest administrative units in Ethiopia) of three districts (Sinana Dinsho, Adaba and Goba) found in and around Bale Mountains National Park, Bale Zone, Southeastern Ethiopia, between latitudes  $06^{\circ}05'46'' - 07^{\circ}54'35''N$  and longitudes  $039^{\circ}33'19'' - 039^{\circ}59'24''E$  (Figure 1) at an altitudinal range of 2441-3600 m a.s.l. The area has a typical vegetation type of undifferentiated Afromontane forests in Ethiopia and has a mean annual rainfall and temperature of 1218.64 mm and  $10.26^{\circ}C$ , respectively. The economic activities of the local people are primarily based upon mixed farming that involves pastoralism and cultivation of crops such as wheat and barely (Figure 1).

### Ethnobotanical data collection

Ethnobotanical data were collected from January 2004 to March 2005 on medicinal plant species used by 43 traditional healers to manage human ailments in the study area. The chair persons of each *Kebele* and local inhabitants were used to identify and register traditional healers residing in and around the Bale Mountains National Park. In addition, identified traditional healers were invited to nominate other traditional healers. Authors demonstrated their maximum effort to involve as many female healers as possible in

the study. However, that was not realized due to the relative absence of female healers as well as lack of consent for some due to complicated socio-cultural reasons, which they could not tell to authors. Any way, all female traditional healers ( $n = 8$ ) who gave their consent were involved in the study whereas systematic list sampling was employed to select 35 male traditional healers. Semi-structured interviews and observations were used (Martin, 1995). Interviews were facilitated by translators who were well conversant of the local language, *Oromiffa*, and this was done having first obtained verbal informed consent from each traditional healer. After consent was obtained, the backgrounds of each traditional healer including address, sex, age, occupation, educational level and marital status were recorded. Additionally the human ailments treated, local name of plant species used, source (wild/cultivated), habit, marketability, status (degree of scarcity), plant part used, form used (fresh/dried), methods of preparation and administration, dosages, other uses of the medicinal plant species, threats to ethnomedicinal plant species, conservation practice and indigenous knowledge transfer were also recorded.

The authors accompanied traditional healers, translators and assistants to the field and collected herbarium voucher specimens for plant species reported as medicinal. The general habitats and morphological features of the ethnomedicinal plant species were also observed and recorded. The specimens were pressed, dried, identified and deposited at The National Herbarium (ETH), Addis Ababa University. Identification of specimens was done using taxonomic keys in the Flora of Ethiopia and Eritrea (Hedberg and Edwards, 1989, 1995; Edwards et al., 1995; Edwards et al., 1997; Edwards et al., 2000; Hedberg et al., 2003; Hedberg et al., 2004) and comparison with herbarium materials.

#### Data analyses

MS Excel 2003 was used to quantify and sort data, determine proportions, and draw bar graphs and tables. ICF (informant consensus factor) values were determined following Trotter and Logan (1986) to evaluate healers' consensus on managing human ailments. The formula used to calculate these values was:  $ICF = \frac{nuc - ns}{nuc - 1}$ , where  $nuc$  = the number of use citations for a specific ailment,  $ns$  = the number of species used to treat the ailment. Fidelity levels (FL) (Friedman et al., 1986) were also determined to identify the most important medicinal plant species used to treat a particular ailment. These values were calculated as:  $FL (\%) = \frac{SF}{TF} (100)$ , where  $SF$  = frequency of citation of a species for a specific ailment and  $TF$  = total number of citations of that species.

Ethnomedicinal data were also analyzed utilizing three nonparametric tests in SPSS 12.0.1. The Spearman rank correlation test was used to see if there was a significant positive correlation between the educational level of traditional healers and the number of ailments treated as well as the number of ethnomedicinal plant species reported. Chi-square test was used to evaluate whether the mean number of ethnomedicinal plant species reported by each traditional healer varied significantly in the three districts and whether there was a significant difference between female and male traditional healers with respect to the number of species reported and used to treat human ailments. Binomial test was used to evaluate;

- i. Whether remedies were prescribed with doses.
- ii. Whether indigenous medicinal plant knowledge was transferred to generations.
- iii. Whether the reported ethnomedicinal plant species had multiple uses other than medicinal value.
- iv. If the medicinal plant species were reported to be threatened and
- v) whether traditional healers were practicing conservation activities for medicinal plant species of the study area.

## RESULTS

The traditional healers involved in this study ranged in their ages from 18 to 88 and most (97.67%) belong to the Oromo ethnic group. Most of the traditional healers were males (81.40%), and had attended educational standards 1 - 4 (32.56%) and could only read and write (30.23%). The proportions of healers who were illiterate (18.60%) and who attended standards 5-8 (16.28%) were also high while one female healer (2.33%) was found to have completed grade 12.

### Consensus of traditional healers in managing human ailments

In total, 56 different human ailments were reported to be managed by traditional healers using various medicinal plant species of the study area (Appendix I). The number of human ailments reported to be treated by each traditional healer was highly correlated (Spearman correlation test,  $r = 0.511$ ,  $\alpha = 0.01$ ,  $p = 0.000$ ) with their educational level.

Traditional healers agreed more in the treatment of eczema (ICF = 0.58), tinea versicolor (ICF = 0.50), rheumatism (ICF = 0.43), haemorrhoids (ICF = 0.33), earache (ICF = 0.33) and gonorrhoea (ICF = 0.27) (Table 1). The species with the highest level of fidelity (FL = 53.85%) in the treatment of eczema was *Olea europae* subsp. *Cuspidata*. This human disease was also reported to be treated using *Solanum anguivi* Lam. and *Heracleum abyssinicum* (Boiss.) Norman, which shared the same fidelity level (FL = 25%). High degree of consensus was observed among the traditional healers on the use of *Datura stramonium* L. (FL = 50%) to manage tinea versicolor but low consensus on using *S. anguivi* (FL = 12.50%).

*Senecio syringifolius* O.Haffm. (FL = 100%), *Hypericum revolutum* Vahl. (FL = 100%) and *Cassipourea malosana* (Baker) Alston (FL = 75%) were medicinal species with very high fidelity level used to manage rheumatism. High fidelity level (FL = 50%) was also observed for *Schefflera volkensii* (Engl.) Harms, *Peperomia tetraphylla* (Foster) Hook. & Arn., *Nuxia congesta* R.Br.ex Fresen. and *Myrica salicifolia* A. Rich. Medicinal plant species with low fidelity levels in managing this ailment were *Linum usitatissimum* L. (FL = 33.33%), *Clerodendrum myricoides* (Hochst.) R.Br. ex Vatke (FL = 30%), and *Eucalyptus globulus* Labill. (FL = 14.29%).

Traditional healers reported that they treat haemorrhoids using *Aloe macrocarpa* Tod. (FL = 40%), *Ranunculus multifidus* Forssk. (FL = 20%), *Olea europae* subsp. *Cuspidata* (FL = 15.38%) and *S. anguivi* (FL = 12.50%). They also agreed in treating earache by employing *Melilotus officinalis* (L.) Lam. (FL = 100%), *Ajuga alba* (Gurke) Robyni (FL = 25%) and *Olea europae* subsp. *Cuspidata* (FL = 7.69%) Table 1.

**Table 1.** Degree of healers' consensus on managing human ailments.

Human disease	ICF	Species	Fidelity level
Eczema	0.58	<i>Heracleum abyssinicum</i> (Boiss.) Norman	25.00
		<i>Olea europae subsp. Cuspidata</i>	53.85
		<i>Solanum anguivi</i> Lam.	25.00
Tinea versicolor	0.50	<i>Datura stramonium</i> L.	50.00
		<i>Solanum anguivi</i> Lam.	12.50
Rheumatism	0.43	<i>Cassipourea malosana</i> (Baker) Alston	75.00
		<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	30.00
		<i>Eucalyptus globulus</i> Labill.	14.29
		<i>Hypericum revolutum</i> Vahl.	100.00
		<i>Linum usitatissimum</i> L.	33.33
		<i>Myrica salicifolia</i> A.Rich.	50.00
		<i>Nuxia congesta</i> R.Br.ex Fresen.	50.00
		<i>Peperomia tetraphyla</i> (Foster) Hook. & Arn.	50.00
		<i>Schefflera volkensii</i> (Engl.) Harms	50.00
		<i>Senecio syringifolius</i> O.Haffm.	100.00
Haemorrhoids	0.33	<i>Aloe macrocarpa</i> Tod.	40.00
		<i>Olea europae subsp. Cuspidata</i>	15.38
		<i>Ranunculus multifidus</i> Forssk.	20.00
		<i>Solanum anguivi</i> Lam.	12.50
Earache	0.33	<i>Ajuga alba</i> (Gurke) Robyni	25.00
		<i>Melilotus officinalis</i> (L.) Lam.	100.00
		<i>Olea europae subsp. Cuspidata</i>	7.69
Gonorrhoea	0.27	<i>Euphorbia depauperata</i> A.Rich.	33.33
		<i>Euphorbia dumalis</i> S.Carter	100.00
		<i>Euphorbia lathyris</i> L.	33.33
		<i>Foeniculum vulgare</i> Mill.	25.00
		<i>Gladiolus dalenii</i> Van Geel	50.00
		<i>Kniphofia isoetifolia</i> Steud. ex Hochst.	50.00
		<i>Lycopersicon esculentum</i> (L.) Mill	50.00
		<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	20.00
Evil spirit	0.25	<i>Helichrysum gofense</i> Cuf.	50.00
		<i>Heracleum abyssinicum</i> (Boiss.) Norman	25.00
		<i>Olea europae subsp. Cuspidata</i>	7.69
		<i>Sideroxylon oxyacanthum</i> Baill.	50.00
		<i>Artemisia afra</i> Jacq. ex Willd.	33.33
Febrile illness ( <i>Michi</i> )	0.25	<i>Cynoglossum amplifolium</i> Hochst.ex A.Rich.	50.00
		<i>Eucalyptus globulus</i> Labill.	14.29
		<i>Satureja punctata</i> (Benth.) Briq.	100.00
		<i>Solanum anguivi</i> Lam.	12.50

### Diversity of medicinal plant species and healers' indigenous knowledge

A total of 101 medicinal plant species distributed in 88 genera and 51 botanical families were recorded and documented. The family reported with the highest number of medicinal plant species was Asteraceae (14 species, 13.86%). This was followed by Apiaceae (8 species, 7.92%) and Lamiaceae (6 species, 5.94%) (Table 2).

Most of the reported species were collected from

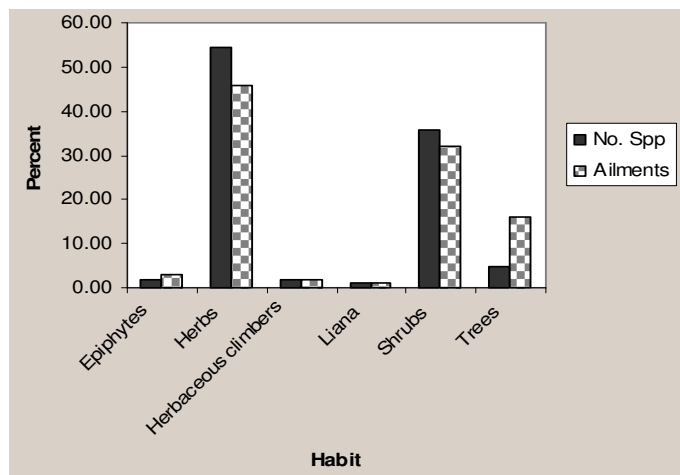
Sinana Dinsho (61.79%) and Goba (30.89%) districts while some (7.32%) from Adaba district. The average number of ethnomedicinal plant species reported by each healer varied significantly ( $\chi^2 = 207.690$ ,  $df = 22$ ,  $\alpha = 0.05$ ,  $p = 0.000$ ) with district: Adaba ( $3.67 \pm 0.333$ ), Goba ( $10.26 \pm 0.837$ ), Sinana Dinsho ( $7.66 \pm 0.367$ ). A significant ( $\chi^2 = 62.338$ ,  $df = 11$ ,  $\alpha = 0.05$ ,  $p = 0.000$ ) difference was also observed between female and male traditional healers with respect to the number of medicinal plant species reported and used. The mean number of

**Table 2.** Medicinal botanical families at Bale Mountains National Park

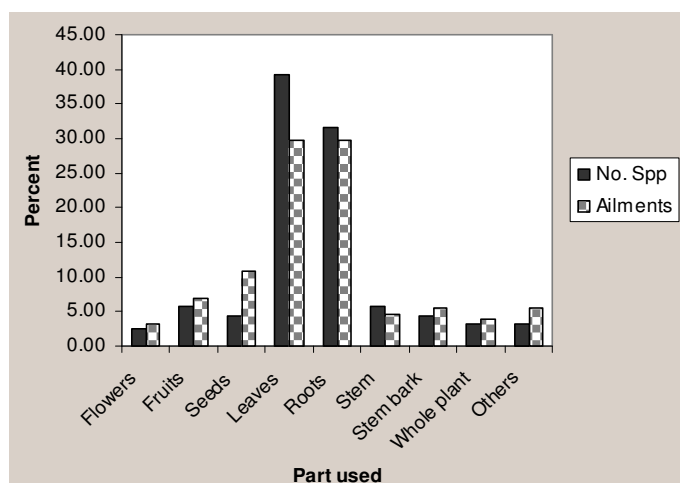
Family	No. Genera	%	No. Species	%	No. Ailments treated	%
Acanthaceae	2	2.27	2	1.98	2	1.10
Aloaceae	1	1.14	1	0.99	4	2.20
Amaranthaceae	1	1.14	1	0.99	3	1.65
Amaryllidaceae	1	1.14	1	0.99	2	1.10
Apiaceae	8	9.09	8	7.92	12	6.59
Aquifoliaceae	1	1.14	1	0.99	1	0.55
Araceae	1	1.14	1	0.99	4	2.20
Araliaceae	1	1.14	1	0.99	3	1.65
Asparagaceae	1	1.14	1	0.99	2	1.10
Asphodelaceae	1	1.14	1	0.99	2	1.10
Asteraceae	12	13.64	14	13.86	20	10.99
Balsaminaceae	1	1.14	1	0.99	1	0.55
Boraginaceae	2	2.27	2	1.98	4	2.20
Cactaceae	1	1.14	1	0.99	2	1.10
Caricaceae	1	1.14	1	0.99	2	1.10
Caryophyllaceae	1	1.14	1	0.99	2	1.10
Celastraceae	2	2.27	3	2.97	5	2.75
Chenopodiaceae	1	1.14	1	0.99	1	0.55
Commelinaceae	1	1.14	1	0.99	1	0.55
Convolvulaceae	1	1.14	1	0.99	1	0.55
Crassulaceae	3	3.41	3	2.97	4	2.20
Euphorbiaceae	1	1.14	3	2.97	6	3.30
Fabaceae	2	2.27	3	2.97	2	1.10
Flacourtiaceae	1	1.14	1	0.99	3	1.65
Geraniaceae	1	1.14	1	0.99	2	1.10
Hyacinthaceae	1	1.14	1	0.99	1	0.55
Hypericaceae	1	1.14	1	0.99	1	0.55
Iridaceae	1	1.14	1	0.99	2	1.10
Lamiaceae	5	5.68	6	5.94	8	4.40
Linaceae	1	1.14	1	0.99	3	1.65
Loganiaceae	1	1.14	1	0.99	2	1.10
Malvaceae	1	1.14	1	0.99	3	1.65
Menispermaceae	1	1.14	1	0.99	1	0.55
Moraceae	1	1.14	1	0.99	1	0.55
Myricaceae	1	1.14	1	0.99	2	1.10
Myrtaceae	1	1.14	2	1.98	6	3.30
Oleaceae	1	1.14	1	0.99	6	3.30
Piperaceae	1	1.14	2	1.98	3	1.65
Plantaginaceae	1	1.14	2	1.98	2	1.10
Ranunculaceae	2	2.27	3	2.97	6	3.30
Rhamnaceae	1	1.14	1	0.99	1	0.55
Rhizophoraceae	1	1.14	1	0.99	2	1.10
Rosaceae	2	2.27	3	2.97	4	2.20
Rubiaceae	4	4.55	4	3.96	4	2.20
Salicaceae	1	1.14	1	0.99	2	1.10
Santalaceae	1	1.14	1	0.99	1	0.55
Sapindaceae	1	1.14	1	0.99	3	1.65
Sapotaceae	1	1.14	1	0.99	3	1.65
Solanaceae	3	3.41	4	3.96	11	6.04
Verbenaceae	3	3.41	3	2.97	12	6.59
Vitaceae	1	1.14	1	0.99	1	0.55

medicinal plant species reported and used by a female and a male traditional healer was  $4.97 \pm 0.390$  and  $8.66 \pm 0.385$ , respectively. Highly significant positive correlation (Spearman correlation test,  $r = 0.509$ ,  $\alpha = 0.01$ ,  $p = 0.000$ ) was observed between the number of species reported and healers' educational level. The absence of

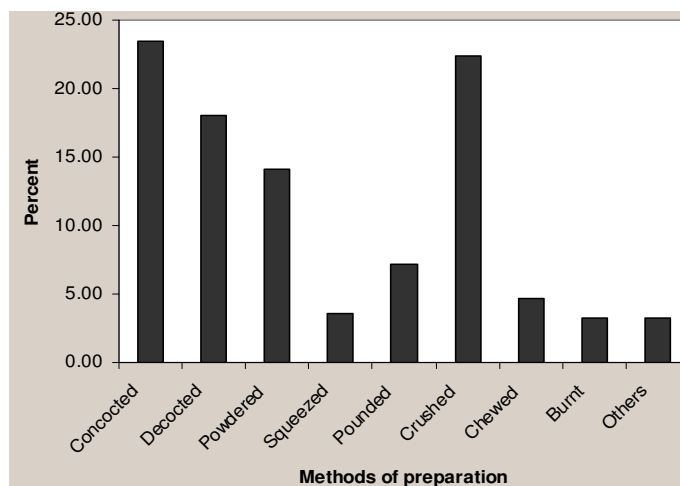
indigenous knowledge transfer was more significantly (binomial test,  $\alpha = 0.05$ ,  $p = 0.022$ ) cited by traditional healers of the study area. Nevertheless, some of the renowned traditional healers (e.g. Shek Tajju Haji Mohammed, Mr. Shifera Mekonnen, Shek Mohammed Haji Hayi, Priest- Meaza G/Wold, Mrs. Shube Sheko Sha-



**Figure 2.** Habit of ethnomedicinal plant species used to manage human ailments.



**Figure 3.** Medicinal plant parts used for remedy preparation.



**Figure 4.** Methods of traditional medicine preparation.

Shaba and Shek Nuru Haji Hussen) demonstrated to authors during the interviews that they have written records of their indigenous knowledge, which could potentially be transferred to the next generation. We actually observed during the interviews that most healers who could at least read and write were referring to their written records while providing the ethnomedicinal information.

The majority of the reported species (83.64%) were wild whereas some (10.91%) were reported as cultivated and others (5.45%) both wild and cultivated. Most of the recorded ethnomedicinal plant species were herbs (54.46%) and shrubs (35.64%) (Figure 2).

### Medicinal plant processing and administration methods

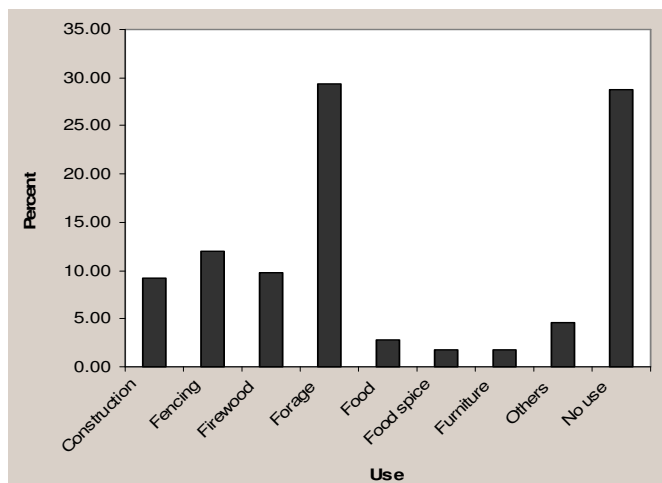
Traditional healers reported to harvest most of the medicinal plant species for their leaves (62 species, 39.24%) and roots (50 species, 31.65%) to prepare remedies (Figure 3). Most species were processed in fresh (46.58%) and fresh or dried forms (32.19%) while some (21.23%) in solely dried forms.

Traditional healers also reported to process remedies mainly through concoction (23.47%), crushing (22.38%), decoction (18.05%), and powdering (14.08%) (Figure 4). Substances like cold water, honey, coffee, butter, olive oil, salt, sugar, kerosene, ash and milk were reported to be mixed with the plant materials during the preparation of remedies. The processed remedies were mostly administered through oral (50.72%) and dermal (37.68%) routes. These were followed by nasal (7.97%), auricular (2.17%) and optical (1.45%) administrations. Remedy prescriptions were mostly claimed to have doses (binomial test,  $\alpha = 0.05$ ,  $p = 0.000$ ) and were measured using water glasses, tea glasses, cups, lids, spoons, pinches, handfuls and forefingers (Figure 4).

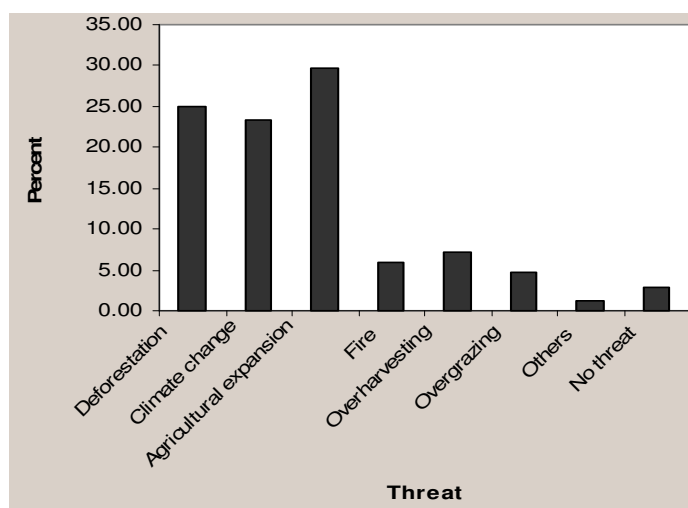
### Use diversity and status of the reported medicinal plant species

The majority of ethnomedicinal plant species were reported as abundant (48.51%) and less abundant (32.67%) where as some as rare (15.84%) and very rare (2.97%). Though many species (28.74%) were indicated to have not use other than their medicinal value, most were reported as multipurpose species (binomial test,  $\alpha = 0.05$ ,  $p = 0.000$ ) and were mainly used for forage (29.31%), fencing (12.07%), firewood (9.77%) and construction (9.20%) (Figure 5).

Although healers reported most species as abundant based on their perception, the existence of threats (binomial test,  $\alpha = 0.05$ ,  $p = 0.000$ ) to the majority of the species was evident from analysis of their responses and the most frequently cited threats to ethnomedicinal plant species of the study area were ecological degradation through agricultural expansion (29.66%),



**Figure 5.** Other uses of the reported ethnomedicinal plant species.



**Figure 6.** Reported threats to ethnomedicinal plant species of the study area.

deforestation (25%) and change in climate or weather condition (23.31%), followed by over-harvesting (7.20%), fire (5.93%) and overgrazing (4.66%) (Figure 6). Although these threats were identified by traditional healers within the study area, most healers indicated that they were not themselves practicing conservation activities for ethnomedicinal plant species within the study area (binomial test,  $\alpha = 0.05$ ,  $p = 0.000$ ). Of course, some healers reported to cultivate many species (30.95%) in their home gardens or the immediate vicinity.

## DISCUSSION AND CONCLUSIONS

Traditional healers of Bale Mountains National Park and buffer zones were found to be rich in their indigenous knowledge on the use of ethnomedicinal plant species to

manage various human ailments within the study area. This was evidenced with the result that a total of 56 human ailments were reported to be treated using 101 ethnomedicinal plant species. However, significant indigenous knowledge loss was evident as it was held in high secrecy and most healers did not yet transfer their knowledge to the subsequent generation. The high degree of secrecy surrounding ethnomedicinal knowledge among the traditional healers could be attributed to the fact that traditional healers derive a sort of 'income monetary or in-kind compensation for the treatments they provide'. The total number of plant treatments cited in this study could however indicate that the general culture of ethnomedicinal knowledge secrecy was slightly lower with few exceptions (Lulekal et al., 2008) compared to some ethnobotanical studies in other parts of the country (Giday et al., 2003; Fassil, 2003; Giday et al., 2007; Teklehaymanot et al., 2007; Teklehaymanot and Giday, 2007; Yineger and Yewhalaw, 2007; Yineger et al., 2008a, Yineger et al. 2008b).

Results of this study showed an increase in the knowledge of ailments and ethnomedicinal plant species with healers' educational level. This could be because of the fragmentation and erosion of the indigenous knowledge especially from the perspective of illiterate traditional healers, because they have no formal written records for reference. Knowledge that disappears from memory is hence lost forever.

Traditional healers dwelling in the three districts varied significantly in their indigenous knowledge on management of human ailments. This could on the one hand be attributed to the individual knowledge differences as a result of their background or indeed the depth of indigenous knowledge inherited. On the other hand it could be because of the ecological and environmental variations of the three districts, in other words there may be variations in species richness of the three districts.

Knowledge on management of human ailments was also found to be significantly different for different sexes; males appeared to be more knowledgeable than females. The gender imbalance of the samples involved in this study might have contributed to this difference. A similar result was also reported by Teklehaymanot et al. (2007) for people around Debre Libanos Monastery in Central Ethiopia, where on average a female healer reported  $1.67 \pm 0.33$  and a male  $5.77 \pm 0.71$  species with significant difference between them ( $\alpha = 0.05$ ,  $p = 0.023$ ).

Our result was, however, contrary to the finding of Kitula (2007) in Tanzania who reported that all the traditional medicine practitioners in the surveyed villages were females. Cultural differences between the study populations in the two countries might have contributed for the observed differences. The high degree of consensus observed among the traditional healers of Bale in managing eczema, tinea versicolor, rheumatism, haemorrhoids, earache and gonorrhoea could give high validity to the species used to treat these ailments and could be due to the existence of common criteria to select a specie

Appendix I. Human ailments reported to be treated and ethnomedicinal plant species used

Human Disease	Scientific name	Family	Local name	Voucher	Part used	Form used	Methods of preparation	Route of admin.
Abdominal irritation (Gastritis)	<i>Galium simense</i> Fresen.	Rubiaceae	Jiddha	Haile 135	Root	Fresh or dried	Chewed	Oral
Acute stomach illness ( <i>Agano</i> , <i>Dingetegna</i> )	<i>Alchemilla haumannii</i> Rothm.	Rosaceae	Endrif	Haile 96	Leaves	Fresh	Chewed	Oral
	<i>Anthriscus sylvestris</i> (L.) Hoffm.	Apiaceae	Bossoqua	Haile 36	Root	Fresh	Crushed, salted, chewed	Oral
	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Barzafi	Haile 55	Leaves	Fresh	Concocted, mixed with roasted coffee, chewed	Oral
	Flower				Fresh or dried	Concocted, crushed, chewed	Oral	
	<i>Geranium arabicum</i> Forssk.	Geraniaceae	Qorsa Guracha	Haile 23	Root	Fresh	Chewed or decocted & mixed with honey	Oral
	<i>Heracleum abyssinicum</i> (Boiss.)Norman	Apiaceae	Bunkaka Hida	Haile 130	Root, Leaves	Fresh or dried	Chewed	Oral
	<i>Lippia adoensis</i> Hochst. ex Walp.	Verbenaceae	Sukahi	Haile 76	Leaves	Fresh or dried	Concocted, crushed, chewed	Oral
					Root, Leaves	Fresh or dried	Chewed	Oral
	<i>Myosotis vestergrenii</i> Stroh	Boraginaceae	Dingetegna	Haile 161	Leaves	Fresh	Squeezed, mixed with water	Oral
	<i>Satureja pseudosimensis</i> Brenan	Lamiaceae	Riggii	Haile 164	Root, Leaves	Fresh or dried	Chewed	Oral
	<i>Senecio myriocephalus</i> Sch.Bip.ex Rich.	Asteraceae	Agadena	Haile 119	Root	Fresh	Concocted, mixed with roasted coffee, chewed	Oral
	<i>Solanum adoense</i> Hochst ex. A.Rich.	Solanaceae	Hiddi	Haile 167	Leaves	Fresh	Concocted, squeezed, salted	Oral
	<i>Solanum anguivi</i> Lam.	Solanaceae	Qore Worabesa	Haile 69	Root	Fresh	Concocted, crushed, mixed with water	Oral
Amoebiasis ( <i>Dubarraa</i> )	<i>Amaranthus caudatus</i> L.	Amaranthaceae	Bertefi	Haile 150	Seed	Dried	Drying seeds	Oral
Amoebiasis ( <i>Dubarraa</i> )	<i>Anthemis tigrensensis</i> J.Gay ex A.Rich.	Asteraceae	Sifay	Haile 2	Root	Fresh or dried	Crushed, powdered, mixed with honey	Oral
	<i>Launea intybacea</i> (Jacq.) Beauv.	Asteraceae	Korsa Sheka	Haile 1	Root, Leaves	Fresh or dried	Decocted	Oral
	<i>Ranunculus multifidus</i> Forssk.	Ranunculaceae	Kartasa	Haile 149	Flower	Dried	Powdered, salted	Oral
Ascariasis	<i>Ajuga alba</i> (Gurke) Robyni	Lamiaceae	Anamuro	Haile 171	Leaves	Dried	Decocted	Oral
	<i>Euphorbia depauperata</i> A.Rich.	Euphorbiaceae	Gurii	Haile 19	Root, Stem bark	Fresh	Crushed, Decocted	Oral



## Appendix I. Contd

Asthma ( <i>Asm</i> )	<i>Ranunculus multifidus</i> Forssk.	Ranunculaceae	Kertassa	Haile 149	Root	Dried	Concocted, mixed with butter	Oral
Cold ( <i>Qora</i> )	<i>Ageratum conyzoides</i> L.	Asteraceae		Haile 126	Leaves	Fresh	Crushed, decocted for steam bath	Dermal
	<i>Cassipourea malosana</i> (Baker) Alston	Rhizophoraceae	Muka Dadi	Haile 176	Root	Fresh	Concocted, decocted	Dermal
	<i>Dorstenia barnimiana</i> Schweinf	Moraceae		Haile 120	Root	Fresh	Crushed, decocted for steam bath	Dermal
	<i>Myrica salicifolia</i> A.Rich.	Myricaceae	Tona	Haile 25	Leaves	Fresh	Decocted	Dermal
	<i>Peperomia abyssinica</i> Mig.	Piperaceae	Rafu Osole	Haile 108	Root	Fresh	Concocted, decocted	Dermal
	<i>Rhamnus staddo</i> A.Rich.	Rhamnaceae	Qedida	Haile 24	Leaves	Fresh	Concocted, decocted	Dermal
	<i>Schefflera volkensii</i> (Engl.) Harms	Araliaceae	Ansha	Haile 33	Leaves	Fresh	Concocted, decocted	Dermal
	<i>Sideroxylon oxyacanthum</i> Baill.	Sapotaceae	Faranqassa	Haile 151	Leaves	Fresh	Powdered	Nasal
Common cold ( <i>Qufa</i> )	<i>Ajuga alba</i> (Gurke) Robyni	Lamiaceae	Anamuro	Haile 171	Leaves	Dried	Concocted, crushed, mixed with honey	Oral
	<i>Galinsoga parviflora</i> L.	Asteraceae	Kundoberbere	Haile 125	Fruit	Dried	Concocted, crushed, decocted	Oral
Constipation	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Bahirzafi	Haile 55	Leaves	Fresh	Crushed, mixed with sugar & salt	Oral
	<i>Lippia adoensis</i> Hochst. ex Walp.	Verbenaceae	Sukahi	Haile 76	Leaves	Fresh	Pounded, mixed with water, salted	Oral
Dandruff ( <i>Forefor</i> )	<i>Aloe macrocarpa</i> Tod.	Aloaceae	Hargissa	Haile 170	Stem exudate	Fresh	Concocted, powdered	Dermal
	<i>Malva verticillata</i> L.	Malvaceae	Lut	Haile 136	Root	Dried	Concocted, powdered	Dermal
	<i>Opuntia ficus-indica</i> (L.) Miller	Cactaceae	Beles	Haile 133	Stem exudate	Fresh	Concocted, powdered	Dermal
<i>Dhukuba Dhudha</i>	<i>Anthemis tigrensensis</i> J.Gay ex A.Rich.	Asteraceae	Sifay	Haile 2	Root	Fresh	Concocted, crushed, decocted	Oral
Diarrhoea ( <i>Bassa</i> )	<i>Rubia cordifolia</i> L.	Rubiaceae	Anqis	Haile 147	Root	Fresh or dried	Powdered, decocted	Oral
	<i>Tagetes minuta</i> L.	Asteraceae	Hada Gola	Haile 84	Leaves	Fresh or dried	Concocted, crushed, decocted	Oral
Diuretic (unable to urinate)	<i>Verbena officinalis</i> L.	Verbenaceae	Dargu(Hulegeb )	Haile 163	Leaves	Fresh	Crushed, filtered, mixed with honey	Oral
Dry cough	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Misirichi	Haile 70	Root bark	Fresh or dried	Decocted	Oral

## Appendix I. Contd

Earache ( <i>Dhibe Gura</i> )	<i>Ajuga alba</i> (Gurke) Robyni	Lamiaceae	Anamuro	Haile 171	Leaves	Fresh	Squeezed	Auricular
	<i>Melilotus officinalis</i> (L.) Lam.	Fabaceae	Hanguge	Haile 111	Leaves	Fresh	Squeezed	Auricular
						Dried	Concocted, crushed, mixed with butter, filtered	Auricular
	<i>Olea europae subsp. Cuspidata</i>	Oleaceae	Ejersa	Haile 95	Stem	Fresh	Oil extracted boiling stem	Auricular
Eczema ( <i>Sibiji, Chife</i> )	<i>Canthium oligocarpum Hiern</i>	Rubiaceae	Amshiq	Haile 12	Leaves	Fresh	Crushed	Dermal
Eczema ( <i>Sibiji, Chife</i> )	<i>Heracleum abyssinicum</i> (Boiss.)Norman	Apiaceae	Anshoshiraa	Haile 11	Root, Leaves, Flower	Dried	Concocted, crushed, mixed with ash & butter	Dermal
	<i>Olea europae subsp. Cuspidata</i>	Oleaceae	Ejersa	Haile 95	Stem	Fresh	Oil extracted burning fresh stem, salted	Dermal
					Stem oil	Fresh	mixed with butter	Dermal
					Leaves, Steam oil	Fresh or dried	Crushed, stem oil extracted	Dermal
					Stem oil	Fresh or dried	Oil extracted burning fresh stem	Dermal
						Fresh	Oil extracted burning fresh stem	Dermal
						Fresh	Oil extracted burning fresh stem	Dermal
						Dried	Oil extracted burning fresh stem	Dermal
	<i>Ranunculus simensis</i> Fresen.	Ranunculaceae	Kinta	Haile 85	Root, Leaves	Fresh or dried	Crushed	Dermal
	<i>Sedum baleensis</i> M.Gilbert	Crassulaceae	Buri	Haile 145	Root	Fresh	Crushed	Dermal
	<i>Solanum anguivi</i> Lam.	Solanaceae	Mujule Worabesa	Haile 69	Fruit, Leaves	Fresh or dried	Powdered	Dermal
					Leaves	Dried	Concocted, crushed, powdered, mixed with butter	Dermal
Epilepsy ( <i>Dhibe Qabana</i> )	<i>Artemisia afro</i> Jacq. ex Willd.	Asteraceae	Chuqne	Haile 56	Leaves, Root, Stem bark	Fresh	Concocted, crushed, mixed with water, squeezed	Nasal
	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Misirichi	Haile 70	Leaves	Fresh	Concocted, decocted	Dermal

## Appendix I. Contd

Epilepsy ( <i>Dhibe Qabana</i> )	<i>Maytenus gracilipes</i> (Welw.ex Oliv) Exell. subsp.arguta (Loes)Sebsebe	Celastraceae	Kombolcha	Haile 90	Leaves	Dried	Powdered, mixed with water	Oral
Evil eye ( <i>Buda</i> )	<i>Artemisia afra</i> Jacq. ex Willd.	Asteraceae	Chuqune	Haile 56	Leaves	Dried	Burnt for smoke bath	Dermal
	<i>Cynoglossum amplifolium</i> Hochst.ex A.Rich.	Boraginaceae	Qorsa Michi	Haile 75	Root	Dried	Concocted, crushed, powdered, mixed with water or milk	Oral
	<i>Dovyalis abyssinica</i> (A.Rich.) Warb.	Flacourtiaceae	Koshimo	Haile 22	Root	Fresh or dried	Concocted, pounded, decocted for steam bath	Dermal
	<i>Justicia schimperiana</i> (Hochst. ex Nees) T.Anders.	Acanthaceae	Dhumuga (Sensel)	Haile 93	Leaves	Dried	Powdered, mixed with water	Oral
	<i>Maytenus arbutifolia</i> (Hochst. ex A.Rich.) Wilztek	Celastraceae	Qartame(Kombolcha)	Haile 152	Leaves	Dried	Pounded	Oral, nasal
Evil spirit ( <i>Dhibe Laffaa</i> )	<i>Sideroxylon oxyacanthum</i> Baill.	Sapotaceae	Kombolcha	Haile 151	Root	Fresh or dried	Concocted, pounded, decocted for steam bath	Dermal
	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Marasisa	Haile 70	Root, Leaves	Fresh	Concocted, crushed, decocted	Oral
	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Misirichi	Haile 70	Leaves	Fresh	Concocted, crushed, powdered, mixed with coffee	Oral
	<i>Helichrysum gofense</i> Cuf.	Asteraceae	Irisha	Haile 43	Leaves, Stem, Root	Fresh	Concocted, decocted	Oral, dermal
	<i>Heracleum abyssinicum</i> (Boiss.)Norman	Apiaceae	Bunkaka Hida	Haile 11	Leaves	Fresh	Burnt for smoke bath	Oral
	<i>Oldenlandia monanthos</i> (A.Rich.)Hiern	Rubiaceae	Matane Ilbisa	Haile 148	Leaves, Stem	Fresh or dried	Concocted, decocted	Dermal
	<i>Olea europae subsp.Cuspidata</i>	Oleaceae	Ejersa	Haile 95	Stem	Fresh	Burnt for smoke bath	Oral, dermal
Evil spirit ( <i>Dhibe Laffaa</i> )	Rubus volkensii Engl.	Rosaceae	Gura Hagena	Haile 10	Leaves	Fresh	Concocted, decocted	Oral, dermal
	<i>Sideroxylon oxyacanthum</i> Baill.	Sapotaceae	Faraqasa	Haile 151	Leaves	Fresh	Concocted, crushed, powdered, mixed with coffee	Oral
					Root, Leaves	Dried	Burnt for smoke bath	Dermal

## Appendix I. Contd

Eye disease ( <i>Dhibe Eja</i> )	<i>Aloe macrocarpa</i> Tod.	Aloaceae	Hargissa	Haile 170	Stem exudate	Fresh	Stem exudate collected making a cut	Optical	
Febrile illness ( <i>Michi</i> )	<i>Malva verticillata</i> L.	Malvaceae	Lita	Haile 136	Leaves	Fresh	Crushed	Optical	
	<i>Artemisia afra</i> Jacq. ex Willd.	Asteraceae	Chikugne	Haile 56	Leaves	Fresh	Crushed, squeezed	Dermal	
	<i>Cynoglossum amplifolium</i> Hochst. ex A. Rich.	Boraginaceae	Kerchaba	Haile 75	Leaves	Fresh	Squeezed	Nasal, dermal	
	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Barzafi	Haile 55	Leaves	Fresh or dried Fresh	Decocted Chewed	Oral Oral	
	<i>Eucalyptus saligna</i> SM.	Myrtaceae	Barzafi	Haile 97	Fruit	Fresh or dried	Burnt for smoke bath	Dermal	
	<i>Plectranthus barbatus</i> Group	Lamiaceae	Damakessie	Haile 169	Leaves	Fresh or dried	Decocted	Dermal	
<i>Satureja punctata</i> (Benth.) Briq.	Lamiaceae	Yemich medihanit	Haile 172	Leaves	Fresh or dried	Crushed, squeezed, mixed with coffee	Oral		
	<i>Solanum anguivi</i> Lam.	Solanaceae	Hiddi	Haile 69	Root	Fresh Fresh or dried	Crushed, squeezed Chewed	Nasal, dermal Oral	
	<i>Thymus schimperi</i> Ronniger	Lamiaceae	Tosigni	Haile 87	Leaves	Dried	Concocted, crushed, mixed with water	Oral	
	Human Disease	Scientific name	Family	Local name	Voucher	Part used	Form used	Methods of preparation	Route of admin.
Gland TB ( <i>Naqarsa</i> )	<i>Arisaema schimperianum</i> Schot	Araceae	Abutashe	Haile 173	Root	Dried	Crushed, mixed with soot	Dermal	
<i>Asparagus setassus</i> (Kunth) Jessap	Asparagaceae	Zeriti	Haile 79	Leaves	Fresh or dried	Powdered	Dermal		
	<i>Cineraria deltoidea</i> Sond.	Asteraceae		Haile 123	Leaves	Fresh or dried	Powdered	Dermal	
	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Alaqa Merga	Haile 128	Leaves	Dried	Concocted, crushed, powdered	Dermal	
	<i>Geranium arabicum</i> Forssk.	Geraniaceae	Kinta	Haile 23	Root	Fresh	Crushed	Dermal	
	<i>Ranunculus multifidus</i> Forssk.	Ranunculaceae	Scherif	Haile 149	Leaves	Fresh or dried	Powdered	Dermal	
	<i>Solanum anguivi</i> Lam.	Solanaceae	Mujule Worabesa	Haile 69	Leaves	Dried	Concocted, crushed, powdered	Dermal	
			Hidi (Mujule Worabesa)	Haile 69	Root	Fresh	Crushed, Decocted	Oral	
		<i>Verbena officinalis</i> L.	Verbenaceae	Atochi (Amh)	Haile 163	Root	Fresh	Concocted, crushed	Dermal
	Gonorrhoea ( <i>Chobto</i> )	<i>Euphorbia depauperata</i> A. Rich.	Euphorbiaceae	Gurii	Haile 19	Root	Fresh	Crushed, Decocted	Oral

## Appendix I. Contd

	<i>Euphorbia dumalis</i> S.Carter	Euphorbiaceae	Gurii	Haile 20	Stem bark	Dried	Powdered, mixed with water & honey	Oral
					Root	Fresh	Crushed, Decocted Concocted, crushed	Oral Oral
	<i>Euphorbia lathyris</i> L.	Euphorbiaceae	Ambuluk Amplu	Haile 118 Haile 118	Seed Seed	Fresh or dried Fresh	Crushed, powdered Pounded, mixed with honey	Oral Oral
Gonorrhoea ( <i>Chobto</i> )	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Ensilal	Haile 128	Leaves	Fresh or dried	Concocted, crushed, decocted	Oral
	<i>Gladiolus dalenii</i> Van Geel	Iridaceae	Kelede	Haile 179	Root	Fresh or dried	Crushed, mixed with water	Oral
Gonorrhoea ( <i>Chobto</i> )	<i>Impatiens aethiopiaca</i> Gray-Wilson	Balsaminaceae	Anshoshila	Haile 30	Root	Fresh	Crushed	Dermal
Haemorrhoids ( <i>Kurmuman, Kintarot</i> )	<i>Kniphofia isoetifolia</i> Steud. ex Hochst.	Asphodelaceae	Shinshile	Haile 316	Root	Fresh or dried	Concocted, crushed, powdered, mixed with coffee & sugar	Oral
	<i>Lycopersicon esculentum</i> (L.)Mill	Solanaceae	Timatimo	Haile 166	Leaves	Fresh or dried	Concocted, crushed, decocted	Oral
	<i>Stephania abyssinica</i> (Dillon & A.Rich.)	Menispermaceae	Kalala	Haile 37	Root	Fresh	Crushed, Decocted	Oral
	<i>Aloe macrocarpa</i> Tod.	Aloaceae	Hargissa/Qore	Haile 170	Leaves	Fresh	Concocted, crushed, powdered, mixed with butter	Dermal
	<i>Aloe macrocarpa</i> Tod.	Aloaceae	Hargissa	Haile 170	Stem oil	Fresh	Concocted, crushed, powdered, mixed with olive oil	Dermal
	<i>Olea europae subsp. Cuspidata</i>	Oleaceae	Ejersa	Haile 95	Stem oil	Fresh	Oil extracted burning fresh stem, mixed with camel dung	Dermal
							Concocted, crushed, powdered, mixed with olive oil	Dermal
		<i>Ornithogalum tenuifolium</i> Delaroche	Hyacinthaceae	Kuras	Haile 180	Seed	Fresh or dried	Concocted, crushed, powdered
Headache & oral sore of children	<i>Ranunculus multifidus</i> Forssk.	Ranunculaceae	Kartasa	Haile 149	Root	Dried	Concocted, powdered, mixed with butter	Dermal
	<i>Solanum anguivi</i> Lam.	Solanaceae	Mujule Worabesa	Haile 69	Fruit, Leaves	Fresh	Crushed	Dermal
	<i>Commelina foliocea</i> Chiov.	Commelinaceae	Harmala	Haile 78	Root	Fresh	Chewing	Nasal

## Appendix I. Contd

Headache ( <i>Bowo</i> )	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Merasisa	Haile 70	Root	Dried	Powdered, decocted for steam bath	Dermal
	<i>Cynoglossum amplifolium</i> Hochst.ex A.Rich.	Boraginaceae	Kerchaba	Haile 75	Root, Leave	Fresh or dried	Chewed	Oral, dermal
Headache ( <i>Bowo</i> )	<i>Helichrysum gofense</i> Cuf.	Asteraceae	Irisha	Haile 43	Leaves	Fresh	Concocted, decocted	Dermal
	<i>Malva verticillata</i> L.	Malvaceae	Lita	Haile 136	Leaves	Fresh	Crushed	Dermal
	<i>Maytenus gracilipes</i> (Welw.ex Oliv)Exell. subsp.arguta (Loes)Sebsebe	Celastraceae	Kombolcha	Haile 90	Leaves, Fruit, Steam bark	Dried	Powdered	Oral
	<i>Schefflera volkensii</i> (Engl.) Harms	Araliaceae	Ansha	Haile 33	Leaves	Fresh	Concocted, decocted	Dermal
Hemorrhage	<i>Ageratum conyzoides</i> L.	Asteraceae		Haile 126	Leaves	Fresh	Crushed	Dermal
Hepatitis B ( <i>Dhibee Sinbiraa</i> )	<i>Aloe macrocarpa</i> Tod.	Aloaceae	Hargessaa	Haile 170	Root	Fresh or dried	Concocted, crushed, mixed with water	Oral
	<i>Anthemis tigrensensis</i> J.Gay ex A.Rich.	Asteraceae	Sifay	Haile 2	Root	Fresh or dried	Concocted, crushed, mixed with water	Oral
	<i>Asystasia excellens</i> Lindau	Acanthaceae	Dhumuga	Haile 177	Leaves	Dried	Concocted, powdered, mixed with water, shaken & filtered	Oral
	<i>Crinum abyssinicum</i> Hochst.ex A.Rich.	Amaryllidaceae	Murquffaa	Haile 60	Root	Fresh or dried	Concocted, crushed, mixed with water	Oral
	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Barzafi	Haile 55	Leaves	Fresh	Concocted, salted, chewed	Oral
	<i>Euphorbia depauperata</i> A.Rich.	Euphorbiaceae	Gura Jarsa	Haile 19	Root, Leaves	Fresh or dried	Concocted, crushed, mixed with water & honey, warmed	Oral
	<i>Euphorbia lathyris</i> L.	Euphorbiaceae	Ambuluk	Haile 118	Fruit, seed	Fresh or dried	Crushed, powdered	Oral
	<i>Justicia schimperiana</i> (Hochst. ex Nees) T.Anders.	Acanthaceae	Sensel	Haile 93	Leaves	Fresh	Crushed, mixed with water, squeezed, filtered, mixed with honey	Oral
Hepatitis B ( <i>Dhibee Sinbiraa</i> )	<i>Justicia schimperiana</i> (Hochst. ex Nees) T.Anders.	Acanthaceae	Dhumuga	Haile 93	Leaves	Dried	Concocted, powdered, mixed with water, shaken & filtered	Oral
	<i>Kniphofia isoetifolia</i> Steud. ex Hochst.	Asphodelaceae	Lela xixiqo (shinshile)	Haile 316	Root	Fresh or dried	Concocted, crushed, decocted	Oral
	<i>Plantago afra</i> Verde	Plantaginaceae	Baxxicha	Haile 63	Root	Fresh	Crushed, Decocted	Oral

## Appendix I. Contd

	<i>Senecio myriocephalus</i> Sch.Bip.ex Rich.	Asteraceae	Agadena	Haile 119	Root	Dried	Concocted, powdered, mixed with honey	Oral
Herpes Zoster (Darabaftu, Almaz balecira)	<i>Dodonaea angustifolia</i> L.f.	Sapindaceae	Kitkitta	Ermias 20	Leaves	Dried	Powdered, mixed with butter	Dermal
Intestinal worms	<i>Cissus adenocaulis</i> Steud. ex A. Rich.	Vitaceae	Qorsa	Haile 13	Root	Fresh	Concocted, pounded, mixed with water	Oral
Intestinal worms	<i>Euphorbia lathyris</i> L.	Euphorbiaceae	Amplo	Haile 118	Seed	Fresh	Pounded, mixed with honey	Oral
Intestinal worms	<i>Ranunculus multifidus</i> Forssk.	Ranunculaceae	Akouku-Qartassa	Haile 149	Root, Leaves	Dried	Crushed, Decocted	Oral
Intestinal worms	<i>Thalictrum rhynchocarpum</i> Dill. & A.Rich.	Ranunculaceae	Sire-Bizu	Haile 107	Root	Fresh	Concocted, pounded, mixed with water	Oral
Jaundice (Hamot)	<i>Euphorbia lathyris</i> L.	Euphorbiaceae	Amplo	Haile 118	Seed	Fresh	Crushed	Oral
<i>Kambussa</i>	<i>Catha edulis</i> (Vahl) Forssk.ex Endl.	Celastraceae	Chat	Haile 99	Leaves	Fresh or dried	Concocted, pounded, decocted	Oral
<i>Kambussa</i>	<i>Haplocarpa rueppelii</i> (Sch.Bip)	Asteraceae		Haile 121	Root	Fresh or dried	Concocted, pounded, decocted	Oral
Kidney disease (Kalee)	<i>Amaranthus caudatus</i> L.	Amaranthaceae	Bertefi	Haile 150	Seed	Fresh	Concocted, decocted	Oral
	<i>Anethum graveolens</i> L.	Apiaceae	Komna	Haile 101	Leaves	Fresh or dried	Pounded, decocted, mixed with honey, filtered	Oral
	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Ensila	Haile 128	Leaves	Fresh	Concocted, decocted	Oral
Kidney disease (Kalee)	<i>Lycopersicon esculentum</i> (L.)Mill	Solanaceae	Timatimo	Haile 166	Leaves	Fresh	Concocted, decocted	Oral
Liver disease (Dhibe Tiru)	<i>Acmella caulirhiza</i> Del.	Asteraceae		Haile 110	Whole plant	Fresh or dried	Concocted, crushed, powdered, mixed with water & sugar	Oral
	<i>Amaranthus caudatus</i> L.	Amaranthaceae	Bertefi	Haile 150	Seed	Dried	Concocted, powdered, mixed with water	Oral
	<i>Arisaema schimperianum</i> Schot	Araceae	Abutashe	Haile 173	Fruit, Leaves	Dried	Concocted, crushed, mixed with water	Oral
	<i>Bidens macroptera</i> (Sch. Bip. ex Chiov.) Mesfin	Asteraceae	Kello	Haile 44	Root	Fresh or dried	Crushed, powdered, mixed with water & sugar	Oral
	<i>Carica papaya</i> L.	Caricaceae	Papaye	Haile 101	Root	Fresh or dried	Pounded, squeezed	Oral
	<i>Cineraria deltoidea</i> Sond.	Asteraceae		Haile 123	Whole plant	Fresh or dried	Concocted, powdered, mixed with water	Oral
	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Misirichi	Haile 70	Fruit	Dried	Concocted, powdered, mixed with water	Oral

## Appendix I. Contd

	<i>Euphorbia lathyris</i> L.	Euphorbiaceae	Amplo	Haile 118	Seed	Fresh or dried	Pounded, mixed with coffee	Oral
	<i>Ferula communis</i> L.	Apiaceae	Gnida	Haile 34	Root	Fresh	Crushed, decocted	Oral
	<i>Maytenus arbutifolia</i> (Hochst. ex A.Rich.) Wilztek	Celastraceae	Kombolcha	Haile 152	Fruit, Leaves	Dried	Concocted, crushed, mixed with water	Oral
Lung disease ( <i>Dhibe somba</i> )	<i>Carica papaya</i> L.	Caricaceae	Papaye	Haile 101	Root	Dried	Powdered, mixed with water	Oral
Menstrual pbm	<i>Polycarpon tetraphyllum</i> (L.)L.	Caryophyllaceae	Lalessa	Haile 109	Root	Fresh	Powdered, mixed with water	Oral
Muje	<i>Agrocharis incognita</i> (Norman) Heywood & Jury	Apiaceae	Shishunka	Haile 35	Root	Dried	Powdered, mixed with honey	Dermal
Muje	<i>Dodonaea angustifolia</i> L.f.	Sapindaceae	Dhitecha	Ermias 20	Leaves	Dried	Concocted, pounded	Dermal
Nosebleed ( <i>Funana</i> )	<i>Chenopodium schraderianum</i> Schult.	Chenopodiaceae	Kimo	Haile 131	Leaves	Dried	Powdered	Nasal
	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Ensilal	Haile 128	Leaves	Fresh	Concocted, crushed, mixed with water, squeezed	Nasal
	<i>Solanum adoense</i> Hochst ex. A.Rich.	Solanaceae	Hidi oromo	Haile 167	Leaves	Fresh or dried	Pounded, mixed with water	Nasal
	<i>Umbilicus botryoides</i> Hochst.ex A.Rich.	Crassulaceae	Darara lafa (Lamcho)	Haile 92	Root	Fresh or dried	Powdered	Nasal
Pharyngitis ( <i>Dhibe Koke</i> )	<i>Umbilicus botryoides</i> Hochst.ex A.Rich.	Crassulaceae	Darara	Haile 92	Whole plant	Fresh or dried	Crushed, mixed with water	Nasal
Qumata	<i>Olea europae subsp.Cuspidata</i>	Oleaceae	Ejersa	Haile 95	Stem oil	Fresh	Oil extracted burning fresh stem	Dermal
Rabies ( <i>Dhibe Sere</i> )	<i>Ajuga alba</i> (Gurke) Robyni	Lamiaceae	Anamuro	Haile 171	Leaves	Fresh or dried	Pounded, mixed with water	Oral
	<i>Anthemis tigrensensis</i> J.Gay ex A.Rich.	Asteraceae	Sifay	Haile 2	Root	Fresh	Concocted, crushed, mixed with water	Oral
	<i>Asparagus setassus</i> (Kunth) Jessap	Asparagaceae	Zeriti	Haile 79	Root	Fresh	Concocted, crushed, mixed with water	Oral
	<i>Convolvulus kilimandschari</i> Engl.	Convolvulaceae	Aserkush Tebetebkush (Amh)	Haile 175	Root	Fresh	Concocted, pounded, mixed with water, shaken, filtered	Oral
	<i>Salix subserrata</i> Willd.	Salicaceae	Aleltu	Haile 139	Leaves	Dried	Concocted, powdered, mixed with water	Oral
Rajoo	<i>Acmella caulirhiza</i> Del.	Asteraceae		Haile 110	Whole plant	Fresh or dried	Concocted, crushed, powdered, mixed with coffee & sugar	Oral



## Appendix I. Contd

Rajoo	<i>Bidens macroptera</i> (Sch. Bip. ex Chiov.) Mesfin	Asteraceae	Kello	Haile 44	Root	Fresh or dried	Concocted, crushed, powdered, mixed with coffee & sugar	Oral
	<i>Cineraria deltoidea</i> Sond.	Asteraceae		Haile 123	Whole plant	Fresh or dried	Concocted, crushed, powdered, mixed with coffee & sugar	Oral
	<i>Heracleum abyssinicum</i> (Boiss.)Norman	Apiaceae	Bobonka	Haile 130	Root	Fresh or dried	Concocted, crushed, powdered, mixed with coffee & sugar	Oral
Retained placenta (Hobati)	<i>Crotalaria rosenii</i> (Pax) Milne-Redh. ex Polhill	Fabaceae	Shashamane	Haile 15	Leaves	Fresh	Decocted	Oral
	<i>Crotalaria agatiflora</i> subsp. <i>Erlangeri</i>	Fabaceae	Shashamane	Haile 146	Leaves	Fresh	Decocted	Oral
	<i>Dovyalis abyssinica</i> (A. Rich.) Warb.	Flacourtiaceae	Koshimo	Haile 22	Leaves	Fresh	Concocted, pounded, mixed with water	Oral
	<i>Linum usitatissimum</i> L. <i>Salix subserrata</i> Willd.	Linaceae Salicaceae	Telba (Amh) Aleltu	Haile 17 Haile 139	Seed Leaves	Dried Dried	Pounded, decocted Powdered, mixed with coffee	Oral Oral
Rheumatism (Harassa, Qilensa, Yebird Beshita)	<i>Cassipourea malosana</i> (Baker) Alston	Rhizophoraceae	Muka Dadi	Haile 176	Twigs	Fresh	Concocted, decocted	Dermal
	<i>Cassipourea malosana</i> (Baker) Alston	Rhizophoraceae	Muka Dadi	Haile 176	Leaves	Fresh	Concocted, crushed, decocted	Dermal
	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Merasisa	Haile 70	Leaves	Fresh	Concocted, decocted	Oral, dermal Dermal
Rheumatism (Harassa, Qilensa, Yebird Beshita)	<i>Eucalyptus globules</i> Labill.	Myrtaceae	Barzafi	Haile 55	Leaves	Fresh	Concocted, decocted	Dermal
	<i>Helichrysum traversii</i> Chiov.	Asteraceae		Haile 5	Stem	Fresh	Concocted, crushed, burnt for smoke bath	Dermal
	<i>Heteromorpha trifoliata</i> (Wendl.)E(K) & Zegh.	Apiaceae	Hare Hanqa	Haile 127	Leaves	Fresh	Concocted, crushed, decocted	Oral
	<i>Hypericum revolutum</i> Vahl.	Hypericaceae	Garamba	Haile 27	Leaves	Fresh	Concocted, decocted	Dermal

## Appendix I. Contd

	<i>Ilex mitis</i> (L.) Radlk.	Aquifoliaceae		Haile 7	Leaves, Sstem bark	Fresh	Concocted, decocted	Dermal
	<i>Myrica salicifolia</i> A.Rich.	Myricaceae	Tona	Haile 25	Leaves, Stem	Fresh	Concocted and burnt for smoke bath	Dermal
	<i>Nuxia congesta</i> R.Br.ex Fresen.	Loganiaceae	Bitena	Haile 89	Leaves, Sstem bark	Fresh	Concocted, decocted	Dermal
	<i>Peperomia tetraphyla</i> (Foster) Hook. & Arn.	Piperaceae		Haile 8	Whole plant	Fresh	Concocted, decocted	Dermal
	<i>Rubus steudneri</i> Schwienf.	Rosaceae	Gora	Haile 14	Leaves	Fresh	Concocted, decocted	Dermal
	<i>Schefflera volkensii</i> (Engl.) Harms	Araliaceae	Ansha	Haile 33	Leaves	Fresh	Concocted, decocted	Dermal
	<i>Senecio syringifolius</i> O.Haffm.	Asteraceae	Lukan Luko	Haile 122	Leaves	Fresh	Concocted, crushed, decocted	Oral
Rheumatism (Kurtmat)	<i>Linum usitatissimum</i> L.	Linaceae	Telba (Amh)	Haile 17	Leaves Twigs Seed	Fresh Fresh Fresh	Concocted, decocted Concocted, decocted Seed oil mixed with gas, salted	Dermal Dermal Dermal
Ringworm (Robii)	<i>Arisaema schimperianum</i> Schot	Araceae	Abutashe	Haile 173	Root	Fresh	Concocted, crushed	Dermal
Scabies (Hossis, Chito)	<i>Nuxia congesta</i> R.Br.ex Fresen.	Loganiaceae	Bitena	Haile 89	Stem bark	Fresh or dried	Concocted, crushed, decocted	Dermal
Scabies (Hossis, Chito)	<i>Peperomia abyssinica</i> Mig.	Piperaceae	Rafu Osole	Haile 108	Leaves	Fresh	Concocted, crushed, decocted	Dermal
	<i>Solanum adoense</i> Hochst ex. A.Rich.	Solanaceae	Hiddi Oromo	Haile 167	Leaves	Fresh	Concocted, crushed, mixed with water	Dermal
Skin disease (Bochore)	<i>Dodonaea angustifolia</i> L.f.	Sapindaceae	Dhitecha	Ermias 20	Leaves	Dried	Powdered	Dermal
	<i>Olea europae subsp. Cuspidata</i>	Oleaceae	Ejersa	Haile 95	Stem oil	Fresh	Oil extracted boiling stem	Dermal
Skin infection (Dhullaa, Bugun)	<i>Crinum abyssinicum</i> Hochst.ex A.Rich.	Amaryllidaceae	Chopi	Haile 60	Root	Fresh	Decocted	Dermal
	<i>Linum usitatissimum</i> L.	Linaceae	Telba (Amh)	Haile 17	Seed	Dried	Concocted, powdered	Dermal
Stabbing Pain (Wugat)	<i>Gladiolus dalenii</i> Van Geel	Iridaceae	Kelede	Haile 179	Root	Fresh or dried	Pounded, mixed with water	Oral
Stomach pain (Garaa Ciniinnaa, Garaa kaasaa)	<i>Dovyalis abyssinica</i> (A.Rich.) Warb.	Flacourtiaceae	Koshimo	Haile 22	Stem bark, Twigs, Flower, Fruit, Seed	Fresh or dried	Crushed, mixed with water	Oral
	<i>Lippia adoensis</i> Hochst. ex Walp.	Verbenaceae	Sukayee	Haile 76	Leaves	Fresh or dried	Crushed, powdered, salted	Oral

## Appendix I. Contd

	<i>Oenanthe procumbens</i> (Wolff) Norman	Apiaceae	Bunkaka Hida	Haile 11	Root	Fresh or dried	Crushed, decocted	Oral
TB ( <i>Samba naqarsa</i> )	<i>Arisaema schimperianum</i> Schot	Araceae	Amoch	Haile 173	Root	Fresh or dried	Concocted, crushed, powdered	Dermal
<i>Tinea versicolor</i> ( <i>Baki, Barile, Quaqucha</i> )	<i>Datura stramonium</i> L.	Solanaceae	Bengi	Haile 165	Leaves	Fresh	crushed, mixed with vaseline	Dermal
	<i>Datura stramonium</i> L.	Solanaceae	Atefaris	Haile 165	Seed	Dried	concocted, powdered, mixed with honey	Dermal
<i>Tinea versicolor</i> ( <i>Baki, Barile, Quaqucha</i> )	<i>Solanum anguivi</i> Lam.	Solanaceae	Hiddi Binessa (Yejob imbuay)	Haile 69	Fruit	Dried	concocted, powdered, mixed with butter	Dermal
Tonsillitis ( <i>Qonqo</i> )	<i>Kalanchoe laciniata</i> (L.)DC.	Crassulaceae	Anchura	Haile 144	Root	Fresh	Pounded, squeezed	Nasal
Toothache ( <i>Hilicani</i> )	<i>Clerodendrum myricoides</i> (Hochst.) R.Br. Ex Vatke	Verbenaceae	Merasisa	Haile 70	Root	Fresh or dried	Chewed	Oral
	<i>Datura stramonium</i> L.	Solanaceae	Bengi	Haile 165	Seed	Fresh	Concocted, pounded, mixed with water, warmed	Oral
	<i>Galinsoga parviflora</i> L.	Asteraceae	Gubdu	Haile 125	Seed	Fresh or dried Fresh	Burnt Concocted, pounded, mixed with water, warmed	Oral Oral
	<i>Osyris quadripartita</i> Decn.	Santalaceae	Karo	Haile 88	Leaves	Fresh or dried	Crushed, decocted	Oral
	<i>Plantago lanceolatum</i> L.	Plantaginaceae	Sandabo	Haile 62	Whole plant	Dried	Crushed, powdered, mixed with water	Oral
	<i>Polycarpon tetraphyllum</i> (L.)L.	Caryophyllaceae	Lalessa	Haile 109	Root	Fresh or dried	Chewed	Oral
Typhoid ( <i>Tesibo</i> )	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Barzafi	Haile 55	Leaves	Fresh	Concocted, crushed, mixed with water and filtered	Oral
Wound	<i>Alchemilla haumannii</i> Rothm.	Rosaceae	Endrif	Haile 96	Leaves	Fresh	Crushed	Dermal
	<i>Opuntia ficus-indica</i> (L.) Miller	Cactaceae	Beles	Haile 133	Root	Fresh	Concocted, crushed	Dermal
	<i>Otostegia erlangeri</i> Gurke	Lamiaceae	Demboba	Haile 168	Leaves	Dried	Concocted, powdered	Dermal

for an ailment which in turn might be developed due to the high prevalence of these ailments in

the study area. On the other hand, the low degree of agreement among those healers in managing

human ailments with low ICF values (<0.27) was due to knowledge differences among the traditio-

tional healers and the variation in local knowledge as the study area was large (Almeida et al., 2006). This might also be attributed to the low prevalence of these diseases within the study area.

Our results showed *O. europaea* subsp. *cuspidata* to be the species with the highest fidelity level in treating eczema. According to Battinelli et al. (2006), extracts of this species were found to have *in vitro* antimicrobial activities and this may validate its traditional use in the study area.

The species with the highest fidelity level reported to be used by traditional healers of Bale to treat tinea versicolor was *Datura stramonium*. Extracts of this species were shown to have antimicrobial (Uzun et al., 2004; Eftekhar et al., 2005) and antimutagenic (Reid et al., 2006) activities. The reported antimicrobial activity of this species could validate its use by the Bale traditional healers to manage tinea versicolor.

*Hypericum revolutum* had the highest fidelity level in treating rheumatism in the current study area. Décostered et al. (1987) discovered antifungal compounds from the leaf and twig extract of this medicinal plant species. Moreover, Decosterd et al. (1989) reported an *in vitro* growth-inhibitory activity against the Co-115 human colon carcinoma cell line from petroleum-ether extract of the root bark of this species. However, these activities were not relevant to the use of this species by traditional healers within the study area to manage rheumatism. Further investigations are recommended on the phytochemical and biological activities of the species in relation to the claimed traditional use. *Myrica salicifolia* was another species with high fidelity level in managing rheumatism. Njung'e et al. (2002) found analgesic and antipyretic activities from the root extracts of this species while Kirira et al. (2006) reported anti-plasmodial activities from the methanol and aqueous extracts. Again the traditional use of this species was not consistent with the reported activity studies and this urges further biological activity investigation against rheumatism.

The Bale Mountains National Park and adjacent areas were found to have high diversity of ethnomedicinal plant species useful to manage human ailments. Most of the ethnomedicinal species were reported to be collected from wild sources. This was similar to studies from other areas (Addis et al., 2001; Giday et al., 2003; El-Hilaly et al., 2003; Ji et al., 2005; Joshua, 2006) where wild collection was frequently indicated to be dominant mode. The majority of ethnomedicinal plant species reported in this study were also reportedly harvested for their leaves and roots. Similar result was shown in the work of Huai and Pei (2005) where the frequencies of harvest for leaves and roots were reported to be 35.22 and 32.08%, respectively.

The plant life form use pattern by traditional healers for remedy preparation in this study was consistent with the use patterns noted by other studies in Ethiopia (Fassil, 2003; Teklehaymanot et al., 2007; Yineger et al., 2007)

where herbs and shrubs were consistently preferred life forms.

Most of the ethnomedicinal plant species were reported to be processed in fresh through concoction, crushing, decoction and powdering and administered mainly through oral and dermal routes. Remedies were mostly indicated to be prescribed by traditional healers of the study area with specific doses. However, their measurement methods were found to lack precision. This may be potentially dangerous as some of the species could have a high degree of toxicity, over dose might cause serious health problems for patients (Hillenbrand, 2006; Kitula, 2007).

Results of this study revealed that most ethnomedicinal plant species used by traditional healers of the study area to manage human ailments had multiple uses in addition to their medicinal values. This was indicative of the degree of threat that medicinal plant species were facing from different directions. On top of that, most species were reported to be threatened by several factors such as agricultural expansion, deforestation, change in climate or weather condition, over harvesting, fire and overgrazing. In addition, traditional healers significantly cited the absence of efforts to conserve the reported ethnomedicinal plant species. Urgent measures should therefore be taken so as to involve the traditional healers residing in and around Bale Mountains National Park in the conservation and sustainable use of ethnomedicinal plant resources as these were found to have significant contribution to meet the primary health cares of the local people in Bale. Any benefits arising from use or application of the indigenous knowledge reported in this study accrues equitably to traditional healers residing in and around Bale Mountains National Park, Ethiopia.

## ACKNOWLEDGEMENTS

This research was funded by the World Bank through the Conservation and Sustainable Use of Medicinal Plants Project in Ethiopia. Traditional healers of Bale Mountains National Park and buffer zones are genuinely acknowledged for their hospitality. We thank Mr. Getachew Addis and Sister Tsehay Ayitenew for their invaluable help in the translation of diseases into their medical terms. The field assistants and translators Mr. Mebratie Alebel, Mr. Kebede Shibru, Mr. Abdurahaman Wario and Mr. Addisu Assefa are also thanked. We are also grateful to the Bale Mountains National Park administration office and The National Herbarium (ETH), Addis Ababa University for letting us use the available facilities. Dr. David Ebbutt of UK, a native speaker of the English language, edited this manuscript. Mr. Zeleke Kebede, a GIS specialist, constructed map of the study area.

## REFERENCES

Abebe D (1986). Traditional Medicine in Ethiopia: The attempts being

- made to promote it for effective and better utilization. SINET: Ethiopian J. Sci. 9:61-69.
- Abebe D (2001). The role of medicinal plants in healthcare coverage of Ethiopia, the possible benefits of integration. In: Zewdu M, Demissie A (eds) Conservation and sustainable use of medicinal plants in Ethiopia: Proceedings of the National workshop, 28 April – 01 May 1998, Institute of Biodiversity Conservation and Research, Addis Ababa, pp. 6-21.
- Abebe D, Ayehu A (1993). Medicinal plants and enigmatic health practices of Northern Ethiopia. B.S.P.E., Addis Ababa.
- Addis G, Abebe D, Urga K (2001). A survey of traditional medicinal plants in Shirka District, Arsi Zone, Ethiopia. Ethiopian Pharm. J. 19:30-47.
- Almeida CFC, de Amorim ELC, de Albuquerque UP, Maia MBS (2006). Medicinal plants popularly used in the Xingó region – a semi-arid location in Northeastern Brazil. J. Ethnobiol. and Ethnomedicine 2:15.
- Battinelli L, Daniele C, Cristiani M, Bisignano G, Saija A, Mazzanti G (2006). In: vitro antifungal and anti-elastase activity of some aliphatic aldehydes from *Olea europaea* L. fruit. Phytomedicine: International J. Phytotherapy & Phytopharmacol. 13:558-563.
- CSA Ethiopia, ORC Macro (2006). Ethiopia: Demographic and Health Survey 2005. Addis Ababa, Ethiopia and Calverton, Maryland, USA. Available at: <http://www.measuredhs.com/pubs/pdf/FR179/FR179.pdf> (Accessed on 5 June 2008; 3:30 P.M.).
- Decosterd LA, Stoeckli-Evans H, Chapuis JC, Msonthi JD, Sordat B, Hostettmann K (1989). New Hyperforin Derivatives from *Hypericum revolutum* VAHL with Growth-Inhibitory Activity against a Human Colon Carcinoma Cell Line. Helvetica Chimica Acta 72:464-471.
- Décostered LA, Hostettmann K, Stoeckli-Evans H, Msonthi JD (1987). New Antifungal Chromenyl Ketones and their Pentacyclic Dimers from *Hypericum revolutum* VAHL. Helvetica Chimica Acta 70:1694-1702.
- Edwards S, Demissew S, Hedberg I (eds) (1997). Flora of Ethiopia and Eritrea. Volume 6. Hydrocharitaceae to Arecaceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Edwards S, Tadesse M, Demissew S, Hedberg I (eds) (2000). Flora of Ethiopia and Eritrea. Volume 2, part 1. Magnoliaceae to Flacourtiaceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Edwards S, Tadesse M, Hedberg I (eds) (1995). Flora of Ethiopia and Eritrea. Volume 2, part 2. Canellaceae to Euphorbiaceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Eftekhar F, Yousefzadi M, Tafakori V (2005). Antimicrobial activity of *Datura innoxia* and *Datura stramonium*. Fitoterapia 76:118-120.
- El-Hilaly J, Hmammouchi M, Lyoussi B (2003). Ethnobotanical studies and economic evaluation of medicinal plants in Taounate province (Northern Morocco). J. Ethnopharmacol. 86:149-158.
- Fantahun M, Degu G (2004). Burden of diseases in Amhara region, Ethiopia. Ethiopian Medical Journal 42:165-172.
- Fassil H (2003). "We do what we know": Local health knowledge and home-based medicinal plant use in Ethiopia. PhD dissertation (unpublished). International Development Centre, University of Oxford, Oxford, UK.
- Fassil H (2005). Beyond plants professionals and parchments: The role of home-based medicinal plant use and traditional health knowledge in primary health care in Ethiopia. Ethnobotany Research and Applications 3:37-49.
- Friedman J, Zohara Y, Amotz D, Palewitch D (1986). A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. J. Ethnopharmacol. 16:275-278.
- Giday M, Asfaw Z, Elmqvist T, Woldu Z (2003). An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. J. Ethnopharmacol. 85:43-52.
- Giday M, Teklehaymanot T, Animut A, Mekonnen Y (2007). Medicinal plants of the Shinasha, Agew-awi and Amhara peoples in northwest Ethiopia. J. Ethnopharmacol. 110:516-25.
- Hedberg I, Edwards S (eds) (1989). Flora of Ethiopia and Eritrea. Volume 3. Pittosporaceae to Araliaceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Hedberg I, Edwards S (eds) (1995). Flora of Ethiopia and Eritrea. Volume 7. Poaceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Hedberg I, Edwards S, Nemomissa S (eds) (2003). Flora of Ethiopia and Eritrea. Volume 4, part 1. Apiaceae to Dipsacaceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Hedberg I, Friis I, Edwards S (eds) (2004). Flora of Ethiopia and Eritrea. Volume 4, part 2. Asteraceae. The National Herbarium, Addis Ababa, Ethiopia, and Department of Systematic Botany, Uppsala, Sweden.
- Hillenbrand E (2006). Improving Traditional-Conventional Medicine Collaboration: Perspectives from Cameroonian Traditional Practitioners. Nordic J. African Studies 15:1-15.
- Huai HY, Pei SJ (2005). Plants Used Medicinally by Folk Healers of the Lahu People from the Autonomous County of Jinping Miao, Yao, and Dai in Southwest China. Economic Botany 58:265-273.
- Ji H, Shengji P, Chunlin L (2005). An Ethnobotanical Study of Medicinal Plants used by the Lisu People in Nuijiang, Northwest Yunnan, China. Economic Botany 58:253-264.
- Joshua K (2006). Conservation of indigenous medicinal botanicals in Ekiti State, Nigeria. Journal of Zhejiang University SCIENCE B 7:713-718.
- Kirira PG, Rukunga GM, Wanyonyi AW, Muregi FM, Gathirwa JW, Muthaura CN, Omar SA, Tolo F, Mungai GM, Ndiege IO (2006). Antiplasmodial activity and toxicity of extracts of plants used in traditional malaria therapy in Meru and Kilifi Districts of Kenya. J. Ethnopharmacol. 106:403-407.
- Kitula RA (2007). Use of medicinal plants for human health in Udzungwa Mountains Forests: a case study of New Dabaga Ulongambi Forest Reserve, Tanzania. J. Ethnobiol. and Ethnomedicine 3:7.
- Lulekal E, Kelbessa E, Bekele T, Yineger H (2008). An ethnobotanical study of medicinal plants in Mana Angetu District, Southeastern Ethiopia. J. Ethnobiol. and Ethnomedicine 4:10.
- Martin GJ (1995). Ethnobotany: a methods manual. Chapman and Hall, London, UK, p. 268.
- Njung'e K, Muriuki G, Mwangi JW, Kuria KAM (2002). Analgesic and antipyretic effects of *Myrica salicifolia* (Myricaceae). Phytotherapy Research 16:73-74.
- Reid KA, Maes J, Maes A, van Staden J, De Kimpe N, Mulholland DA, Verschaeve L (2006). Evaluation of the mutagenic and antimutagenic effects of South African plants. J. Ethnopharmacol. 106:44-50.
- Tadesse M, Demissew S (1992). Medicinal Ethiopian Plants: Inventory, Identification, and Classification. In: Edwards S, Asfaw Z (eds) Plants used in African Traditional Medicine as Practiced in Ethiopia and Uganda. Botany 2000: East and Central Africa, NAPRECA Monograph Series No. 5. NAPRECA, Addis Ababa University; Addis Ababa. pp. 1-19.
- Teklehaymanot T, Giday M (2007). Ethnobotanical study of medicinal plants used by people in Zegie Peninsula, Northwestern Ethiopia. J. Ethnobiol. and Ethnomedicine 3:12.
- Teklehaymanot T, Giday M, Medhin G, Mekonnen Y (2007). Knowledge and use of medicinal plants by people around Debre Libanos monastery in Ethiopia. J. Ethnopharmacol. 111:271-283.
- The World Factbook (2007). Ethiopia. Available at: <https://www.cia.gov/cia/publications/factbook/print/et.html> (Accessed on 09 February 2007; 9:40 A.M.)
- Trotter R, Logan M (1986). Informant consensus: new approach for identifying potentially effective medicinal plants. In: Etkin NL (eds) Indigenous Medicine and Diet: Behavioural Approaches, Redgrave Publishers, New York, pp. 91-112.
- Uzun E, Sariyar G, Adersen A, Karakoc B, Gülten Ötük G, Oktayoglu E, Pirildar S (2004). Traditional medicine in Sakarya province (Turkey) and antimicrobial activities of selected species. J. Ethnopharmacol. 95:287-296.
- WHO (2006). Ethiopia Country Health System Fact Sheet. Available at [http://www.afro.who.int/home/countries/fact\\_sheets/ethiopia.pdf](http://www.afro.who.int/home/countries/fact_sheets/ethiopia.pdf) (Accessed on 5 June 2008; 3:30 P.M.).
- Wondimu T, Asfaw Z, Kelbessa E (2007). Ethnobotanical study of medicinal plants around 'Dheeraa' town, Arsi Zone, Ethiopia. J. Ethnopharmacol. 112:152-161.

- Yineger H, Kelbessa E, Bekele T, Lulekal E (2007). Ethnoveterinary medicinal plants at Bale Mountains National Park, Ethiopia. *J. Ethnopharmacol.* 112: 55-70.
- Yineger H, Yewhalaw D (2007). Traditional medicinal plant knowledge and use by local healers in Sekoru District, Jimma Zone, Southwestern Ethiopia. *J. Ethnobiol. and Ethnomedicine* 3:24.
- Yineger H, Yewhalaw D, Teketay D (2008a). Ethnomedicinal plant knowledge and practice of the Oromo ethnic group in Southwestern Ethiopia. *J. Ethnobiol. and Ethnomedicine* 4:11.
- Yineger H, Yewhalaw D, Teketay D (2008b). Plants of veterinary importance in Southwestern Ethiopia: The case of Gilgel Ghibe area. *Forests, Trees and Livelihoods* 18 (2). [http://www.foreststreesandlivelihoods.co.uk/forthcoming\\_articles.htm](http://www.foreststreesandlivelihoods.co.uk/forthcoming_articles.htm)