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Ethnobotanical study on the use and knowledge of medicinal plants at three kebeles of Fedis district of Oromiya Regional state; adjacent to the Babile Elephant Sanctuary, Eastern Ethiopia

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Abstract
This study was carried out to collect and document indigenous knowledge on medicinal plants among the traditional healers of Fedis district of Oromiya regional state, East Ethiopia. The ethnobotanical data were collected from 36 traditional healers (24 male and 12 female) using semi-structured questionnaire, observation and guided field walks. The survey identified 64 medicinal plants distributed into 39 families and 59 genera. The Asteraceae and Fabaceae families were the most dominant plant families contributed medicinal plant species. The study revealed that 53 species (82.8%) were used against human ailments, 3 species (4.7%) were used to treat health problems of livestock while 8 species (12.5%) were used to treat both human and livestock ailment. Leaf was the most commonly used part (29.7%) followed by root (23.4%), stem (12.5 %), both root and leaf (10.9%), both stem and leaf (7.8%), both leaf and root (4.7%), and whole plant (3.1%). Traditional remedies were processed mainly through crushing, followed by squeezing. The study revealed five types of route of administrations of traditional medicine i.e., oral drinking, dermal application, oral or dermal, nasal, and subcutaneous. The study showed that Fedis district possess wealthy of indigenous knowledge on medicinal plants and their applications. Moreover, this ethnobotanical study can assist scientists for further research on medicinal properties of identified plants species that could contribute to development of new drugs.

Keywords: indigenous knowledge, traditional healers, medicinal plant, Fedis district, Ethiopia

1. Introduction
According to world health organization, traditional medicine (TM) is the sum total of the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures and nations which is used in the maintenance of health, prevention, diagnosis, or treatment of disorders [1, 2]. The practice of using TM as a solution for human and livestock ailments is popular in the developing world and it is rapidly spreading in the developed nations as well. Literatures indicate that 30–50% of the total drug consumption in China arise from traditional herbal preparations. In African countries like Ghana, Mali, Nigeria and Zambia, the first choice for 60% of children with high fever resulting from malaria is the use of herbal medicines. Similarly, in Ethiopia up to 80% of the population uses TM for preventive or curative purposes against human and livestock health problems [3, 4, 5]. In addition, traditional medicines already comprise a multi-billion dollar, international industry, and the biomedical sector is increasingly investigating the potential of genetic resources and traditional knowledge [6]. So far, 887 to 1000 medicinal plant species are reported in the Ethiopian Flora [6, 7].
Plants have played crucial role as a source of traditional medicine in Ethiopia from the time immemorial to combat different ailments of human sufferings [8]. It was the only system available for healthcare prior to the introduction of modern medicine for prevention, diagnosis and treatment of social, mental and physical illness [9]. To date traditional medicine has become an integral part of the culture of the Ethiopian people due to its long period of practice and existence [10]. Due to acceptability, accessibility and biomedical benefits there is a large magnitude of use and interest of medicinal plants in Ethiopia [11]. The long history of use of medicinal plants in Ethiopia is reflected in various medico-religious manuscripts produced on parchments and believes to have originated several centuries ago [12]. Reviews of medical textbooks that have been written in Geez or Arabic between 17th and 18th centuries indicated

that the majority of Ethiopians, with the exception of a few privileged groups, starting from the time of the Italian occupation, have been depending almost entirely on the traditional medicine [13]. Moreover, Ethiopia is home for more than 80 ethnic groups with a diversified culture which reflected in enormous traditional knowledge on use of herbal for medicine and associated knowledge [14, 15, 16].

Traditional medicinal knowledge is dynamic and various across different locations, regions, linguistic and cultural backgrounds with their own specific knowledge about use of plants, ways of preparation and conservation [17]. This knowledge exists in indigenous community as secret oral traditions hence, documenting and protecting these medicines is becoming a greater priority. This is true in Ethiopia, even though progress have been made regarding documentation of traditional knowledge over the past decades e.g., [18, 19]. Ethiopia is increasingly making efforts to protect their genetic resources and TM knowledge through conservation and national legislation for benefit sharing. However, lack of well documented information on community knowledge is a great and persistent challenge [20]. Therefore, there is an urgent need to document the medicinal plants and the associated indigenous traditional knowledge [21].

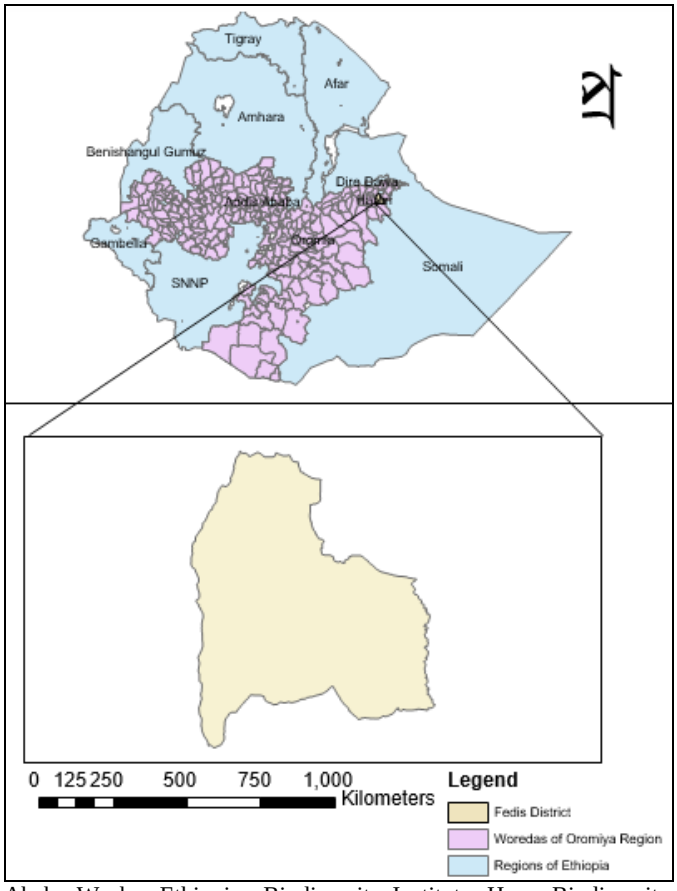
Various studies indicated that local experiences which have been gained through generation to solve indigenous problems are disappearing due to lack of written documents, death of elders, migration of people due to drought and social problems, urbanization, influence of modern medicine and exotic cultures. As a result, many plant species have become extinct and some are endangered and many are not yet identified [22, 7]. Particularly, the home range of the elephants in the Babile Elephant Sanctuary has shrunk by about 65.5% since 1976 due to mass influx of a large number of farmers and their domestic stocks from the east and north [23]. Hence, collecting and documentation of indigenous traditional medicine is now important than ever to preserve associated knowledge and medicinal plant biodiversity in order to assist modern drug improvement.

Apart from the efforts made to document ethno botanical information in various parts of Ethiopia; very little was done in Fedis district. Therefore, the aim of this study was to investigate and document the traditional medicinal plants used by indigenous people, way of practice and mode of delivery for the treatment of human and livestock aliments, as well as to record and document the current status of traditional knowledge and utilization of medicinal plants in three kebeles of Fedis district adjacent to the Babile Elephant Sanctuary, East Ethiopia.

2. Materials and Methods

2.1. Study Area Description

The study was conducted in three kebeles namely Agudora, Rizki, and Anani of Fedis district of Oromiya regional state at Eastern Hararge zone, eastern Ethiopia (Fig 1). The study area is located at about 549 km east of Addis Ababa and 24 km north of Harar city. The district consists of 19 rural kebeles and 2 urban cities. Geographically, the area is located between 8.022 to 9.014 N and 42.062 to 42.019 E with an altitude ranging from 1200 - 2118 m.a.s.l. Generally the district covers a total surface area of 1,105 km^2. The area is characterized by the presence of various soil types including red-brown and black that is clay-loam (80%), clay (15%) and sandy-loam (5%) and it has high fertility and water holding capacity. Fedis is bordered on the east by Midhaga Tola and Babille, on the west by Girawa, on the northwest by Haromaya and kurfa chele, on the north by the Harari Region. The administrative center of this woreda is Boko. The temperature of the study area ranges from 25 - 30ºc. It rain twice a year with an average annual rainfall of 650 – 900 mm. According to the projection made from 2007 population and housing census, the 2012 total populations of the district are about 130,344 of which 65,976 are male and the rest 64,368 are females. The majority of the inhabitants (99.22%) are Muslim.



Abebe Worku, Ethiopian Biodiversity Institute, Harar Biodiversity Center, Harar, June, 2018

Fig 1: Map of the Study Area, Fedis district, Oromiya region, Ethiopia

2.2 Data collection method

The ethnobotanical data were collected from local community and traditional healers through semi-structured questionnaire, guided field walks and focus group discussions based methods given by Martin [24, 25]. A total of 36 informants (24 male and 12 female) were selected purposefully with the help of local administrators and community scouts of the Babile elephant sanctuary working at the three kebles (Agudora, Rizki, and Annani) of Fedis district. An ethnobotanical survey was conducted from Mar, 2018 to June, 2018 at respondent's house and fields. Every traditional healer was asked to list the main plant species by local name which he/she used to treat human or livestock ailments. The preparation methods, parts used and route of applications were also the major questions that were delivered to the interviewed herbalists. In addition, field walks with traditional healers were employed to collect herbarium specimens for identification purpose and live samples of medicinal plant species which are endanger of extinction for conservation purpose.

2.3 Data analysis and taxonomic classification

Voucher specimens collected from field were dried and

prepared using standard herbarium techniques and were taken to National Herbarium of Ethiopian Biodiversity Institute (EBI) identified and preserved there. The raw data were analyzed using descriptive statistics and the percentiles, figures and graphs were used to summarize the various parameters of the collected medicinal plants. Statistical Package for Social Sciences (SPSS) Version-20 software was used to produce the percentiles and the presented graphs [26].

3. Results and Discussions

The preset study has revealed 64 plant species distributed in 39 families and 59 genera that are used for medicinal purposes by the traditional healers of the Fedis district of Oromiya regional state, Ethiopia. Asteraceae and Fabaceae were the two plant families with the largest number of plant species used for medicinal purposes in the study area by containing 9 and 7 species, respectively whereas the rest of the families were represented by 2 or 1 species (Table 4). However, most previous studies in the country reported that Fabaceae is the family with the highest number of medicinal plant species [27, 28, 29].

Regarding the different parts of medicinal plants leaf is the most commonly used part (29.7%) followed by root (23.4%), stem (12.5 %), both root and leaf (10.9%), both stem and leaf (7.8%), both leaf and root (4.7%), and three parts stem, root and flower (3.1%) (Fig 2). The finding of present study is in line with the previous reports [5, 3, 29].

Most of the traditional medicinal plant preparations were used in fresh form (75%) while some were in dried form for future uses (17%) and dry or fresh form (8%). Similar study also reported from elsewhere in Ethiopia [19, 29].

In this study, the life form of most recorded medicinal plants were shrub (39.1%), followed by herb (33.2%), trees (18.8%), climber (9.4%) and grass (1.6%) (Fig 3). Except the displacement of the shrub by herb the same order were reported by other studies [30, 31]. On contrary, [6] finding on the southern part of Ethiopia showed that the highest proportion (30 %) of documented medicinal plants were trees.

Numerous authors reported that traditional medicine includes the knowledge of remedies for human and livestock diseases. In the present study, 53 species (82.8%) were used against human ailments, 3 species (4.7%) were used to treat health problems of livestock while 8 species (12.5%) were used to treat both human and livestock ailment. The finding of a prior study from Harari region reported similar proportion [29]. This study revealed that some ethnomedicinal plant species such as *Withania somnifera*, *Vernonia schimperi*, *Vernonia amygdalina*, *Kalanchoe quartiniana*, *Foeniculum vulgare*, *Cucumis dipsaceus*, *Cardus macracanthus*, *Calpurnia aurea*, and *Azadaricatha indica* were used to treat both human and animal ailments in the study area (Table 1).

The study revealed five types of route of administrations of traditional medicine i.e., oral drinking dermal application, oral or dermal, nasal, and subcutaneous. Except subcutaneous insertion method the rest of the systems were frequently reported by similar surveys of ethnobotany from other parts of the country [29, 31, 32]. In the present study oral application (67.2%) was the most common route followed by dermal (25%), oral or dermal (4.7%) of applying traditional medicine in the study area (Table 2). The result of the present study agrees with the reports of ethnobotanical studies in Hararri region [29], Diredawa [31], and Gimbi [32] reported oral application as the most frequent route of administration of medicinal plants.

The traditional healers of the study area reported crushing as the most commonly used method of preparations of remedies followed by squeezing, mixing with other medicinal plants, smoking or cooking, chewing and mixing with milk of goat, in that order (Table 2). The result of this study is consistent with other reports of similar studies for example [33 and 34] reported crushing as the most common way of preparation of remedies

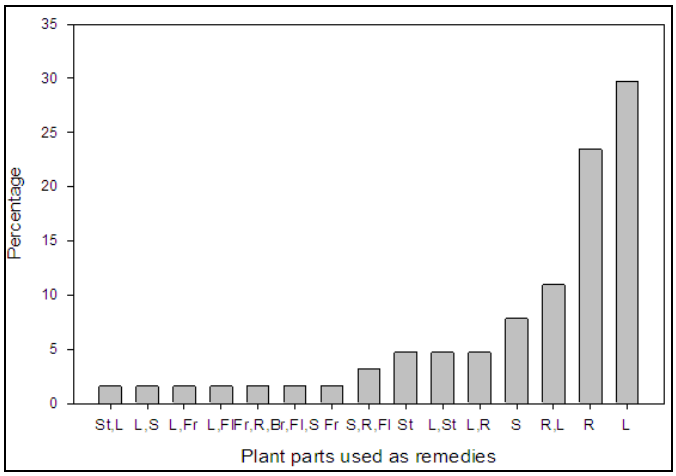


Fig 2: Percentage of plant parts used for remedies of human and livestock ailments; (L-Leaf, R-root, S-Stem, Fl-Flower, Fr-Fruit, B-Bulb, S-Seed, and St-Shoot)

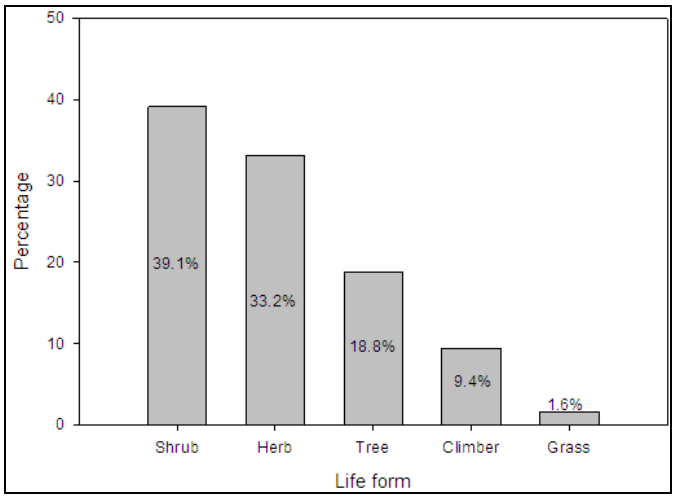


Fig 3: percentage of life form of the medicinal plants

Table 1: Source of medicinal plants in Fedis district

Source of medicinal plants	Number of species	Percentage
Wild	48	75
Farm land	11	17.2
Market	3	4.7
Both wild and home garden	2	3.1

Table 2: Application methods of medicinal plant remedies

Route of administration of medicinal plants	Number of species	Percentage
Oral	43	67.2
Dermal	16	25
Both Oral and Dermal	3	4.7
Subcutaneous	1	1.6
Nasal	1	1.6

Table 3: Methods of preparations of medicinal plant remedies

Route of administration of medicinal plants	Number of species	Percentage
Crushing	27	42.2
Squeezing	13	20.3
Mixing with other medicinal plants	10	15.6
Smoking	5	7.8
Cooking	5	7.8
Chewing	3	4.7
Mixing with milk of goat	1	1.6

Table 4: List of medicinal plant species against their family, local name, habit, and the disease they cure recorded in the study area

Voucher No.	Scientific Name	Family	Local Name	Habit	Disease cured	Parts used
BES-10	*Acacia brevispica*	Fabaceae	Hamaresa	Sh	Headache	L
BES-60	*Allium sativum*	Alliaceae	Qullubbii adi	H	Malaria, typhoid	St
BES-23	*Aloe calidophylla*	Aloeceae	Argeesaa	H	Back pain	L
BES-03	*Artemisia absinthium*	Asteraceae	Ariitti	Sh	Cough,malaria	L
BES-16	*Artemisia afra*	Asteraceae	Cuqqun	H	Evel eye, parasite	L
BES-31	*Azadaricatha indica*	Meliaceae	Kinina**	T	Malaria, fungal infection,intestinal worms	L,Fl
BES-46	*Balanites aegyptiaca*	Balanitaceae	Baddano	T	Intestinal parasite	Fr,R,B
BES-61	*Berchemia discolor*	Rhamnaceae	Jejeba	T	Heart disease	R
BES-01	*Bidens pilosa*	Asteraceae	Mexene	H	Skin fungus	L
BES-17	*Cadaba farinosa*	Capparidaceae	Kalkalcha	Sh	Urine retention, kidney disease	R
BES-32	*Calpurnia aurea*	Fabaceae	Cekha**	Sh	Typhoid	L
BES-47	*Cardus macracanthus*	Asteraceae	Qoree-harree*	Cl	Fever	R
BES-62	*Carissa spinarum*	Apocynaceae	Agamsa	Sh	Evil eye	R
BES-02	*Cassipourea malosana*	Rhizophoraceae	Lalessa	H	Intestinal Parasite	R
BES-18	*Cassipourea malosana*	Rhizophoraceae	Lookoo	Sh	Pneumonia	St,L
BES-33	*Chenopodium murale*	Chenopodiaceae	Maxxannee	H	Fungal infection	L,R
BES-48	*Cissampelos mucronata*	Menispermaceae	Balteki	Cl	Heart, kidney	R
BES-63	*Citrus aurantifolia*	Rutaceae	Tuto	Sh	Abdominal ache	Fr
BES-04	*Commelina africana*	Commelinaceae	Hollegebis	H	Allergic	St
BES-19	*Commicarpus africanus*	Nyctaginaceae	Kontoma*	H	Throat infection	L,R
BES-34	*Croton macrostachys*	Euphorbiaceae	Bekkannissa	T	Wound	L
BES-49	*Cucumis dipsaceus*	Cucurbitaceae	Haregoge**	Cl	Evil eye, fever	R
BES-64	*Cucumis ficifolius*	Cucurbitaceae	Hiddii	Cl	Stomachache	R
BES-05	*Cymbopogon citratus*	Poaceae	Citashekhussien	G	Intestinal parasite	L,St
BES-20	*Diospyros abyssinica*	Ebenaceae	Lookoo	Sh	Pneumonia	L,St
BES-35	*Doviyalis abyssinica*	Flacourtiaceae	Dhangaggoo	Sh	Parasite	R,L
BES-50	*Echinopes kebericho*	Asteraceae	Qabarichoo	H	Pneumonia	S,R,Fl
BES-06	*Echinops macrochaetus*	Asteraceae	Qoree-harree	H	Pneumonia	S,R,Fl
BES-21	*Ehretia cymosa*	Boraginaceae	Oolaga	Sh	Eye	L
BES-36	*Erythrina brucei*	Fabaceae	Wolensu	T	Pneumonia	L
BES-51	*Euclea divinorum*	Ebenaceae	Mieessaa	Sh	Ghonorea	R
BES-07	*Foeniculum vulgare*	Apiaceae	Insilaalii**	H	Urine retention	L
BES-22	*Galiniera saxifraga*	Rubiaceae	Abbayyii	Sh	Intestinal parasite	S
BES-37	*Hagenia abyssinica*	Rosaceae	Feto/Hieto	T	Intestinal parasite	S
BES-52	*Heliotropium aegyptiacum*	Boraginaceae	Maadaaris	H	Constipation, elephantiasis	R,L
BES-08	*Impatiens rothi*	Balsaminaceae	Buri	Cl	Hemoroid, mad dog bite	R
BES-38	*Jasmin grandiflorum*	Oleaceae	biluu	Sh	Malaria	L
BES-53	*Jatropha spicata*	Euphorbiaceae	Mowo	Sh	Parasite	S
BES-09	*Kalanchoe quartiniana*	Crassulaceae	Bitu**	H	Mastites, Breast inflammation,Black leg	R
BES-24	*Lantana camara*	Verbenaceae	Bekarketie	Sh	Fungi	L
BES-39	*Maesa lanceolata*	Myrsinaceae	Abbayyii	Sh	Intestinal parasite	S
BES-54	*Mirabilis jalapa*	Nyctaginaceae	Harmel dima	Sh	Heart	R,L
BES-10	*Moringa oleifera*	Moringaceae	Shiferaw	T	Blood pressure	L,S
BES-25	*Nigella sativa*	Ranunculaceae	Habsuuda	H	Asmathic	S
BES-40	*Ocimum lamiifolium*	Lamiaceae	Korcha michi	H	Bacterial infection	L
BES-55	*Olea europea sub.sp. cuspidata*	Oleaceae	Ejersa	T	Back pain	St
BES-11	*Osyris quadripartita*	Santalaceae	Riga	H	Kidney disease	R
BES-26	*Plantago laceolata*	Plantaginaceae	Gortebe	H	Herpus zosper	L
BES-41	*Polygala sphenoptera*	Polygalaceae	Harmel	Sh	Heart	R,L
BES-56	*Pterollobium stellatum*	Fabaceae	Kajima*	Sh	Cow refuse it's calf	R,L
BES-12	*Punica granatum*	Lythraceae	Rumaa	Sh	Amoeba	L,Fr
BES-27	*Rubus apetalus*	Rosaceae	Gora	Sh	Evil eye	R,L
BES-42	*Salvadora persica*	Salvadoraceae	Ade	T	Parasite	R
BES-57	*Senna Italica*	Fabaceae	Celeloo	Cl	Snake bite	R,L
BES-13	*Solanecio angulatus*	Asteraceae	Jinaras	H	Pneumonia	L
BES-28	*Steganotaenia araliacea*	Apiaceae	Afretoo	T	Pneumonia	L
BES-43	*Tamarindus indica*	Fabaceae	Roka	T	Stomachache/ Parasite/Malaria	Fr,Fl,S
BES-58	*Trema orientalis*	Fabaceae	Hudu	Sh	Evil eye	R
BES-14	*Vernonia amygdalina*	Asteraceae	Eebicha**	Sh	Fever	L

BES-29	*Vernonia Schimperi*	Asteraceae	Eebicha**	Sh	Forufor, Anthrax	L
BES-44	*Withania somnifera*	Solanaceae	Hidebudie**	H	Evile eye	L,St
BES-59	*Xanthium stramonium*	Solanaceae	Mexene	H	Skin fungus	L,R
BES-30	*Ximenia americana*	Olacaceae	Hudaloni	Sh	Heart disease	R
BES-60	*Ziziphus spina-christi*	Rhaminaceae	Kurkua adi	T	Joint problem	L

Habit: Sh-shrub, T-tree, Cl-climber, H-herb, G-grass; Parts used: R-root, L-leaf, St-stem, Fl-flower, B-bark, Fr-fruit, S-seed Symbol:- **Medicinal plants used for both animal and human, * medicinal plants used only for animal, others used only for human.

4. Conclusion and recommendations

The study revealed 64 plant species are used as remedies for either human or livestock aliments in the study area. Mixing some parts of medicinal plants with other medicinal plants or animal products during the preparations of traditional remedies might be the unique findings in this study. Furthermore, there are also some unreported traditional practices as remedies of health problems in relation to traditional beliefs. It indicates that the community in the study area has rich traditional knowledge on the use of medicinal plant remedies for health problems of human and livestock's. According to the reply of the local community and the traditional healers the community of the study area are using traditional medicine widely, not only because of limited health facilities but also it is part of their life and culture. However, there are no studies conducted on the efficiency and marketability of traditional medicines. In addition, traditional healers reported the declines of some major medicinal plant species in the wild as well as they do not have the culture to conserve these species in home garden. Hence, launching an international research agenda on the indigenous knowledge of herbal medicines is an urgent need so as to generate baseline information. Therefore, this study recommends, an extensive inventory of medicinal plants; establishing priority species for in-situ and ex-situ conservation, providing awareness for traditional healer, encouraging home garden cultivation of rare species, incorporate community knowledge into formal research and education before complete lost. Furthermore, there is an urgent need for key national level laboratory for basic research on medicinal plant pharmaceutical efficiency, product development and packaging should be considered to benefit the knowledge holders and the nation at large.

5. Abbreviations

CBD- Convention on Biological Diversity
NBSAP- National Biodiversity Strategy Action Plan
TM- Traditional Medicine
MP- Medicinal Plant
TK- Traditional Knowledge
SPSS- Statistical Package for Social Sciences
WHO- World Health Organization

6. Availability of Data and materials

The raw data set used for analysis is available at the author's hand.

7. Funding

This study was funded by the UNDP project called Enhanced Management and Enforcement of Ethiopia's Protected Area Estate.

8. Author Detail

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