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Determination and analysis of informant consensus factor of medicinal plant species used as remedy in Northern Pakistan

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Abstract

In current quantitative ethno botanical research survey, ethno botanical knowledge of 62 plants species from 38 families was studied through semi-structured interviews and well-organized questionnaire from March 2012 to August 2015. Informants were knowledgeable elders, local authorities and development agents of different age class groups. The family percentage was observed as (Lamiaceae 15%), (Solanaceae 12%) and (Rosaceae 10%). The leading families were Lamiaceae, Solanaceae and Rosaceae. Habit wise the percentage of plant species observed as herb (59.6%), shrubs (25.8%) and trees (14.51%). Part used found as whole plant (45.16%) followed by fruit (16.13%), leaves (16.13%), bark (9.68%), root (4.84%), seed (3.23%), capsule (1.61%), flower (1.61%) and gum (1.61%). For the preparation of ethno medicines 67 randomly selected informants to include 47 male (70.14%) and 20 female (29.85%) followed by (34.32% illiterate) were interviewed to document ethno medicinal and sociocultural information. Out of total recipes preparation, the peoples of the locality use crushed (43.55%) followed by decoction (41.94%), extract (11.29%), original and paste (1.61%). On the basis of diseases categories, the fic value was high for anthelmintic (0.98. The survey determined *P. sominiferum* with FL value as 100%. DMR results showed that rank wise *Olea ferroginea* got first (24).Unwise harvesting and over grazing of plant species for medicinal and fuel wood purpose was found at peak level in research are a due to which medicinal flora is on the edge of extinction. Further exploratory trips, conservative strategies, inspective committees, awareness, and wise use of resources are highly needed.

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Introduction

Ethnobotany is the interdisciplinary field of science which covers all kind of connections and dealings concerning peoples and plants. Rate of infectious diseases have been increased with growing technology in the world History regarding medicinal plant use by individuals for the treatment of different diseases remained important part of ancient civilizations (Carballo *et al.,* 2002; Mann *et al.,* 2008; Ikram *et al.,* 2015). This old-style worthy knowledge stored for centuries obtained through trial and error methods passed from generation to generation orally, About 80% occupants of developing world depend on old-style medicines (Patwardhan *et al.,* 2004).Apart from medicinal uses, plant species also have an important role in improvement of economics position of locals (Ali *et al.,* 2011). Due to high marketability the medicinal plant species business will reach to 5 trillion dollars (US) by 2050 (Shinwari and Qaiser, 2011).

According to different studies 442000 flowering plants were known, out of these 50000 are used as medicines while 5000 plant species have been examined with respect to phytochemistry. Due to increase in price of synthetic drugs the peoples who cannot afford the price compel them to utilize medicinally important plants to cure different health disorder, but researchers who are following them are strengthened. Due to their easy availability, safety, economical, with less side-effect, plants are generally used as therapeutic medicine in different parts of developing countries throughout the globe. (Mahmood *et al.,* 2011; Mohamad *et al.,* 2011; Shrivastava and Kanungo, 2013; Bibi *et al.,* 2014).

It has observed that about 600 to 700 plant species are found in Pakistan round about 12% are used as medicine (Shinwari, 2010). Ethno-medicinal importance of some plant species of family Apiaceae and Euphorbiaceae found in Pakistan were studied (Ikram *et al.,* 2015). The flora of Mansehra was surveyed with respect to medicinal and traditional knowledge (Shah and Khan, 2006), Kurram flora by (Gilani *et al.,* 2003), medicinal flora of Kotli by (Ajaib *et al.,* 2010), Medicinal flora of Kalat by (Durrani and Hussain, 2005), Chitral flora by(Ali and Qaiser, 2009) and medicinal flora of Attock by (Noor and Kalsoom, 2011). The information regarding medicinal plants receiving appreciation in Pakistan as it is calamitous to identify where and in which surroundings ethno-medicinal plants are present, because such kind of knowledge is essential to categorize susceptible plant species to collect or habitat change ethnobotanical studies on some useful herbs of Haramosh and Bugrote Valleys in Gilgit, Northern Areas of Pakistan(Qureshi, 2012).Similar to other distant parts of the country, people of mountainous areas of the Malakand division, uses medicinal plants due to which such kinds of studies are in practice which help in providing chance to get local traditional information and available resource managements (Barkatullah and Ibrar, 2011).

Present research survey will not only file traditional understanding about medicinally important plant species of the locality but will support pharmacologists, taxonomists, wild life managers, ecologists, environmentalists, bio-conservationists, and foresters for future planning. The aim of the study was 1. To document most important medicinal plant in Miandam valley (North Pakistan); 2.To know the accurate application of medicinal plant species from the peoples of the locality; 3.How local peoples use wild medicinal plant species to cure different health disorders and to verify its fact amongst peoples.

Materials and methods

Study area

The study area Miandam is located in Khyber Pakhtunkhwa, Pakistan lies in foot hills of Hindu kush mountain range and enriched in medicinal plants. Geographically, the area can be traced on 35°, 02′ N and 72°, 33′ E northwest of the country and 1800 m above sea level. Mean annual precipitation ranges from 1000 mm-1250 mm.

Mean monthly temperature remains below 10°C for about 6 months in a year. The valley consisted of 4,388 ha area and population of 19,516 living in 2,006 houses. Because of its huge difference in altitude, topography, temperature, moisture, soil type and, the vegetation of the study area may be classified as series of altitudinal belts, namely dominated by *Pinus wallichiana, Quercus semecarpifolia* (montane), *Olea ferruginea, Quercus oblongata* (submontane), *Abies pindrow, Picea smithiana* and alpine-subalpine flora, respectively(Sher *et al.,* 2005; Adnan *et al.,* 2006).

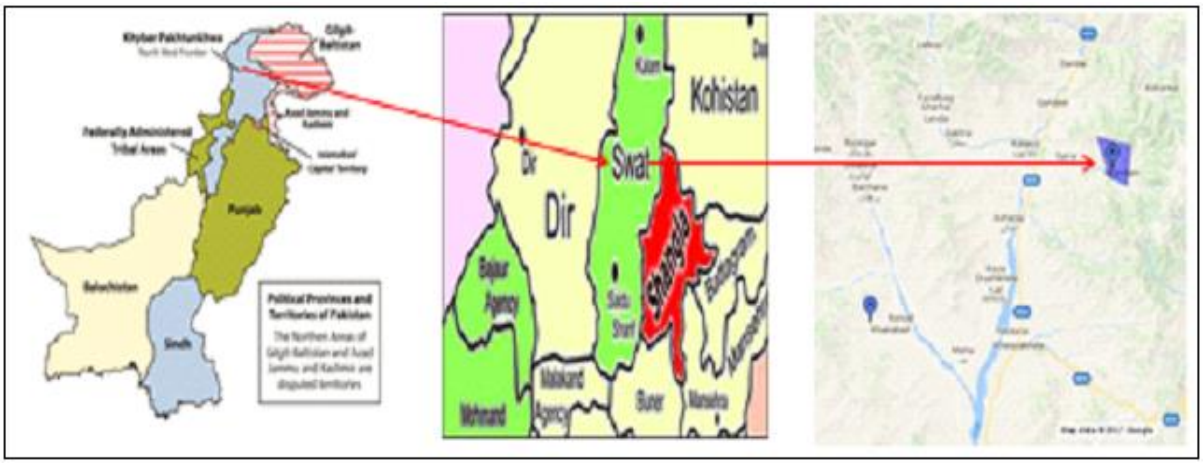

Fig. 1. Study area map.

Data collection

Six plant collection trips were arranged to study area and collection was done in flowering season from March 2012 to August 2015. Informants were recommended by knowledgeable elders, local authorities, and development agents. Out of total randomly selected 67 (47 men and 20 women) as identified key informants. The selected informers were local inhabitants of the area of age up to 75 years. Ethnobotanical survey was taken to gather information on traditional plants utilized by the local healers for the treatment of human ailments in the district following standard methods(Gary,1995; Cotton, 1996; Khan *et al.,* 2014)**.** The survey was done by using proper semi structured interviews and group discussions. A checklist of questions was prepared in English language for undertaking interviews and discussions. The questionnaire contained no strict questions and informants were allowed to speak spontaneously and without pressure. Key questions about medicinal plants were on local name of a particular medicinal plant, types of disease treated, mode and method of remedy preparation, parts of the plants used, use of fresh or dry plant parts, use of single or mixture of plants for remedy preparation, mode of administration, and dose requirement. Sociocultural information about informants were also collected during interview. The informants were interviewed in their local language Pashto. The purpose of the present study was also explained to each informant in order to remove their hesitation and to encourage them that their knowledge will be a great contribution in the scientific literature. Created a friendly environment with the locals while documenting ethno medicinal and sociocultural information to obtain more possible information regarding plant species.

Herbarium specimen preparation and preservation

The collected plants specimens were pressed, dried, poisoned, mounted, identified according to standard protocol used in Herbaria and deposited under voucher numbers (Table 1) to Herbarium Department of Botany University of Malakand Pakistan. During plant collection and preparation of complete herbarium specimen the apparatus/equipment were used.

News halves, press straps, field notebook, diggers and clippers, hand lens, collecting bottles, mercuric chloride, ethanol, collecting bags, waxed paper,

envelope, cardboard, insecticides and repellents, Maps, camera, color charts, hand Pruner, Rope, pencil, cutter, GPS, field presser, Driers (blotters), No. tages, Ethanol etc were used. Mounted the dried plant specimens on herbarium sheets of size, 11.5x16.5 inches with glue and cloth tape after the removal of the extra parts from the specimen for obtaining morphological data for their identification.

Identification

The collected plant specimens were identified in Herbarium Department of Botany at University of Malakand Pakistan through taxonomist and flora of Pakistan (Stewart, 1967).

The specimens were deposited to Herbarium department of Botany at University of Malakand Chakdara Dir (L.) KP, Pakistan for future reference.

Data set up

Data obtained was organized into Excel spreadsheet 2007 and concised by graphical statistical methods like percentage. On the basis of habit plant species were characterized into Herbs, Shrubs and Trees. Part used by the healers to prepare ethno medicines was grouped as bark, leaves, fruit, whole plant, root and seed etc. Different illnesses treated were categorized into 26 as antidiarrheal, antiseptic, dermatitis, pain killer, tonic, carminative, diuretic, febrifuge, laxative, purgative, anthelmintic, antiasthmatic, hepatitis, astringent, blood purifier, stimulant, vermifuge, analgesic, antidiabetic, antimalarial, aphrodisiac, emetic, flavoring agent, gastrointestinal, musculoskeletal and tuberculosis. Literacy level like (Illiterate, Middle, Secondary, Higher Secondary, Graduate), Professional level, House wives, Teacher, Shopkeepers, Farmers, Labors, Hakeem and nomads, Male, Female and Age classes were the basic part of the questionnaire.

Analysis

Informant Consensus Factor (Fic). Factor informant consensus (Fic) was applied to analyze overall usage of medicinal plants with respect to specific culture applicability.

Informants' consensus between cultural groups and in the community specifies which plant iscommonly applied, therefore include in selection of plants for phytochemical and pharmacological studies (Giday *et al.,* 2007; Khan *et al.,* 2014).According to such kind of analysis disorders were classified into groups like plant species having high Fic value can be considered to be more pharmacologically effective as compared to plant species with low Fic value (Ragupathy *et al.,* 2008). A maximum Fic value was recorded as 0.98. Fic values remains maximum if one or few plant species are acknowledged to be applied by huge figure of respondents to treat a particular disease. On the other hand low Fic values provide an indication that informers were approved over what kind of plant to be used (Heinrich *et al.,* 1998; Canales *et al.,* 2005; Khan *et al.,* 2014). Fic value may be calculated by the formula Fic=nur-nt/ nur-1 Where Fic = informants consensus factor, nt = number used species while nur = number of use citation in each group.

Fidelity Level (FL)

Fidelity level is a good tool to identify the key informants' best preferred medicinal plant species used to treat disorders. Medicinally important plant species taken by the locals have high Fidelity Level (FL) than those which were less relevance. Fidelity Level specifies the degree percentage of informants apply the use of several plant species for same purpose. It was aimed to calculate the importance of plant species for the said purpose.

All the aliments were grouped into categories before calculating Fidelity Level (Giday *et al.,* 2009). Fidelity Level (FL) was assessed(Table 3) by the formula FL = Ip/Iu × 100, as Ip is respondents number used medicinal plant species for a particular disorder while Iu is respondents number used same plant for any disorder (Friedman *et al.,*1986; Sridevi *et al.,* 2008).

Direct Matrix Ranking (DMR)

It was calculated by using methods to compare the use of plant species based on data obtained from respondent by (Cotton 1996; Martin, 2004). For DMR data collection informants were interviewed for values such as (0= not used,1= least used,2= less,3= good,4= very good,5= best).The values calculated were ranked.

Results and discussion

The use of plant species for existence of mankind is as basic as their race itself. The history of plants with respect to their uses co-evolved with human civilization generation after generation because individuals would have faced to chronic, endemic, epidemic diseases apart from severe disorders (Hamayaun, 2003).

Table 1. Different aspects of medicinal plant species used for various health disorders.

Botanical name	Family	L.name	Habit	Part Used	Illness treated	Herbal formulation	Dosage/Day	Mode of application	V. number
Acacia modesta W.	Mimosaceae	palosa	tree	bark	pain killer	crushed	twice	oral	H.N.111
Adiantum capilus-veneris L.	Polypodiaceae	sunbal	herb	whole plant	febrifuge	crushed	twice	oral	H.N.112
Amaranthus viridus L.	Amaranthaceae	chalwai	herb	whole plant	diuretics	decoction	per need	oral	H.N.113
Andrachne cardifolia W.	Euphorbiaceae	karachai	shrub	whole plant	antiseptic	decoction	twice	oral	H.N.114
Artimesia scoperia L.	Asteraceae	jawkay	herb	whole plant	purgative	decoction	twice	dermal	H.N.115
Asparagus officinalis L.	Asparagaceae	tendoray	herb	whole plant	diuretic	crushed	twice	oral	H.N.116
Berberis lycium Royle.	Berberidiaceae	kwary	shrub	root	blood purifier	crushed	once	oral	H.N.117
Calotropis procera W.	Asclepidiaceae	spalmai	shrub	whole plant	dermatitis	crushed	twice	dermal	H.N.118
Cannabis sativa L.	Canabiaceae	bang	herb	leaf	pain killer	original	once	dermal	H.N.119
Capsella bursa-pestoris L.	Brassicaceae	bambesa	herb	areal part	stimulant	decoction	once	oral	H.N.120
Celtis australis L.	Ulmaceae	tagha	tree	fruit	tonic	extract	once	oral	H.N.121
Chenopodium album L.	Chenopodiaceae	sarmay	herb	leaf	febrifuge	decoction	twice	oral	H.N.122
Chenopodiumambrosioide L.	Chenopodiaceae	binakai	herb	leaf	vermifuge	decoction	once	oral	H.N.123
Chenopodiumbotrys L.	Chenopodiaceae	kharawa	herb	whole plant	vermifuge	decoction	once	oral	H.N.124
Cotoneaster microphyllus L.	Rosaceae	mamanra	shrub	leaf	astringent	crushed	twice	dermal	H.N.125
Cotoneaster nummularia L.	Rosaceae	mamanra	shrub	fruit	anti- hepatitis	extract	twice	oral	H.N.126
Datura anoxia M.	Solanaceae	bathora	herb	whole plant	pain killer	decoction	twice	oral	H.N.127
Demostachyabipinnata L.	Poaceae	della	herb	whole plant	anti-asthmatic	decoction	twice	oral	H.N.128
Dodoniaviscosa L.	Sapindaceae	ghwarasky	shrub	bark	antiseptic	crushed	dermal	dermal	H.N.129
Equisetum arvense L.	Equecitaceae	bandakay	herb	whole plant	tuberculosis	crushed	twice	oral	H.N.130
Eucalyptus lanceolata L.	Myrtinaceae	lachi	tree	Gum	antiseptic	paste	twice	dermal	H.N.131
Euphorbia helioscopia L.	Euphorbiaceae	mandano	herb	whole plant	dermatitis	crushed	twice	dermal	H.N.132
Ficus carica L.	Moraceae	enzar	tree	fruit	laxative	extract	twice	oral	H.N.133
Foeniculum vulgares M.	Apiaceae	kaga	herb	fruit	carminative	crushed	twice	oral	H.N.134
Fragaria indica Andrew.	Rosaceae	zmakintot	herb	fruit	tonic	extract	once	oral	H.N.135
Fumaria indica H.	Fumariaceae	papra	herb	whole plant	anti-diabetic	decoction	twice	oral	H.N.136
Hyocymus niger L.	Solanaceae	diwanabang	herb	leaf	pain killer	crushed	once	dermal	H.N.137
Hypericum perporatum L.	Hypericaceae	balsana	herb	whole plant	gastrointestinal	crushed	twice	oral	H.N.138
Indigofera haterantha L.	Lamiacea	ghwareja	shrub	whole plant	anti-hepatitis	decoction	twice	oral	H.N.139
Isodon rugosus L.	Lamiaceae	sperkay	shrub	leaf	antiseptic	crushed	twice	dermal	H.N.140
Justica adhathoda L.	Acanthaceae	bekand	shrub	leaf	pain killer	decoction	twice	oral	H.N.141
Lathrys lyceum L.	Papilionaceae	kurkamanay	herb	whole plant	flavoring agent	crushed	per need	oral	H.N.142
Lipidum sativum L.	Brassicaceae	halam	herb	seed	aphrodisiac	crushed	once	oral	H.N.143
Malva salvestris Wall.	Meliaceae	panerak	herb	whole plant	antidiarrheal	decoction	twice	oral	H.N.144
Melia azedarach L.	Meliaceae	thorashandai	tree	bark	dermatitis	crushed	twice	dermal	H.N.145
Mentha arvense L.	Lamiaceae	podina	herb	whole plant	carminative	crushed	twice	oral	H.N.146
Mentha longifolia L.	Lamiaceae	enalay	herb	whole plant	carminative	crushed	twice	oral	H.N.147
Mimosa pudica L.	Fabaceae	sabunbuty	herb	leaf	febrifuge	decoction	twice	oral	H.N.148
Monotheca buxifolia F.	Sapotaceae	gwargora	tree	fruit	tonic	extract	once	oral	H.N.149
Nasturtium officinalis W.	Brassicaceae	talrmira	herb	whole plant	diuretic	decoction	twice	oral	H.N.150
Nerium indicum L.	Apocynaceae	gendhery	shrub	whole plant	dermatitis	crushed	twice	dermal	H.N.151
Olea ferroginea Royle.	Oleaceae	khona	tree	bark	dermatitis	crushed	twice	dermal	H.N.152
Onosmahispidum W.	Boraginaceae	paimeme	herb	whole plant	stimulant	decoction	once	oral	H.N.153
Oxalis carniculata L.	Oxalidaceae	zamakintaroky	herb	whole plant	dysentery	crushed	twice	oral	H.N.154
Papever sominiferum L.	Papeveraceae	kashkash	herb	capsule	analgesic	decoction	once	oral	H.N.155
Parthenium hysterophorus L.	Asteraceae	sqabutay	herb	whole plant	anti-malarial	decoction	twice	oral	H.N.156
Phasylis minima L.	Solanaceae	mangotay	herb	Fruit	antiseptic	crushed	twice	dermal	H.N.157
Polygonum glabrum L.	Polygonaceae	pulpoluk	herb	leaf	astringent	crushed	twice	dermal	H.N.158
Punica granatum L.	Punicaceae	anangoray	shrub	fruit	tonic	extract	extract	oral	H.N.159
Ranunculus aquatilis L.	Ranunculaceae	ziyargulay	herb	leaf	anthelmintic	decoction	once	oral	H.N.160
Ricinus communis L.	Euphorbiaceae	arhanda	shrub	seed	purgative	decoction	once	oral	H.N.161
Robinia pseudocassia L.	Mimosaceae	kekar	tree	bark	antidiarrheal	crushed	once	oral	H.N.162

Rosa indica J.	Rosaceae	gulab	shrub	flower	laxative	decoction	twice	oral	H.N.163
Rubus fruticosus S.	Rosaceae	karwara	shrub	fruit	antidiarrheal	extract	once	oral	H.N.164
Rumex histatus L.	Polygonaceae	tarooky	herb	root	purgative	crushed	twice	oral	H.N.165
Salvia moocroftiana L.	Lamiaceae	kharghwag	herb	root	antidiarrheal	decoction	twice	oral	H.N.166
Sarcococca saligna D.	Bucsaceae	ladan	shrub	whole plant	antidiarrheal	decoction	twice	oral	H.N.167
Solanum nigrum A.	Solanaceae	kamacho.	herb	whole plant	laxative	decoction	twice	oral	H.N.168
Solanum surattense B.	Solanaceae	maraghoney	herb	whole plant	anti-asthmatic	decoction	twice	oral	H.N.169
Verbiscum Thapsus L.	Lamiaceae	khardhag	herb	whole plant	emetic	decoction	once	oral	H.N.170
Zanthoxylum armatum D.	Rutaceae	dambara	shrub	fruit, seed	anthelmintic	crushed	once	oral	H.N.171
Zizyphus sativa G.	Rhamnaceae	markhanai	tree	bark	blood purifier	crushed	once	oral	H.N.172

Research survey

In current research survey a total of 62 plants species from 38 families were studied**.** The percentage of families was observed as (Lamiaceae 16%), (Solanaceae 12%), (Rosaceae 10%), (Brassicaceae, Chenopodiaceae, Euphorbiaceae 7%), (Mimosaceae 5%), (Papilionaceae, Polygonaceae, Asteraceae 5%) while remaining 29 families used as (1%).The leading families were Lamiaceae, Solanaceae and Rosaceae respectively. With respect to habit the percentage of plant species observed as (herb 59.6%), (shrubs 25.8%) and (trees 14.51%) (Table 1).Same kind of studies were also observed in different part of the world (Nahdi *et al.,* 2016). Apart from this other plant species are also in common practice such as fodder, timber, fruit and fuel from the study area (Hazrat *et al.,* 2011). The peoples of the locality were observed with respect to their dependency on herbs more than shrubs and trees species to cure different health disorders. In nut shell it may be their easy accessibility and good results to take it for the treatment of numerous diseases (Sher *et al.,* 2005). Our results are in connection with other surveys observed by (Tareen *et al.,* 2010; Hazrat *et al.,*2011), where traditional healers use plant species of Lamiaceae, Solanaceae, Rosaceae, Brassicaceae, Chenopodiaceae, Euphorbiaceae, Mimosaceae, Papilionaceae and Polygonaceae for the preparation of ethno medicine.

Table 2. Fic values of traditional medicinal plants used as remedy in Miandam District Swat.

Disease	nt	nur	Fic
antidiarrheal	24	204	0.89
antiseptic	22	187	0.89
dermatitis	13	37	0.67
pain killer	09	31	0.73
tonic	06	27	0.81
carminative	11	21	0.50
diuretic	13	13	0.00
febrifuge	10	12	0.18
laxative	03	19	0.89
purgative	02	35	0.97
anthelmentic	02	58	0.98
antiasthmatic	05	23	0.82
hepatitis	01	21	1.00
astringent	01	11	1.00
blood purifier	01	29	1.00
stimulant	02	13	0.92
vermifuge	03	11	0.80
analgesic	02	24	0.96
antidiabetic	01	09	1.00
antimalarial	02	11	0.90
aphrodisiac	01	13	1.00
emetic	03	17	0.88
flavouring agent	01	07	1.00
gastrointestinal	03	10	0.78
musculoskeletal	04	12	0.73
tuberculosis	05	16	0.73

Table 3. Fidelity level (FL) value of medicinal plants reported for given diseases.

Botanical name	Illness treated	lp	lu	FL value %
Papever sominiferum L.	analgesic	18	18	100.00
Ranunculus muricatus L.	anthelmintic	18	18	100.00
Zanthoxylum armatum D.	anthelmintic	23	23	100.00
Demostachyabipinnata L.	anti-asthmatic	15	17	88.24
Fumaria indica H.	anti-diabetic	24	26	92.31
Indigofera haterantha L.	anti hepatitic	29	31	93.55
Parthenium hysterophorus L.	anti-malarial	25	28	89.29
Solanum surattense B.	antiasthmatic	19	21	90.48
Robinia pseudocassia L.	antidiarrheal	10	13	76.92
Rubus fruticosus S.	antidiarrheal	19	22	86.36
Salvia moocroftiana L.	antidiarrheal	23	25	92.00
Sarcococca saligna D.	antidiarrheal	17	20	85.00
Malvasa lvestris Wall.	antidiarrheal	15	18	83.33
Andrachne cardifolia W.	antiseptic	6	9	66.67
Dodonia viscosa L.	antiseptic	11	14	78.57
Eucalyptus lanceolata L.	antiseptic	7	9	77.78
Isodon rugosus L.	antiseptic	12	15	80.00
Phasylis minima L.	antiseptic	5	7	71.43
Lipidum sativum L.	aphrodisiac	10	13	76.92
Cotoneaster microphyllus L.	astringent	6	8	75.00
Polygonum glabrum L.	astringent	12	14	85.71
Berberislycium Royle.	blood purifier	13	16	81.25
Zizyphus sativa G.	blood purifier	9	12	75.00
Foeniculum vulgares M.	carminative	15	19	78.95
Mentha arvense L.	carminative	10	14	71.43
Mentha longifolia L.	carminative	11	15	73.33
Calotropis procera W.	dermatitis	16	21	76.19
Euphorbia helioscopia L.	dermatitis	18	25	72.00
Melia azedarach L.	dermatitis	26	30	86.67
Nerium indicum L.	dermatitis	22	29	75.86
*Oleaferrogineа*Royle.	dermatitis	21	29	72.41
Nasturtium officinalis W.	dieuretic	13	23	56.52
Asparagus officinalis L.	diuretic	14	26	53.85
Amaranthus viridus L.	diuretics	11	17	64.71
Oxalis carniculata L.	dysentery	14	19	73.68
Verbiscum Thapsus L.	emetic	19	30	63.33
Adiantumcapilus-veneris L.	febrifuge	23	31	74.19
Chenopodium album L.	febrifuge	13	20	65.00
Mimosa pudica L.	febrifuge	13	19	68.42
Lathrys lyceum L.	flavouring agent	18	24	75.00

Hypericum perporatum L.	gastrointestinal	14	21	66.67
Cotoneaster nummularia L.	hepatitic	9	17	52.94
Ficus carica L.	laxative	7	16	43.75
Rosa indica J.	laxative	9	15	60.00
Solanum nigrum A.	laxative	11	14	78.57
Acacia modesta W.	musculoskeletal	14	18	77.78
Cannabis sativa L.	pain killer	9	13	69.23
Datura anoxia M.	pain killer	7	14	50.00
Hyocymus niger L.	pain killer	8	19	42.11
Justica adhathoda L.	pain killer	13	20	65.00
Artimesia scoperia L.	purgative	18	22	81.82
Ricinus communis L.	purgative	5	12	41.67
Rumex histatus L.	purgative	16	23	69.57
Capsella bursa -pestoris L.	stimulant	17	27	62.96
Onosma hispidum W.	stimulant	22	26	84.62
Celtis australis L.	tonic	6	11	54.55
Fragaria indica Andrew.	tonic	8	14	57.14
Monotheca buxifolia F.	tonic	6	14	42.86
Punica granatum L.	tonic	11	19	57.89
Equisetum arvense L.	tuberculosis	8	16	50.00
Chenopodium ambrosioide L.	vermifuge	9	13	69.23
Chenopodium botrys L.	vermifuge	12	17	70.59

Common ailments in the study area

The peoples of the study area use 62 plant species to cure different health disorders were grouped into 26 main disease categories like (6) plant species as antidiarrheal, (5) antiseptic and dermatitis, (4) pain killer, tonic, (3) carminative, diuretic, febrifuge, laxative,purgative, (2) anthelmintic, antiasthmatic, hepatitis, astringent, blood purifier, stimulant, vermifuge and (1)analgesic, antidiabetic, antimalarial, aphrodisiac, emetic, flavoring agent, gastrointestinal, musculoskeletal and tuberculosis(Fig. 2).

Table 4. DMR score for 62 medicinal plants species with additional uses besides medicinal uses.

Plant	Agriculture tools	Construction	Fodder	Fuel	Medicinal	Rank
Oleafer roginea R.	5	4	5	5	5	24
Zizyphus sativa G.	5	5	3	5	5	23
Acacia modesta W.	5	3	4	5	5	22
Melia azedarach L.	3	4	4	5	5	21
Robinia pseudocassia L.	4	5	4	5	3	21
Celtis australis L.	3	3	4	5	4	19
Ficus carica L.	3	3	4	5	4	19
Monotheca buxifolia F.	3	3	3	5	5	19
Eucalyptus Lanceolata L.	3	4	2	5	3	17
Dodonia viscosa L.	0	4	3	5	4	16
Zanthoxylum armatum D.	1	2	4	4	5	16

Berberis lycium Royle.	0	0	4	5	5	14
Indigofera haterantha W.	0	3	2	5	3	13
Isodon rugosis L.	0	3	2	5	3	13
Punica granatum L.	0	0	3	5	5	13
Calotropis procera W.	0	0	3	4	5	12
Cotoneaster microphyllus W.	0	0	4	3	5	12
Cotoneaster nummularia F.	0	0	4	3	5	12
*Rubus fruticusis*S.	0	0	4	3	5	12
Amaranthus viridus L.	0	0	5	1	5	11
Foeniculum vulgares M.	0	0	4	2	5	11
Papever sominiferum L.	0	0	4	2	5	11
Rumex histatus L.	0	0	5	1	5	11
Solanum nigrum A.	0	0	4	2	5	11
Artimesia scoperia W.	0	0	2	3	5	10
Justica adhathoda L.	0	0	3	3	4	10
Malvasa lvestris W.	0	0	5	1	4	10
Asparagus officinalis L.	0	0	3	1	5	9
Cannabis sativa L.	0	0	2	3	4	9
Chenopodium album L.	0	0	3	2	4	9
Chenopodium ambrosioide L.	0	0	3	2	4	9
Chenopodium botrys L.	0	0	3	2	4	9
Fragaria indica A.	0	0	4	0	5	9
Lathrys lyceum L.	0	0	5	0	4	9
Nasturtium officinalis W.	0	0	5	0	4	9
Nerium indicum L.	0	0	0	4	5	9
Phasylis minima L.	0	0	3	1	5	9
*Ricinus communis*L.	0	0	0	4	5	9
Rosa indica J.	0	0	3	3	3	9
Andrachne cardifolia W.	0	0	2	3	3	8
Datura anoxia M.	0	0	1	2	5	8
Fumaria indica H.	0	0	4	0	4	8
Lipidum sativum L.	0	0	3	0	5	8
Mentha arvense L.	0	0	3	0	5	8
Mentha longifolia L.	0	0	3	0	5	8
Onosma hispidum W.	0	0	3	1	4	8
Salvia moocroftiana L.	0	0	3	2	3	8
Capsella bursa-pestoris L.	0	0	2	2	3	7
Hypericum perporatum L.	0	0	2	1	4	7
Oxalis carniculata L.	0	0	3	0	4	7
Ranunculus aquatilis L.	0	0	3	1	3	7
Verbiscum Thapsus L.	0	0	3	2	2	7
Hyocymus muticus L.	0	0	1	1	4	6
Mimosa pudica L.	0	0	2	1	3	6

Sarcococca saligna D.	0	0	2	2	2	6
Adiantum capilus-veneris L.	0	0	0	2	3	5
Demostachya bipinnata L.	0	0	4	0	1	5
Equisetum arvense L.	0	0	1	0	4	5
Solanum surattense B.	0	0	2	1	2	5
Euphorbia helioscopia L.	0	0	0	0	4	4
Parthenium hysterophorus L.	0	0	0	3	1	4
Polygonum glabrum L.	0	0	0	1	3	4
Rank	35	46	179	149	251	

Criteria used for data collection and analysis (0= not used,1=least used,2=less,3=good,4=very good,5=best)

Table 5. Gender, age classes, literacy level, and occupation of people interviewed.

Gender	Density	% Contribution
Male	47	70.14
Female	20	29.85
Age classes		
25-30	5	7.46
31-35	6	8.95
36-40	9	13.43
41-45	7	10.44
46-50	7	10.44
51-55	8	11.94
56-60	9	13.43
61-65	10	14.92
66-70	4	5.97
71-75	2	2.98
Literacy level		
Illiterate	23	34.32
Middle	15	22.38
Secondary	17	25.37
Higher Secondary	7	10.44
Graduate	5	7.46
Professional level		
House wives	20	29.85
Teacher	9	13.43
Shopkeepers	7	10.44
Farmers	25	37.31
Labors	2	2.98
Hakeem and nomads	4	5.97

The results obtained are in close connection with studies conducted at national and international level(*Das et al.,* 2008; Nath *et al.,* 2011; Noor and Kalsoom, 2011). The use of more plant species as antidiarrheal, antiseptic and dermatitis in the locality might be due to use of unclean water, wood as fuel for cooking and bad hygiene. Results obtained as informant consensus have shown high mark of consensus for (anthelmintic (0.98), followed by purgative (0.97), analgesic (0.96) and so on.

Highest plant species use citation was found for antidiarrheal (204) followed by antiseptic (187) and so on while the lowest value (7) was recorded for flavoring agent (Table 2). These values (Fic) declare that such kinds of diseases are common in the study area that might be due to poverty, unclean water, unhygienic foods and wood fuel smoke.

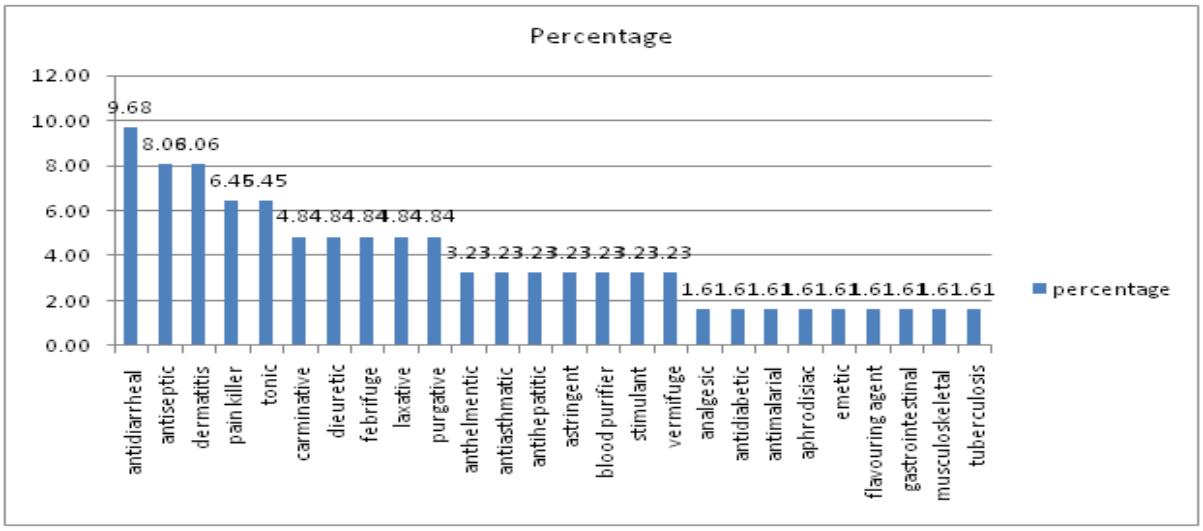

Fig. 2. Percentage of health disorders cure through medicinal plants in study area.

According to (Mesfin *et al.,* 2013), Fic values play a vital role in plant species selection for further research with respect to their chemical constituents used against different disorders. Plant species having high pic values might be taken as sign for high chemical constituents with fruitful results (Table 2).Medicinally important plants used for the above mentioned disorders reported from the study area are also taken in different part of the country and the rest of the world which are in connection with(Jan *et al.,* 2011; Nedelcheva, 2013).

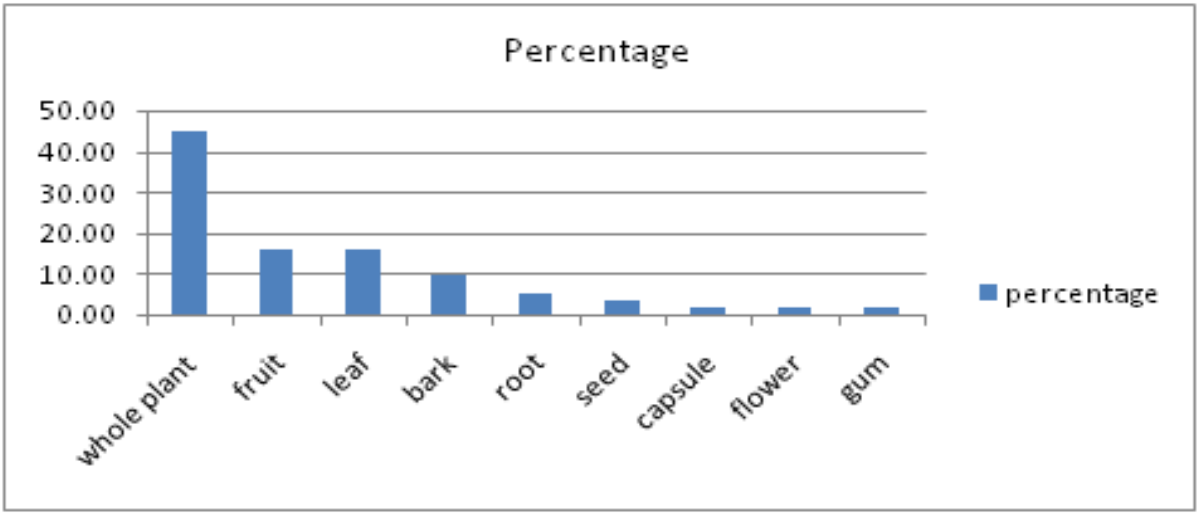

Fig. 3. Percentage part use of medicinal plant species.

Plant species with high unique chemical constituents can be consider more valuable and accurate regarding their action against diseases like *Cannnabis sativa* having cannabinine, cannabinol and phenolic compounds used in dysentery, pain killer, and taken as aphrodiasic. *Berberis lyceum* with berbamine, alkaloids, starch, tannin taken in diarrhea, blood purifier and stomachic. *Dedonea viscosa* with dodonine, tanin, gum, resin, acids, alcene and idogenin used to cure wound healing skin burn and swellings. *Melia azedarach* with alkaloid azarridine, tanin, Resin, melotonic acids, bakayanin used diuretics, dermatitis and taken for edema. *Mentha longifolia* with volatile oil, thymol, resin, gum and tannin as pain killer, anthelmentic, carminative and anti-diarrheal. All these above mentioned plant

species are believed to account for its better medicinal value. The study is in connection observed in different areas by (Shinwari, 2006;Akhtar, 2013;Hamayun, 2017).Plant species with high FL value may be subjected for further analysis to investigate bioactive compounds for its high potential (Lulekal *et al.,* 2013).

Preparation of ethno medicines

The peoples of the locality use plant species as herb (59.6%), shrubs (25.8%) and trees (14.51%).

Part used found as whole plant (45.16%) followed by fruit (16.13%), leaves (16.13%), bark (9.68%), root (4.84%), seed (3.23%), capsule (1.61%), flower (1.61%) and gum (1.61%) (Fig. 3). Majority the use of whole plant was observed (45.16%).It may be due to their easy collection and to get more and more chemical constituents for fruitful results. Dose wise (Fig. 5) and percentage (Fig. 6) mode of application of ethno medicines were also evaluated.

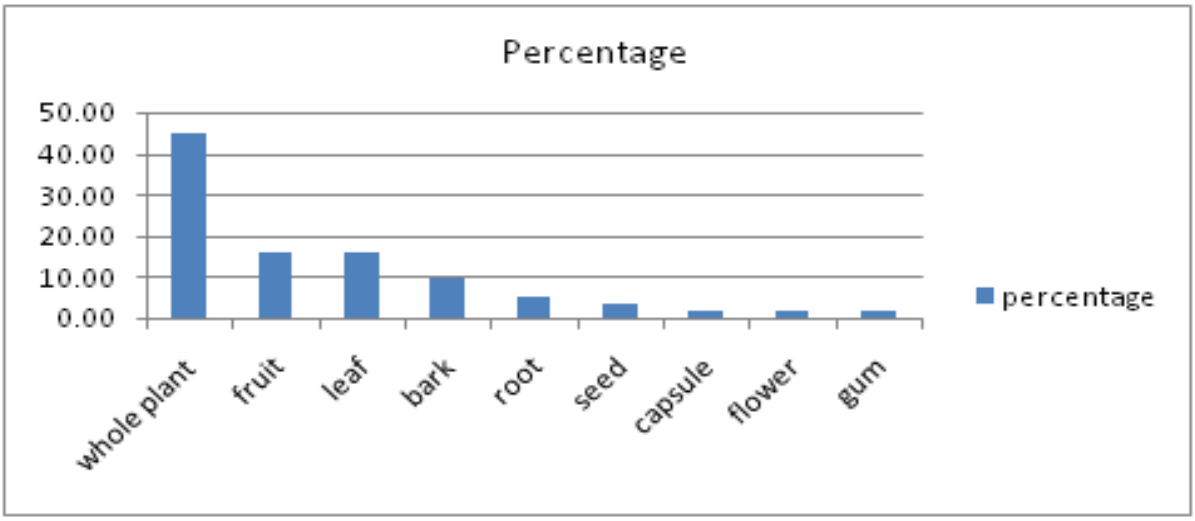

Fig. 4. Methods for preparation of ethno medicines.

The findings are in strong connection regarding preparation of remedies from plants for various health disorders to the results of (Awan *et al.,* 2011; Badshah and Hussain, 2011). Out of total recipes preparation the peoples of the locality use crushed (43.55%) followed by decoction (41.94%), extract (11.29%), original and paste (1.61%) (Fig. 4).

The process of crushing and decoction of plants for ethno medicines preparation might be due to their effectiveness for health disorders. Same was also described by (Deeba, 2009) as crushing, decoction, and grinding methods are applied for active compounds extraction. While recipes preparation the locals used single plant (fresh or dried) for single or multipurposeas well as mixture of species ,like crushed the roots of *Berberis lycium* and take with finger tips for treatment of sour mouth.

Leaves of *Canabis sativa* after heating are tied on fracture bones. A full tea spoon of crushed *Mentha longifolia* is used to treat diarrhea, abdominal pain, anthelmintic and carminative disorders.

The seeds of *Lipidum sativum* and *Eucalyptus* are mixed with sugar and boiled in milk to treat abdominal pain, urinary tract disorders and menses regulation. Same was also observed as plants which are used in mixture for the preparation of remedy increase its effectiveness (Bako *et al.,* 2005).Our results are in connection with studies conducted in other areas of the country as (Durrani and Hussain, 2005; Hazrat *et al.*, 2011).

The healers mostly favor crushed and boiling method of remedy preparation than that of fresh parts to avoid microbial attacks. Large quantity of fresh plant parts may threaten plant species due to the degree of excessive use.

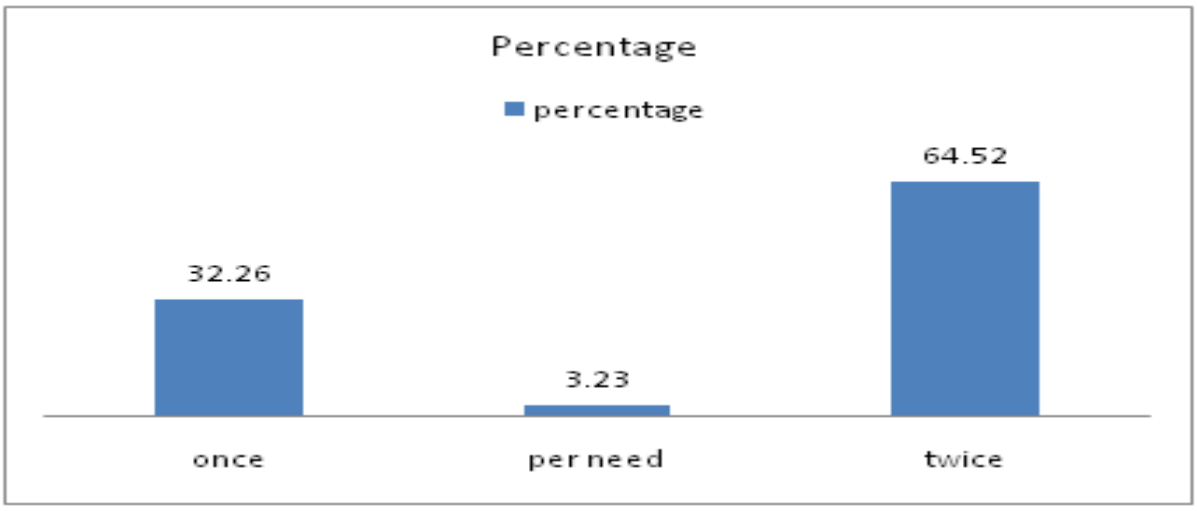

Fig. 5. Percentage dose taken of ethno medicines.

Route of administration and dosage

According to current ethno medicinal survey the route of administration was observed orally mostly (77.42%) followed by dermal (22.58%)(Fig. 6).For to take ethno medicines without any difficulties and to get a good taste they use additives like, milk, water, sugar, desighee, flour, fruit extracts, and dry fruits. There was not a proper dosage observed which full filled standard criteria like modern medicines but was given after going through the technical aspect of the patient. Ethno medicines were added from a finger tips to tea spoon according to the dose they want to prepare which transfer from generation to generation. Some peoples were observed who used ethno medicines at regular basis until the recovery of their Physical health conditions. Same was also observed from the study conducted by (Abbasi *et al.,* 2009).

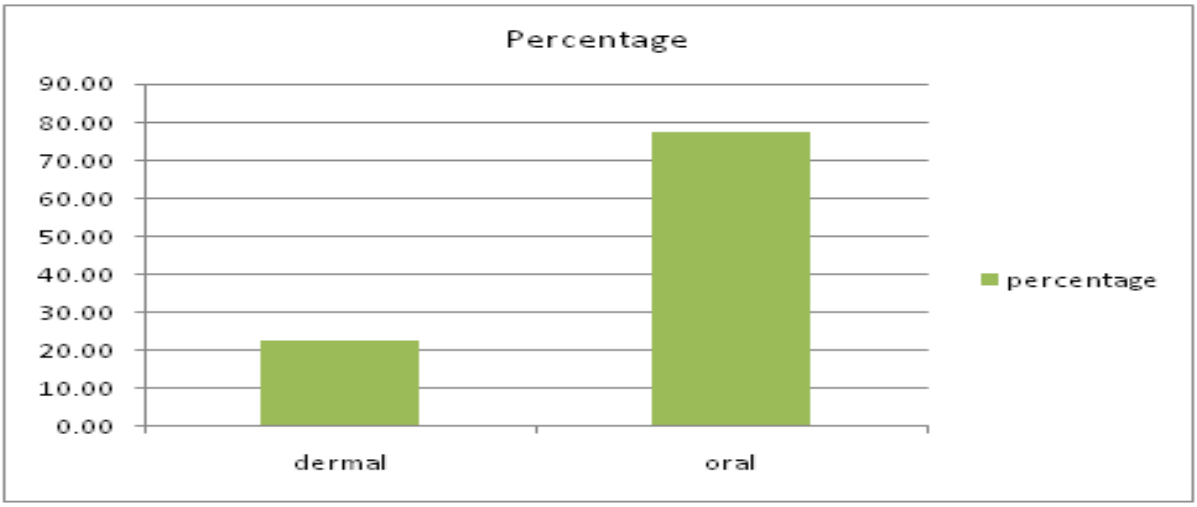

Fig. 6. Percentage mode of application of ethno medicines.

Medicinal plants and their extinction

From DMR results it may be easily observed to know about the conservation status and up to what limit the species are under stress. Rank wise *Olea ferroginea* got first rank by second *Zizyphus sativa*, third *Acacia modesta,* fourth *Melia azedarach*, *Robinia pseudocassia* fifth, *Celtis australis, Ficus carica, Monotheca buxifolia* six, *Eucalyptus lanceolata* seven, *Dodonia viscosa, Zanthoxylum armatum* eight, *Berberis lyceum* nine, *Indigofera haterantha* ten and so on (Table 4). Mostly trees were observed followed by shrubs and herbs which are

under pressure because of unsustainable and improper harvesting by the locals to fulfill their basic needs like fire wood, construction, fodder, agricultural tools, furniture, small shops construction and fodder. Such kinds of factors subject these important plant species towards critical conditions (decline).Grazing was observed common in the area.

There is a dire need (biodiversity conservation.) to overcome such kinds of threats to be suffered in future. Our findings are in close connection with the studies conducted at international and national level (Heinrich *et al.,* 1998; Muthu *et al.,* 2006; Razaq *et al.,* 2010; Jan *et al.,* 2011), stated the same as the peoples used plant species for both medicinal as well as to full fill their basic needs ultimately put pressure on the available resources which needs proper protection.

Gender, age classes, literacy level, and occupation of people interviewed

Out of 67 informants, 47 were males (70.14 %) and 20 female (29.85%)(Table 5).The knowledge regarding ethno medicines were found that, males were more knowledgeable than female it may be due to males are more responsible than female to fulfill the basic requirements of their family in the study area. Age wise the informants were observed as above 45 years. Literacy level was observed as illiterate (34.32%), teachers (13.43%) farmers (%37.31), hakeem and nomads (%5.97), house wives (29.85%) (Table 5).

The young generation was found very few who take interest in such kind of knowledge it may be due to trust and modernization, while literate people had less knowledge than that of illiterate peoples.

The study is in connection with (Gedif and Hahn, 2003; Ghorbani, 2005; Chellappandian *et al.,* 2012) who described ethno medicinal knowledge with respect to literacy level, conservation status, age factor, income resources and future planning.

Conclusion

The locals depend on plants species to cure health disorders even english medicine facilities are accessible for the locals up to some extent. Majority of the peoples claimed that they are in touch with these medicinal plants from their childhood to this age like used *Berberis lycium* to cure sour mouth, and other plant species now to take as food intake not as pharmacological. It was concluded that harvesting of plant species for medicinal and fuel wood purpose is common in the study area.

They are unaware regarding their sustainable use like scientific collection, parts use, preservation and storage which may decline density of these important plant species which can be considered as a huge loss to biodiversity.

The most important thing which was observed the informants were found ready to share their ethno botanical knowledge with researchers. Further exploratory trips, conservative strategies, inspective committees, awareness, Joint collaboration and wise use of resources are highly needed.

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