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MEDICINAL VALUE AND BIO-EFFICACY OF IMPORTANT TRADITIONAL PLANTS OF GARAM CHASHMA VALLEY CHITRAL

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Abstract: **Background:** Medicinal plants have been used for treatment having the potential of human well being and always been a matter of high concern; serve as a raw material for pharmaceutical synthesis or chemical synthesis. **Objective**: To document the medicinal plants, the most commonly used, use variability and bio-efficacy of traditionally used plant. **Methodology**: A total 40 native people including local elderly knowledgeable persons, local herbal practitioners, and plant collectors of Garamchashma valley were interviewed and information was gathered about plant uses through an open ended questionnaire. Identification of plants was done through local people with correct local name, confirmed through various literatures and studies. Use variability of plant use and bio-efficacy was determined through calculation and comparisons with previous studies respectively. **Results**: wounds and cuts, gastro-intestinal disorders, cold and cough, musculo-skeletal problems, headache, fever, menstrual disorders, dizziness and weakness were the ailments treated with medicinal plants. 9/20 plants were the most commonly used plants having their medicinal information to more than 70% respondent. Overall consensus factor (F_{IC}) for all studied plant was 0.95. The Comparison of current reported traditional use with already known pharmacological and phytochemical properties showed, complete (64.7%), partial and No correspondence (17.6% each) for 17of the 20 plants respectively. **Conclusion**: Garam chashma valley is rich in its herbal medicine and people of this valley possess good ethnopharmacological information. This study provide identification of the most commonly used effective medicinal plants indicating high potential for economic development through sustainable collection and trade.

Keywords: Medicinal plants, bio-efficacy, gastro-intestinal disorders, musculo-skeletal problems, consensus factor

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INTRODUCTION

Plant natural resources are rich with great natural chemical compounds that are potentially well-off for further utilization by the human being for different purposes. But typically only a few plants which have been put into practice for the treatment of a variety of ailments in a particular region or the traditional plants serve as a starting agent for pharmaceutical or chemical synthesis.

Traditional plants has been used from the time when there begin origin of life on earth. In the start Plant use was limited to only medicine, food and shelter but as time passed man discovered the benefits of plants for a number of other purposes. Hence, their reliance on herbal plants increased directly and indirectly. Wild plants always been focused and have been used for their ability of human well being[1, 2].

Pakistan has a total of 5521 species belonging to 1572 genera, which is mostly confined to the mountainous areas of the country[3]. Few studies were documented regarding the uses of medicinal plants in Chitral district, i.e. Hussain (2003) collected ethnobotanical information of fruit plants of Chitral and listed about 19 cultivated fruit plant species[4]. Similarly Ahmed *et al*., (2006) conducted ethnobotanical studies on some medicinal plants of Booni valley[5], while Hussain *et al*., (2007) conducted an extensive survey on the medicinal plants of Mustuj valley and documented the uses of 111 plant species[6]. Ajaz (2007) explored the nontimber forests produce of Kalasha valley and reported 27 marketable medicinal plants which can be utilize for poverty reduction[7], while an ethnobotanical studies with particular reference to medicinal plants in Chitral valley was given by Haidar and Qaiser (2009)[8]. Khan *et al*., (2010) discussed the plants used as fuel, fence and their medicinal uses focusing in five major valleys including Bumburate, Rumbur, Birir, Shehekuh and Golin Gol Valley of District Chitral[9]. Plant natural resources are provided with great natural chemical compounds that are almost rich for further experimentation for different ailment purposes. Naturally only those herbal plants which normally have been used for the treatment of various diseases in a specific region, or serve as a raw material for pharmaceutical or chemical synthesis.

Garamchashma valley of chitral is famous for its hot springs found in different places, main Garamchashma, Gobor and Arkari area. Temperature of these springs range between 66C° to 68 C°. These springs contain sulphur (SO_4) in huge quantity 366.1mg/l. Other elements/chemical found are Ca (39.4mg/l), (170.9 mg/l), K (8.5 mg/l), Mg (2.1 mg/l), Na HCO_3 (128 mg/l), Cl (25.1mg/l), NO_3 (3.5mg/l), and SiO_2 (53.5mg/l) [10]. These ingredients give some unique feature to the soil constituent of this area. Unique features of the soil of this region may have an impact on biological diversity of the region. Beside other natural resources, the area is also enriched with useful medicinal plants.

This study was carried out in order to explore the following objectives:

1. To explore the medicinal plants used traditionally for treatment of various ailment in the valley of Garamchashma, Chitral, Pakistan

2. To determine the most commonly used medicinal plant.

3. To determine use variability of traditionally used medicinal plants, also to calculate informant agreement.

4. To determine the bio-efficacy of medicinal plants by finding its local uses and comparing them with findings from already published pharmacological and phytochemical studies,

SUBJECTS AND METHODS

The author conducted a survey of Garamchashma area development organization (GADO) office in chitral and collected data of traditional plants of Garamchashma valley. First hand information was gathered through interactions with rural people and plant practitioners on behalf of most commonly used traditional plants for curing different ailment. Twenty different plants were selected for this purpose. The traditional uses of plants, its local name were documented through a pre designed questionnaire and the local elderly knowledgeable persons including local herbal practitioners were interviewed. Plant collectors and students were also included in the study after taking consent that their medicinal information is to be disseminated. A total 40 native people of Garamchashma valley were interviewed and information was gathered about plant uses that what herbal species were used to treat what kinds of ailment, modes of utilization and parts used. During the study these plants species were gathered, collected, sun dried, documented and were subjected to identification by comparing them with herbarium specimen of PCSIR and with the help of flora of Pakistan[11, 12]. Identification was confirmed with correct local name provided by knowledgeable elderly people, and compared them with previous local studies, [5, 6,8,13].

Herbarium specimens were collected for included specimen and deposited in PMRC lab KMC Peshawar for further study.

Collected data were processed to determine the most commonly used plants, informant consensus factor and bioefficay of traditionally used plants.

The most commonly used plants:

The most commonly used species in the area based on that more than 70% respondent have an idea about medicinal importance of these species. These plants are the priority plant to be used in case of ailment.

Informant consensus factor

Use variability of medicinal plants, that a particular disease is treated by variable

plant is considered as informant consensus factor (F_{IC}) was calculated.

Value of Informant consensus factor FIC range from 0.00 to 1.00, High FIC values are obtained when only one or a few plant species are reported to be used by a high fraction of study participant to treat a particular illness, whereas low F_{IC} values shows that informants disagree over which ailment plant to use. High F_{IC} values can thus be used to identify particularly interesting herbal species for the search of bioactive compounds. F_{IC} value is calculated by[14].

$F_{IC} = N_{ur}-N_t/N_{ur}-1$

N_{ur} is the number of individual plant use reports for a specific illness category, and N_t is the total number of herbal species used by all informants for this ailment category.

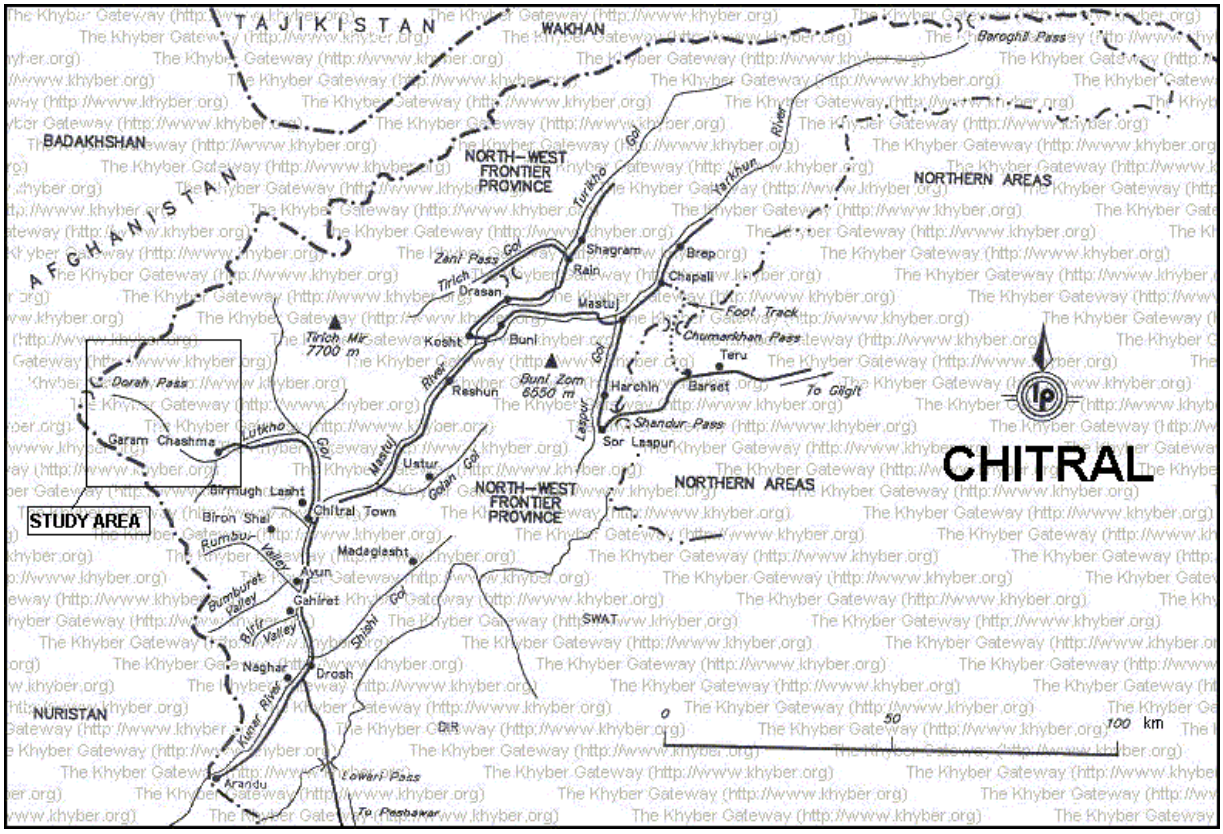
Bio-efficacy of traditionally-used medicinal plants:

In order to substantiate the bioefficacy of traditional plant, experimental observations on the use of herbal medicinal plants by the Garamchashma people of the district Chitral needed to be validated with previous phytochemical and pharmacological studies. Local uses of medicinal plants were compared with phytochemical and pharmacological importance sorted in previous article/ literature for authentication of their medicinal value similar study was carried out by in Nepal in 2003 and 2010 [14, 15].

Study area:

A survey was carried out in Garamchashma valley of Chitral district Khyber pokhtunkhwa (KPK) Pakistan. This area lies between a latitude of 36.33 (36° 19' 60 N) and a longitude of 71.92 (71° 55' 0 E), is a populated place located in monotonous region of KPK. The location is situated 726 kilometers north (14°) of the approximate center of Pakistan and 314 kilometers north (339 cº) of the capital Islamabad. It has an average elevation of 3177 meters above the sea. The Garamchashma valley have graded and harsh climatic conditions in district Chitral. Prominent hihg altitudinal gradients, along with composite topography, large mountains, hot springs (66-68cº) and geology, have resulted in a varied biological diversity and distinctive vegetation ecology.

It is bordered on the east by Tehsil Mastuj valley of district Chitral, on the south by Chitral Gol. Nuristan of Afghanistan lies across the border to the south-West and on west by the Wakhan corridor, which separates Pakistan and Tajikistan, north side of this valley is bounded by peak of Tarich Mir mountain (Fig.1). Mountain ranges of Hindu Kush lie in the north west of this region which is extended to Tajikistan.



RESULT

This study includes information gathered from 40 local resident people of Garamchashma valley. It include (09)22.5% female and (31)77.5 %male respondent (Fig I). 3 local herbal practitioners were included in this study that was educationally middle and Metric. (22)55% respondents were having age level greater than 40 years. (18)45% respondent having age level between 18-40 years. Educationally (18) 45% respondents was graduate, (12) 30% were having middle and metric level education. (6) 15% was having primary education and only (4)10% was illiterate (Fig II).

Demographic characteristics	Number (%)
Gender	
Male	31(77.5)
Female	9(22.5)
Age distribution	
18-40 years	22(55)
>40years	18(45)
Educational distribution	
Graduate	18(45)

Middle and Metric	12 (30)
Primary	6 (15)
Illiterate	4(10)

Ailment treated and parts of plants used

Whole plants, roots, leaves, flowers, fruits, pollen almost all plant parts were used to prepare different medicinal formulations. The most commonly used plant parts were leaves. Seeds, roots, flower and whole plants also used but lesser than leaves. Few cases showed that multiple parts of plant have been used as formulation.

Gastro-intestinal disorders, cuts and wounds, cough and cold, arthritis problems, fever and headache, weakness and menstrual disorders were the major diseases treated with medicinal plants. Highest diversity of medicinal plant species were used to treat fever and headache, cuts and wounds, cough and cold, gastro-intestinal disorders, and musculo-skeletal problems. (Table 1).Few species were found to use for treatment of different ailment but most species were used to treat one ailment (Table 1).

Majority of people were familiar with the uses of species used against common ailment, but in case of complication they took advice from popular local herbal practitioner.

Table 1

Medicinal plants and their traditional uses:

Botanical name (Family name)	Local name	Part used	Uses
Arcenthobium oxycedri **(Cupressaceae)**	saroz	leaves	Antihypertensive
Artemisia parviflora **(Asteraceae)**	kharkhalij	Seeds/leaves	stomach pain, back pain
Capparis spinosa **(Capparidaceae)**	kaveer	Seeds/leaves	High fever, typhoid, reduce blood pressure
Carum carvi **(Umbelliferae)**	hojoj	leaves	Diarrhea, Dysentery

***Cichorium intybus* (Asteraceae)**	kasthi	roots	fever, typhoid
***Codonopsis clematidea* (**Campanulaceae)	Gundustak	roots/leaves	fever, typhoid
Ferula narthex/ Ferula asafoetida **(Umbelliferae)**	Raw	Milky extract of roots/leaves	Vasoconstrictor
Foeniculum vulgare (umbelliferae)	Bodiyong	leaves	malaise, arthritis, blood thinner
***Anthemis cotula L.* (Asteraceae)**	shirisht	flower	nausea, stomach pain
***Mentha royleana* Benth (Labiatae)**	Bhan	leaves	antiulcer, acidity, vomiting
***Morchella esculenta* (Helveliaceae)**	Quchi	Whole plant	Anemia, high proteinacious plant,anticancer
Nepeta cataria L (lamiaceae)	Mutrich	leaves	gastritis, strong bone
Papaver somniferum (papaveraceae)	koknar	seeds	cough, malaise
***Paeonia emodi* (Paeoniaceae)**	Mamakhi	leaves	backache, infertility
***Peganum hermala* (Umbelliferae)**	ispandur	seeds	hypertension , cardiac pain, evil eyes
Prangos pabularia Lindl (Umbelliferae)	muchain	leaves	bone fracture, animal food stuff
Rheum webbianum Royle	chovanch	Seeds/fruits	enhance haematopoiesis

(Salicaceae)			
Urtica dioica L. (Urticaceae)	drozono	leaves	anti constipation, protein rich diet
Viola odorata	banavsha	flower/leaves	typhoid , malaise
ziziphora *clinopodioides* *(lamiaceae)*	zoghor	leaves	Diarrhea, Dysentery

The most commonly used plants

Result showed that most species were used to treat different ailment, with the highest number of species being used for gastro-intestinal problems, followed by fever and headache (Table 1). About 9 medicinal plants (Table 2) were ranked as the most commonly used species in the area.

Table 2: The Most commonly used species with high effectiveness

Disease/Botanical Name/Local Name	Mode Of Administration
GASTROINTESTINAL DISEASES	
Artemisia parviflora / kharkhalij	Seeds are dried, commonly used in a form of traditional diet kharkhalichokh kari, sometime boiled in water and used.
Carum carvi /hojoj	One gram dried leaves are boiled in a glass of water/milk and used
Mentha longifolia /Bhan	Leaves of plants are directly chew the extract produce reduce acidity. Generally leaves of plants are boiled and used.
zisiphora *clinopodioides*/ zoghor	Dried leaves are boiled and used in case of diarrhea

TYPHOID/ FEVER	
Capparis spinosa / kaveer	Dried seeds and flower are boiled in water and used in case of fever. Normaly used in a traditional diet kaveerogh kari used in case of high fever and typhoid.
Codonopsis clematidea/ Gundustak	Dried roots/leaves are boiled in water and used in case of high fever and malaise
ARTHRITIS	
Foeniculum vulgare/ Bodiyong	Dried leaves are boiled in water and milk and used in case of joints pain and malaise
Nepeta cataria /Mutrich	Dried leaves are boiled in water/milk and used to make bone strong
GYNECOLOGICAL DISORDERS	
Paeonia emodi /Mamakhi	Leaves are boiled in milk and used in case of infertility specially by woman

Informant consensus factor

Result shows that informant agreement was high for almost all kind of ailment categories. For Gastro intestinal disorder and musculoskeletal disorder it is 0.97. For other ailment it is little below, 0.92, 0.95, 0.96 for anxiety, cough and cold and fever respectively (Table 3). (FIC = 1.00) was even obtained for cuts and wounds and Gynecological problems (Table 3).

Table 3: Informant consensus factor (F_{IC}) for different ailment categories.

Ailment	Number of Taxa (Nt)	Number of use reports (Nur)	Informant consensus factor (FIC)
Gastro-intestinal ailments	6	174	0.97
Fever and headache	5	103	0.96

Anxiety and cardiac problems	3	26	0.92
Musculo-skeletal problems	2	35	0.97
Cough and cold	2	24	0.95
Cuts and wounds	1	11	1.00
Gynecological problems	1	17	1.00
Total	**20**	**390**	**0.95**

Bio-efficacy and comparison with other studies of traditionally-used medicinal plants

Different studies about pharmacological and biochemical properties of different medicinal plants were found in the studied literature for 17 of the 20 medicinal plant species used by the local people of Garamchashma valley of district Chitral. This comparison of reported traditional use with already known phytochemical and pharmacological properties showed different pattern of correspondent for 17 of the 20 plants (Table 4).

Table 4: comparison of local use with phytochemical/ pharmacological use

Species	Local use (Present study)	Phytochemical/pharmacological properties (Previous studies)	Local use coherent with known phytochemical/pharmacological properties
Artemisia parviflora	seeds are meshed with flour are cooked and used in case of stomach pain, back pain	powdered seeds is taken with a glass of water to cure abdominal pain.[16]	Yes
Capparis spinosa	The floral buds meshed with wheat flour are	gastro-intestinal problems, strangury, inflammation, emmenagogue,	Yes

	cooked to prepare Kaveerough,which is taken orally to cure typhoid fever	anemia, liver dysfunction, rheumatism, antispasmodic analgesic; anthelmintic; deobstruent; depurative; diuretic; antipyretic expectorant; and general body tonic in indigenous, Ayurvedeic, Chinese and Unani system of medicines.[17]	
Carum carvi	leaves are boiled and used in case of diarrhea and dysenteries	It posses antibacterial [18], antiulcerogenic , antitumor , antiproliferative and antihyperglycemic infertility [19]	Yes
Cichorium intybus	roots are boiled and extract produced is very effective against typhoid	It is used in treatment of jaundice, liver enlargement, gout and rheumatism [20]	No
Ferula narthex/ Ferula asafoetida	milky extract is vasoconstrictor	Asafoetida contain essential oil (10-17%)[21] having antioxidant[22] , antiviral[23] , cancer chemopreventive[24], anti-diabetic [25], hypotensive activity [26]	Yes
Foeniculum vulgare	leaves are boiled and used in case of malaise, enhance blood flow, arthritis,	plant-derived heparins, cathechins, ginkgolids, flavonoids, stilbenes, tocotrienols, statins, thiosulfinates,	Yes

	for reduction of blood pressure	phenylpropanoids and phenolic compounds have antithrombotic or antiplatelet and vasorelaxant action [27].	
Anthemis cotula L.	Flower are boiled in water/milk are effective against nausea , stomach pain and blood thinner	Hydroalcoholic extraction are active against cardiovascular disease,atherosclerosis,thrombosis and mycocardial anfraction. Flowers are boiled in water or tea and used for various gastrointestinal disorders like stomachache and gas trouble.[8]	Yes
***Mentha royleana* Benth**	Leaves are directly chewed, extract produce reduce acidity. Also boiled and used in case of ulceration, stomach pain and vomiting.	dried leaves are mixed with green tea and are taken for the treatment of vomiting. The powdered leaves are mixed with curd and eaten for the treatment of dysentery and diarrhea.[8]	Yes
Morchella esculenta	Whole plant Used as vegetable. Practitioners recommend it for anemic and cancer patient.	It contain phenolic compounds have different properties like anti-inflammatory, antioxidant, free radical scavenging abilities, anti-carcinogenic etc [28,29]	Yes
Nepeta cataria L	Leaves are boiled the extracted juice	*Nepeta cataria* possesses spasmolytic and myorelaxant activities mediated possibly	No

	is effective in case of back pain, strong bone and gastritis.	through dual inhibition of calcium channels and PDE, which may explain its traditional use in colic, diarrhea, cough and asthma.[30]	
***Papaver somniferum* L.**	Past of seed are used, highly effective against cough and malaise.	Seeds and leaves remidies have antioxidative enzyme activities and lipid peroxidation[31]	Partial
Paeonia emodi	Boiled leaves are used by women in case of infertility. Also effective against back pain.	ethanol extract are effective against epilepsy and backache and are also used as a stimulant, emetic, therapeutic, blood filter and colic while the seeds are purgative [32].The roots are used for the treatment of headache, dizziness, vomiting and to aid pregnancy [13]	Yes
Peganum hermala	Dry fruit and seeds are burn and children and their Cloths are fumigated with smoke in order to protect them from evil eyes. Similarly used in hypertensive and cardiac patients.	harmaline and harmine as beta-carboline alkaloids containg plant have antileishmanial activities [33]	No

Prangos pabularia Lindl	Animal food stuff. Some time it is grinded and applied in fracture parts f animals.	Sesquiterpen containing plant used as diuretic agent and a treatment for leukoplakia, digestive disorders, healing scars and stopping bleeding [34].	No
Urtica dioica L	Flower used as vegetable, effective against constipation.	Effective reducing power, free radical scavenging, superoxide anion radical scavenging, hydrogen peroxide scavenging, and metal chelating activities. phenolic compounds in the WEN were determined as pyrocatechol equivalent. WEN also showed antimicrobial activity against nine microorganisms, it is used as antiulcer and have analgesic effect [35].	Partial
Viola odorata	Flower/ leaves are boiled and used in case of typhoid and malaise.	alcoholic and water extract contain violin which is emetic ,possess anti pyretic properties. Used as Alternative medicine inrespiratory and digestive disease[36].	Yes
Zisiphora *clinopodioides*	Leaves are boiled and used in case of diarrhea, dysenteries	pulegone cineole ,limonene ,menthol ,β–pinene ,menthone ,piperitenone and piperitone are constituents of its extract had a broad-spectrum antimicrobial activity[37].	Yes

Discussion:

Although more than 100 different types of traditional medicinal plants are used by the native people of Garamchashma valley of chitral Pakistan for different ailments. Only 20 plants were selected for this study based on their high medicinal value and easy availability**.** Herbs being more rich are consider as the primary source of medicinal plant species. It is assumed that the more rich a plant is, the more medicinal benifits it may possess [38]**.** Generally leaves and roots of traditional herbs are used as traditional healer give the reasoning that roots and leaves generally contain great amount of biologically active compounds[39]. Traditional healers uses these plants as antibacterial, antifungal ,antimalaria, cold, fever, cough, headache, diarrhea, fertility problem, stomach ach, wounds and variety of other disease. It is uniformly proved that the medicinal plants have many other uses as some could be used as fruits, trees, vegetables, , ornamentals etc. the different uses can be explained by the fact that, a single plant can serve many purposes or perform different functions and it may be due to the ecological variations observed in different regions. Local traditional healers and common people use few plants more frequently and have medicinal idea to more than 70% respondent. Local community should be actively involved creating awareness about the useful medicinal plants and their commercial value and community participation can be initiated. Similar study was performed in research institutes of south-west Nigeria in 2008 which shows that local healer were using few plants to treat more number of diseases were the most commonly used herbal plants[40], the plants included were mostly herbs and few sharbs but Some wild species like, *Ferula narthex* and *Paeonia emodi* in the valley are endangered due to past over-harvesting by the local communities inhabiting nearby and also due to overgrazing by domestic animals.

Few plants like *Artemisia parviflora*, *Anthemis cotula L., Mentha royleana* Benth and zisiphora *clinopodioides* are traditionally been used by local people in case of stomach pain, ulceration and acidity. Similar study from chitral showed that One teaspoonful of *Artemisia parviflora* powdered seed is taken with a glass of water to cure abdominal pain. Also *Anthemis cotula* L and *Mentha royleana* Benth used in case of gastrointestinal disorder[16]. zisiphora *clinopodioides are used in case of diarrhea and dysenteries by the local respondent of this study. This plant contain an assential oils which has antibacterial activity[37].*

This study showed that Capparis spinosa , Cichorium intybus, Codonopsis clematidea,and Viola odorata are used in case of high grade fever. Local practitioner recommend Cichorium intybus in case of typhoid and local respondent said that it is very effective in case of typhoid. It gives no correlation with other study in which this plant is used in treatment of jaundice, liver

enlargement, gout and rheumatism[20]. Geographic and unique features of this valley may variate phytochemical content which should be explore as no study has been done in this regard.

Paeonia emodi is another wild plant used in case of infertility of women by the local people from ancient time. 85% respondent has an idea about its medicinal value. In another study broad medicinal value of this plant has been explored are effective against backache and epilepsy and are also used as a stimulant, emetic, cathartic,blood filter and colic while the seeds are purgative[32].

Another commercially important species *Morchella esculenta* is found in spring season starting from April to June in different moisture areas of this locality. Local people use it as vegetable and economically important plant with a high selling market price of about Rs. 2000-3000/ 500grm dry plant in the local market. As far its medicinal importance is concern it has anticancer, anti rheumatic and antioxidant activity [29].

The overall average FIC value for all illness described was 0.95, showed a high level of informant agreement compared to similar studies conducted in Rasuwa District of Central Nepal[14]. Similar studies were also conducted in Maxico[41] and india [42]. Almost high level of F_{IC} was obtained for all kind of ailment (Table 3) showed the informant agreement and greater medicinal value of these plants.

In order to evaluate the herbal importance of traditional plant of Garamchashma valley of chitral, It is needed to be authenticated with different biochemical, phytochemical and pharmacological studies in order to confirm their bio-efficacy. Needed concern of this study was to compare medicinal plants of this valley with other studies in order to assess and explore unique effectiveness of medicinal plants having topographic and geographic variation of this locality [10]. The need and concern were raised by different studies carried out in Nepal, but needed evidence was provided by few such studies[14, 43]. Comparison of local uses and phytochemical/pharmacological properties for 17 medicinal plant species showed that traditional use was consistent with known different biological and pharmalogical properties in 90% of the cases. *Cichorium intybus* is used in treatment of jaundice, liver enlargement, gout and rheumatism[20]. Local people of Garamchashma used this plant in case of typhoid fever; recommend it highly effective plat in case of typhoid (Table 4). Root of *Cichorium intybus* is used in this case and its unique medicinal use may be geological or phytochemical variability, which need to be explored. Partial correlation was also obtained for *Capparis spinosa*, *Anthemis cotula L. Nepeta cataria L and* Urtica dioica L (Table 4).

Traditional uses of medicinal plants are a ancient knowledge which is normally being transferred from seniors, elders and Household seniors. This knowledge is

transmitted orally, from generation to generation, and remains confined to a limited group of people[44].this study will help to disseminate knowledge about traditional plants of Garamchashma valley Chitral.

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