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Health care and livelihood support through medicinal plants in indigenous communities of LEH district in Ladakh

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Abstract

Despite tremendous advances in allopathic medical practices, medicinal plants still play a vital role in the health care system. Equally, livelihoods are significantly supported by the commercial sale of large numbers of medicinal plants and medicinal formulations. The indiscriminate exploitation of biodiversity, alarming bio piracy threats, escalating patent conflicts on bio-resources and livelihood degradation led to document and preserve the traditional wisdom on health care practices by the indigenous communities. This study provides ethno-medicinal information on the plants used for production of various drugs to cure different diseases and valued for livelihood support by the indigenous communities in Leh district of Ladakh. Multi-stage random sampling technique was employed to select the blocks (5), villages (10) and households (185). Primary data were collected through personal interviews using the interview schedule and non-participant observations. The study documented the information on indigenous traditional knowledge (ITK) on medicinal plants, local names, parts used, medicinal formulations, diseases cured and mode of treatments. The local people used 65 plant species belonging to 52 genera under 332 families for treatment of various ailments. Among the plant part used, the whole plant represented the maximum (26) followed by leaves (18), flowers (10), seeds (7), roots (6), fruits (2), bulbs (1) and stem (1). Of the total (65) medicinal plants, mostly (80.00%) were herbs while rest (20.00%) were shrubs. The medicinal plants accrued an income of ₹274034.40 annum⁻¹ and an employment of 514.09 man-days annum⁻¹. To conserve the medicinal biodiversity, preserve traditional health care systems and strengthen livelihood support some policy implications are imperative.

Keywords: Health care, livelihoods, medicinal plants, biodiversity, indigenous communities, LEH

Introduction

Human society depends on numerous natural resources, amongst which plants play an important role in providing food, fodder, fuel, mulch and compost, medicine, timber, housing and fencing materials, utensils, furniture, fibre, dyes, thatch, brushes and brooms, agricultural implements, ornamental and decorative materials, religious and aesthetic goods, clothing *etc.* (Alex and Vidyasagan, 2016; Islam and Quli, 2017)^[1-2]. Medicinal plants have been known for millennia as a rich source of therapeutic agents for the treatment and prevention of various diseases thus occupying an important place in medicinal field (Jain *et al.*, 2017)^[3]. Livelihood and health security through medicinal plants is an integral part of human lives among the indigenous communities from time immemorial (Babu *et al.*, 2010)^[4]. In spite of tremendous advances made in allopathic medical practices, medicinal herbs still play an important role in the management of various diseases in the primitive societies (Sharma *et al.*, 2012)^[5]. Over eras, societies around the world have learned how to use plants to fight illness and maintain health (Chandra *et al.*, 2007)^[6]. These traditional herbal medicines form the basis of an accessible and affordable health-care system and are an important source of socio-cultural and economic livelihood for indigenous people around the world (Barbhuiya *et al.*, 2009)^[7]. The World Health Organization (WHO) estimated that 80% of the populations of developing countries rely on traditional medicines, mostly plant drugs, for their primary health care needs (Gerard *et al.*, 1997)^[8]. Of the total 297000–510000 plant species found worldwide (Dad and Khan, 2011)^[9] about 70000 (10–18%) are being used in healthcare since ages to cure different ailments (Gangwar *et al.*, 2010)^[10]. In India, of the total indigenous plant resources (17500), about 6000 (34%) are known to have medicinal importance (Ved, 2008)^[11]. The Himalaya, the youngest mountain range of the world, has been known for its varied characteristic ecosystems and rich floristic and faunal wealth (Pant *et al.*, 2009)^[12]. The Indian Himalaya is a rich storehouse of medicinal plants having a total of 1748 species (Samant *et al.*, 1998)^[13].

Due to over exploitation most of the species are experiencing tremendous pressure and are found in very small quantities in the accessible habitats (Vashistha *et al.*, 2006) [14]. In certain cases, the over exploitation is so harsh that numerous herbs are either on the threshold of extinction (Nautiyal *et al.*, 2002) [15] or have become rare or endangered (Kala, 2006a) [16]. The Ladakh is usually confined to higher altitudes and circumpolar regions of the world covering about 16% of landmass under cold desert. A vast cornucopia of medicinal plants is found in the region naturally which represent the basis of healthcare since the earliest days of mankind. In the Ladakh region, due to its remoteness and limited medical facilities over 60% of the population is dependent on traditional health care systems locally called *Gsowa Rigpa* or the *Amchi* system of medicine (Gurmet *et al.*, 1998) [17]. The *Gsowa Rigpa* (science of healing) medicinal system is based on a Tibetan system of medicine. This system has been popularly practiced in Tibet, Mongolia, Bhutan, China, Nepal, the Himalayan regions of India and the Bhuriyat region of Russia. It is principally based on theories of three humors (Nespa-Sum) and five elements (Jung-wa-lna) (Chaurasia and Gurmet, 2004) [18]. There is a multitude of studies (Kala, 2006b; Verma and Chauhan, 2007; Udayan *et al.*, 2007; Tomar, 2009; Kadavul and Dixit, 2009; Jamir and Limasemba, 2010; Nath and Choudhury, 2010; Srivastava, 2010; Upadhyay *et al.*, 2010; Tangiang *et al.*, 2011; Jamshidi-Kia *et al.*, 2018; Bamola *et al.*, 2018) [19-30] across the country which documented the diverse aspects on ethno-botanical and ethno-medicinal uses of plants. However, the values of indigenous health care practices in livelihood earnings have been owed little or no attention is given in the scientific arena so far. Therefore, this study was undertaken to document the role of medicinal plants and medicinal formulations in household livelihood support besides health care practices in

the primitive societies in Leh district of Ladakh of Kashmir province of Jammu and Kashmir.

Materials and Methods

Study Area

Geographically the Leh district (Figure 1.) is situated between 32°-36° North latitude and 75°- 80° East longitude at an altitude of 2300-5000 meters above MSL at a distance of 434 km from Srinagar, the state capital (Anonymous, 2011) [31]. Topographically whole area of Leh is dominated by mountainous landscape and is surrounded on the north by Ghanche District (Gilgit-Baltistan), a small border with Xinjiang, China, via the Karakoram Pass which is part of the district, Aksai Chin and Tibet are to the east, Kargil district to the west and Lahul and Spiti to the south. The total geographical area of the district is 45110 sq. km which makes it second largest district in the country. The district has a total population of 147104 making it the second least populous district of Jammu and Kashmir (Census of India, 2011) [32]. The district has literacy rate of 80.48%, population density of 3 inhabitants per sq. km and sex ratio of 583 females for every 1000 males. Approximately 23.30% population is semi urban and remaining 76.17% is rural. The people of Leh are ethnic Tibetan, speaking Ladakhi, an East-Tibetan language. The main occupations engaged the working forces are cultivation, agriculture labor, household industry and other works. Leh has a cold desert climate with long, cold winters from November to early March, with minimum temperatures well below freezing for most of the winter. The city gets occasional snowfall during winter. The weather in the remaining months is generally fine and warm during the day. Average annual rainfall is only 102 mm. The principal access roads include 434 km Srinagar-Leh and 473 km Leh-Manali Highways which opens only on a seasonal basis.

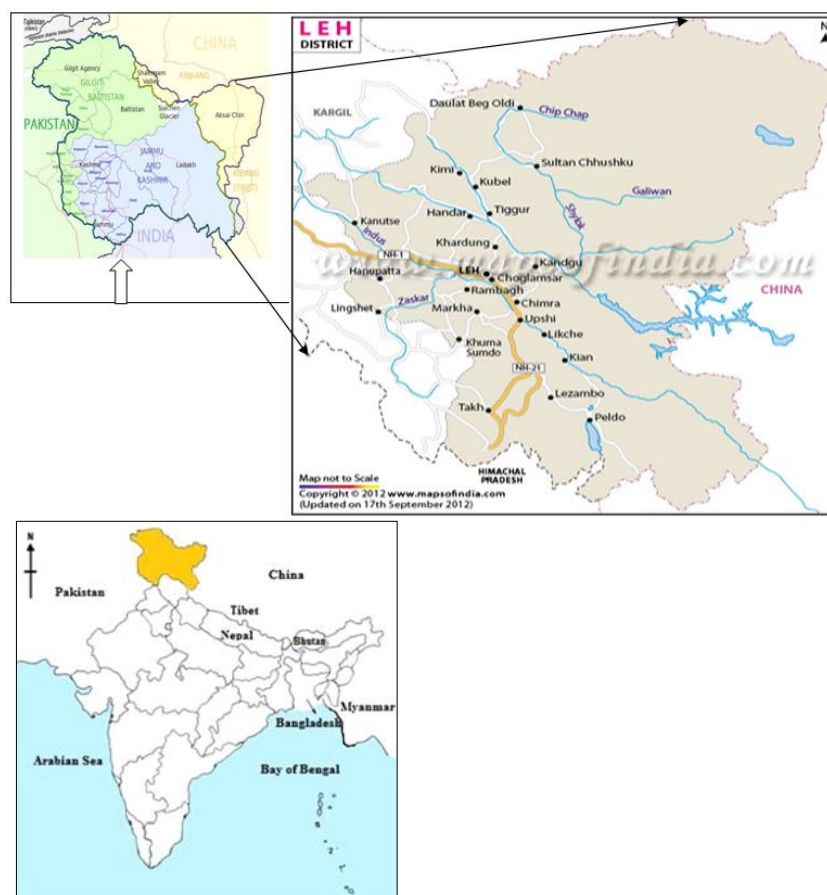


Fig 1: Location map of study area

Sampling technique and Sample

A multi-stage random sampling technique (Ray and Mondol, 2004) [33] was employed to select the blocks, the villages (10) and households (185) for the study. In the 1st stage, five (5) blocks namely, Leh, Nyoma, Chochot, Panamic and Khaltsi were selected randomly. The 2nd stage involved random sampling of ten (10) sample villages viz., Saboo from Leh block, Chumathang and Mud from Nyoma block, Stakna and Nang from Chochot block, Lakjung and Panamic from Panamic block and Dha, Lamayuru and Nurla from Khaltsi block. A total of 185 households were drawn from the sample villages having 15 percent sampling intensity for the field study in the 3rd stage. The respondents interviewed were either household heads or eldest members.

Data collection and Analysis

The primary data were collected by the personal interviews of the respondents through a well-structured pre-tested interview schedules and non-participant observations (Mukherjee, 1993) [34]. The primary data on indigenous use pattern of medicinal plant resources included name of species, common/ vernacular name, part used and usage. The data regarding livelihood support of the herbal health care practices included involvement in collection, quantity collected, subsistence consumption, involvement in marketing, quantity sold, rate, income earned and employment accrued. Simple descriptive statistics viz., range, frequency (f), mean (x) and percentage (%) were used for analysis of the data (Snedecor and

Cochran, 1967) [35] and the results were displayed through tables.

Results and Discussion

Health care through medicinal plants

The study documented 65 medicinal plants belonging to 52 genera and 32 families which were being utilized in the traditional health care system of the indigenous communities (Table 1.). The plant species recorded in the present study are arranged in alphabetical order. Botanical name of each plant is followed by family, local name, parts used and mode of medicinal use. The maximum representation of the species was from the family Asteraceae (15) followed by Ranunculaceae (8), Scrophulariaceae (4), Fabaceae (3), Apiaceae (2), Brassicaceae (2), Crassulaceae (2), Lamiaceae (2), Orchidaceae (2), Plantaginaceae (2), Solanaceae (2), Boraginaceae (1), Campanulaceae (1), Capparidaceae (1), Caryophyllaceae (1), Chenopodiaceae (1), Cuscutaceae (1), Elaeagnaceae (1), Euphorbioaceae (1), Gentianaceae (1), Geraniaceae (1), Hippuridaceae (1), Juncaginaceae (1), Juniperaceae (1), Liliaceae (1), Papaveraceae (1), Parnassiaceae (1), Poaceae (1), Rosaceae (1), Rubiaceae (1), Saxifragaceae (1) and Zygophyllaceae (1). The majority of medicinal plants were herbs 52 (80.00%) followed by shrubs 13 (20.00%) (Figure.1). Most frequently utilized plant parts were whole plant (26) followed by leaves (18), flowers (10), seeds (7), roots (6), fruits (2), bulbs (1) and stem (1) (Figure. 2).

Table 1: Medicinal plants exploited for health care in the sample households (N=185)

Species	Family	Local name	Part used	Use
<i>Aconitum heterophyllum</i> Wall. ex, Stapf.	Ranunculaceae	Nylo	Root	Abdominal pain
<i>Aconitum rotund folium</i> Kar. & Kir.	Ranunculaceae	Boma karmo	Whole plants	Expels intestinal infection.
<i>Aconitum violaceum</i> Jac, ex. Stapf.	Ranunculaceae	Yangtso	Root	Dried roots are used to cure cough.
<i>Adonis chrysocyathus</i> Hk.f.&T.	Ranunculaceae	Semshi	Whole plants	Cures skin diseases.
<i>Arabidopsis multiflorum</i> Hk.f. & Kir.	Brassicaceae	Umnako	Whole plants	Used to stimulate appetite.
<i>Artemisia annua</i> Roxb.	Asteraceae	Khamang	Whole plants	Used as diuretic.
<i>Artemisia parviflora</i> Roxb.	Asteraceae	Khamang	Leaves	The whole plant is diuretic.
<i>Artemisia scoparia</i> Waldst. & Kit.	Asteraceae	Khamchu	Leaves	Antimicrobial intestinal worms.
<i>Artemisia stracheyi</i> Hk. f. & Tex Comp.	Asteraceae	Rumonlo	Whole plants	Useful in toothache.
<i>Asperugo procumbens</i> Linn.	Boraginaceae	Zingsha	Entire plant	Used as tonic.
<i>Astragalus cicerifolium</i> Royle ex Fisch.	Fabaceae	Luguruk serpo	Root	Stops vomiting during long journey.
<i>Astragalus rhizanthus</i> Royle ex Benth.	Fabaceae	Krelseng	Root	Stimulant heart.
<i>Bupleurum marginatum</i> Wall.ex.Dc.	Apiaceae	Zera karmo	Seeds	Liver disease.
<i>Capparis spinosa</i> Linn.	Capparidaceae	Kabra	Leaves/ flowers	High fever, headache.
<i>Carum carvi</i> var.gracile Linn.	Apiaceae	Go-nyod	Flower/ Seeds	Used in appetite disorders, inflammation etc.
<i>Catabrosa aquatica</i> Linn.	Poaceae	Lemma	Entire plant	The plants are believed to be effective in reducing high fever.
<i>Centaurea depressa</i> M.Bieb.	Asteraceae	Bashakha	Whole plants	Fever
<i>Chrysanthemum griffithi</i> Cl.Comp.	Asteraceae	Serpan	Flowers	Flower quite useful to correct menstruation.
<i>Codonopsis ovata</i> Benth.	Campanulaceae	Ludut	Leaves/ flowers	Rheumatism, Stimulant
<i>Corydalis rutifolia</i> DC.	Papaveraceae	Chimlo	Whole plants	Used to cure skin diseases.
<i>Cousinia thomsonii</i> Clark.	Asteraceae	Krestising	Leaves	Cures body ache and swelling due to sprain. Diuretic.
<i>Cuscuta gigantea</i> Griff.	Cuscutaceae	Hande-thapa	Whole plants	The whole plants are considered as an antiseptic by Amchis.
<i>Dactylo rhizahatagirea</i> (D.Don) Soo.	Orchidaceae	Wang-lack	Whole plants	General tonic. useful for increasing sexual appetite and body strength.
<i>Delphinium brunonianum</i> Royle	Ranunculaceae	Lunde-Kaown	Seeds	Seeds and vegetative parts are used as insecticide.
<i>Dianthus deltoides</i> Linn.	Caryophyllaceae	Khenchpa	Whole plants	This plant is used against the constipation.
<i>Echinops cornigerus</i> DC.	Asteraceae	Aczema	Seeds	Septic wound
<i>Echinops niveus</i> ex DC.	Asteraceae	Ekzema	Leaves	Leaves are used in treatment of septic wounds.
<i>Epipactis helleborine</i> linn.	Orchidaceae	Penginlo	Whole plants	An infusion of plants is used as blood purifier.
<i>Euphorbia hispida</i> boiss.	Euphorbioaceae	Therno	Whole plants	The plant is recommended by the Amchi against skin diseases.
<i>Geranium sibiricum</i> Linn	Geraniaceae	Eyamlomentok	Leaves	Leaves cure diarrhea.

<i>Halerprestis tricuspis</i> Hand-Mazz.	Ranunculaceae	<i>Churuk-balak</i>	Flowers	Used as febrifuge, diuretic, antiseptic and rheumatism.
<i>Hippophae tibetana</i> Schlecht.	Elaeagnaceae	<i>Sastalulu</i>	Fruit/ leaves	Source of multi vitamins.
<i>Hippuris vulgris</i> Linn.	Hippuridaceae	<i>Dambu kara</i>	Whole plants	Cold, headache, fever.
<i>Juniperus macropoda</i> Bioss.	Juniperaceae	<i>Sukpa</i>	Leaves	Purgative, anti inflammatory.
<i>Krascheninnikoviua cerastoidea</i> (L) Guelden.	Chenopodiaceae	<i>Gapshan</i>	Leaves	Hyperacidity.
<i>Lancea tibetica</i> Hoof.f. & Th.	Scrophulariaceae	<i>Payag-Tsawa</i>	Fruit/ leaves	Fruit is used as cardio stimulant; leaves are useful in healing wounds. Whole plant used as tonic
<i>Loydia serotina</i> Linn	Liliaceae	<i>Kangkar</i>	Bulb	Used to purify blood.
<i>Nepeta clarkei</i> Hk. f.	Lamiaceae	<i>Khamyu</i>	Whole plants	Used against septic wounds.
<i>Paranassia paxmanni</i> Pall.	Parnassiaceae	<i>Pangyan karmo</i>	Whole plants	Stomachache, cold, cough, fever, dysentery.
<i>Plantago asiatica</i> Linn.	Plantaginaceae	<i>Karche</i>	Leaves	Blood purification.
<i>Plantago himalaica</i> Pilger.	Plantaginaceae	<i>Khilchakarpo</i>	Whole plant	Whole plant sedative in headache pain, renal colic and backache.
<i>Potentilla anserine</i> Linn.	Rosaceae	<i>Troma</i>	Whole plants	Fever, cold and cough.
<i>Psychrogeton andryloides</i> DC.	Asteraceae	<i>Luchchugba</i>	Fresh plant	Decoction of the fresh plants used for expulsion of worm.
<i>Rubia coradifolia</i> L.	Rubiaceae	<i>Btsod</i>	Stem/ roots	Powered stems and leaves are found effective stomachache, and indigestion.
<i>Saussurea glaciales</i> Linn.	Asteraceae	<i>Panispa</i>	Flower buds	Flower buds are used in intestinal complaints.
<i>Saussurea sacra</i> Wall.	Asteraceae	<i>Spangea</i>	Whole plants	Headache
<i>Saussurea stollczkai</i> Clarke.	Asteraceae	<i>Lupha</i>	Flowers	Flowers are used to cure fever.
<i>Saxifraga flagellaris</i> Willd.	Saxifragaceae	<i>Teetasarzing</i>	Leaves	Crushed leaves are used to cure headache and fever.
<i>Scrophularia koelzii</i> Pennell.	Scrophulariaceae	<i>Yarma</i>	Seeds	Paining joints for relief, cures sciatic and other pains.
<i>Sedum crassipes</i> Wall.	Crassulaceae	<i>Koad</i>	Plant	Soothing effect.
<i>Sedum ewersii</i> Ledeb.	Crassulaceae	<i>Churuppa</i>	Whole plants	Soothing effect.
<i>Senecio pedunculata</i> Edgew.	Asteraceae	<i>Umarswah</i>	Whole plants	Headache
<i>Solanum nigrum</i> Linn	Solanaceae	<i>Tsigma</i>	Leaves/ seeds	Leaves/ seeds having cooling properties, eaten boiled to improve constipation, appetite and taste.
<i>Solanum xanthocarpum</i> Schrada.	Solanaceae	<i>Batkatel</i>	Flowers	Helps in digestion.
<i>Stachys tibetica</i> Vatke.	Lamiaceae	<i>Jatuk-napo</i>	Whole plants	Psychosomatic effect, epilepsy or fits
<i>Swertia thomsonii</i> C.B.Cl.	Gentianaceae	<i>Tikta</i>	Whole plant	Headache and fever.
<i>Tanacetum gracile</i> Hk. f. & T.	Asteraceae	<i>Kamcku</i>	Leaves/ flowers	Decoction of leaves and flowers is given in small dozes to intestinal worm mainly in children.
<i>Thalictrum alpinum</i> Linn.	Ranunculaceae	<i>Alpine ruel meadow</i>	Root/ leaves	Used to reduce fever.
<i>Thalictrum minus</i> Linn.	Ranunculaceae	<i>Chakchhoo</i>	Whole plants	Used against the allergic redness and other diseases
<i>Thlapsi arvense</i> Linn.	Brassicaceae	<i>Treka</i>	Seeds	Rheumatism
<i>Tribulus terrestris</i> Linn.	Zygophyllaceae	<i>Zema</i>	Seeds	Activates in kidney function.
<i>Triglochin palustre</i> Linn.	Juncaginaceae	<i>Marcha</i>	Leaves	Healing of wound, Antidiarrhoeal.
<i>Verbascum thapsus</i> L.	Scrophulariaceae	<i>Raikse</i>	Whole plants	The whole plants is recommended by <i>Amchis</i> as a tonic
<i>Veronica macrostemon</i> Bunge ex Ledeb.	Scrophulariaceae	<i>Shimiogar</i>	Leaves	The decoction of leaves is used locally to cure skin diseases.
<i>Vicia sativa</i> Linn.	Fabaceae	<i>Bugsuskkang</i>	Whole plants	Used against the urinary infection and stoppage of urine

Leh occupies a distinctive position in India as it has a good potential in terms of diversity and heritage of medicinal plants due to its varied climatic and edaphic conditions. The medicinal plants are an important source of drugs in traditional system of medicinal practices. Principally, they are valuable natural resources and regarded as potentially safe drugs. The medicinal plant based drug formulations have been in use against various diseases since time immemorial. Leh possess often harsh and cold climate, which remains cut off from the rest of the country for more than 5-6 months every year thus, blocks the communication which results the local people derive their daily needs from their own resources especially to meet their health care needs from the ages.

Although, some good medical facilities have been created in the recent years but most of the villages which are far off from the town are still dependent on the traditional system of medical treatments. Under such circumstances *Amchi*- a local practitioner/ herbalist play an important role in curing the different health related problems like fever, cold, stomach ache, cough, indigestion, pain, vomiting, diarrhea, internal worms, dysentery, skin-infection, frost-bite, bone-fracture, expulsion of kidney stones, urinary tract infection, menstruation problems *etc.* by prescribing different formulations of wild herbs. Generally, most of the medicinal formulations were prepared with plant parts only without addition of any other ingredient. But sometimes honey, milk,

butter, jiggery or sugar were given along with the prescribed dosage of medicine, which may be probably to mask unpleasant taste of the plant and to make it more acceptable to

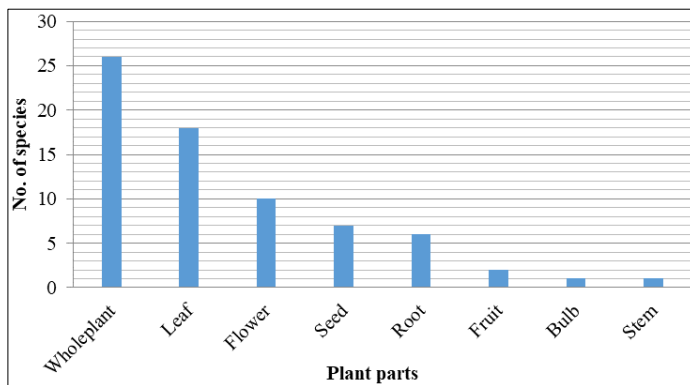


Fig 2: Medicinal plants by plant part utilized

the patients. Besides that all of these substrates are considered to be good for health and vitality by ethnic communities of Leh.

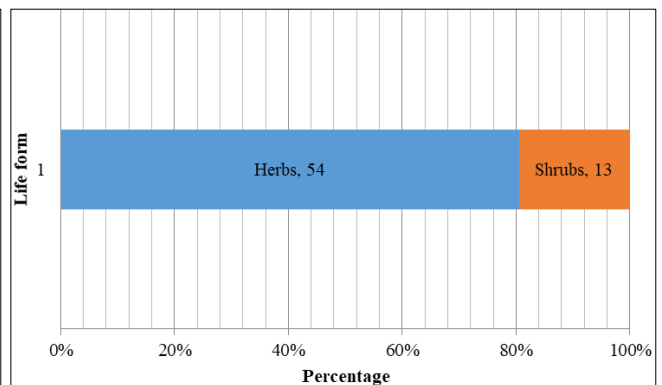


Fig 3: Medicinal plants by different life forms

Livelihood support through medicinal plants

The data pertaining to household collection, consumption, sale, income and employment from medicinal plants are summarized in the Table 2. Among the households surveyed the involvement in the medicinal plants collection was 14.05% whereas the involvement in marketing was only

8.11%. The medicinal plants fetched the total income of ₹274034.40 annum⁻¹ @ ₹1481.27 household⁻¹ annum⁻¹ and accrued an employment of 514.09 man-days annum⁻¹ with average employment opportunities of 0.35 mandays household⁻¹ annum⁻¹ in the sampled population.

Table 2: Medicinal plants exploitation for income and employment generation (N=185)

Variable	Involvement in collection (Hh)	Collection (tons annum ⁻¹)	Consumption (tons annum ⁻¹)	Involvement in marketing (Hh)	Sale (tons annum ⁻¹)	Rate (₹ kg ⁻¹)	Income (₹ annum ⁻¹)	Employment (man-days annum ⁻¹)
Medicines	26 (14.05)	2.57	0.46	15 (14.15)	2.11	50-200	274034.40	514.09
Average	-	0.014	0.002	-	0.011	-	1481.27	0.35

Note: Hh= Household, Figures in parentheses show percentages

The medicinal plants play an important role in the livelihood support of aboriginal people in terms of subsistence and income generation. The medicinal plants are of great interest to the local harvesters they affect the culture, the lifestyle, and the economic and subsistence practices of aboriginal communities throughout the province. Although, the scope of boosting incomes through commercialization of medicinal plants is very high but most of the medicinal plant collectors of the district still depend only for subsistence income. Various socioeconomic and biophysical conditions those which affect the role of medicinal plants in local livelihoods are, availability of alternative employment opportunities, access to market, availability of products with established market, agricultural development, the degree of linkage with urban areas *etc.* Despite the significant livelihood contribution of medicinal plants, the state has not paid much attention on the development and value addition of these products and most of these products are wasted for lack of post harvesting technology in cleaning, drying, packing, storage and processing.

Conclusion

The study led to conclude that the medicinal plants an integral part of local communities playing pivotal role in health care and livelihood support in Leh. The record of ethno-botanical uses of medicinal plants will help to carry out plant pharmacokinetic and pharmacological activities and establish their therapeutic properties. The results of this work can later be applied to biodiversity conservation, community development and for development of new drug against various diseases. The potential of the wild herbs in treating the different ailments allow the scientists and research

scholars to have through scientific investigation on these medicinal plants growing at high altitudes, their herbal formulations and potential isolation of bioactive compounds. Such efforts eventually will lead to the discovery of novel drugs for the wellbeing of mankind. Therefore, its mandatory to conserve the rare and endangered species of cold desert by involving the research institutions, NGOs, state departments by instituting the herbal gardens, medicinal parks *ex-situ* and *in-situ* conservation, in order to maintain the sustainable supply of these forest resources in future. Further, the domestication, value addition and commercialization of medicinal plants can be included as paramount entrepreneurial strategy for livelihood diversification in the society.

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