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Investigation into Ethnopharmacological perception and practices among traditional communities of Karakorum Mountain Ranges: special reference to Berberis species

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Abstract

Berberis is used for treatment of more than 100 diseases globally. Traditional communities from Karakoram Mountain Ranges, like several other folk communes in the world, are a great source of pharmacological knowledge. Present survey study on medicinal use of Berberis revealed its effective consumption treating more than fifteen (15) different human ailments. Frequent complaints recorded were bone injury (33.28%), backache (13.02%), bone pain (10.36%), joint pain (10.21%), wounds (6.51%), injuries internal (5.18%), knee injury (4.14%), leg injury (3.85%), feet injury (3.40%), stomachache (3.11%), backbone fracture (2.37%), knee pain (1.78%), abdominal pain (1.48%), internal body pains (0.89%) and sciatica (0.44%).There is a highly significant relationship ($p< 0.000$) among age groups, folk medicine use, habitat, collection, dose frequency and treatment length. Root is the most commonly (95.4%) used part followed by stem (47.7%) and debarked stem (29.8%).As compared to oral intake (90.1%), only 9.7%is applied externally. No injecting practice was recorded. To reduce its bitterness, it is used with water (72.1%), milk (71.0%), butter (21.4%), kernel oil (17.7%), tea (3.2%), bread (3.2%) or any other edible (1.1%).Over the last 40-50 years, communities have sharply undergone socio-cultural transformation leading to an even faster decline of folk medication in the area.

Key words : Ethnopharmacology, ethnomedicine, Karakorum, folk wisdom

INTRODUCTION

Ethnopharmacological wisdom with the traditional communities across the globe is a great source of alternatives to cope with the emerging health issues including pathogenic resistance to antibiotics, cancer and diabetes[1,2,3]. However, ethnomedicinal use and practices are declining at a higher speed[4]. According to Hocking[5] people from these areas were 80% dependent on medicinal plants for treatments which declined to 70% in 1987[6]. In 2013, Khan et al.[7] reported only20% use from the area which is far greater than its near extinction use (1.4%) reported from adjoining areas of Hunza Valley[8].

Berberis species are a great source of essential alkaloids including Berberine, which is an important therapeutic agent. Research has proven that Berberine exhibits anticancer, anti-diabetic, anti-AIDS, anti-jaundice, anti-cholera, anti-diarrhea, anti-leprosy and anti-inflammation effects[9,10,11,12,13,14,15,16,17]. Due to its inhibitory effect on oncogene-protein expression, Berberine is considered as an alternate, safer and effective medicine for chemotherapy[18,19]. Similarly, some scientific examinations reveal its multi-potent effect active against Alzheimer, diabetic, cardiovascular, hypertension, musculoskeletal and ocular ailments[20,21,22,23].

Berberine concentration differs from part to part viz; roots, rhizomes, stems, bark and berries of these plants[24,25,26]. Roots show relatively higher Berberine concentration (2.418%) as compared to stem (1.522%) and other parts[24,25,26].

Gilgit-Baltistan, besides being famous for largest and longest glacial chains, meeting point of 4 mighty mountain ranges of the world viz; Himalaya, Hindukush, Karakoram and Pamir, harbor taxonomically diverse, rich and complex flora and fauna in the world. Communities living in these high mountainous areas rely on floral wealth for healthcare and several other purposes including timber, firewood, medicine, food, grazing, agriculture, dining utensils and even musical instruments[27,28]. Present research was aimed at investigation of ethnopharmacological uses of Berberis among traditional communities of high mountainous lands of Gilgit-Baltistan in general and Central Karakoram National Park (CKNP) in particular. Research is unique in its nature and reported for the first time from the area.

MATERIALAND METHODS

Study area:

Geography: Most of the research area falls under the geographical limits of Central Karakorum National Park (CKNP) and its buffer zone. However, Naltar and Nomal valleys lie annexed to the watershed scheme of the park. Besides, the aforementioned valleys, there are three major valleys viz; Bagrot, Rahimabad-Goro and Nagar (Rakaposhi) (Fig. 1). Until recent developments in communication sector, area has remained geographically inaccessible except for the masses except for military mission and adventure travelers.

Ethnography: study area is diverse with respect to socio-ethnographically and access wise. There are at least 16 major tribes (fig. 2) in the area and Shien tribe (33.5%) exists with highest frequency followed by Yashkun (13.4%) and Altitkuz (6.4%) as top scorers. Three major languages are frequently spoken in the area viz; Shina, Brushaski and Doomaki. Shina is

Fig 1: Study area represented with a small red dot on the globe on left middle. Lower part of the figure shows study area within geographical boundaries of Gilgit-Baltistan (formerly Northern Areas of Pakistan) represented with reddish overlay. Upper most part shows core research site with sample sites represented with red dots. Map by Tika Khan.

widely spoken and understood vernacular.

Sample Frame:

According to Government Statistics Bureau (2013) of Gilgit-Baltistan, there are 52,045 (Bagrot 11045, Rahimabad-Naltar 9000, Nagar 32000) individuals in 5480 households. Moreover, there are at least 29 small (<100 households) and medium (>100 households) sized villages in the area. Rahimabad represents almost the entire valley rather than individual villages which are almost 13 in number.

Sample size:

Using Creative Research Systems survey software (sample size calculator) and with the help of the following statistical sample size calculation method[29], we drew the sample size (381) from the given sample frame (52, 045). For the purpose of calculations we determined 95% confidence level and a confidence interval of 5. During the study we have been able to

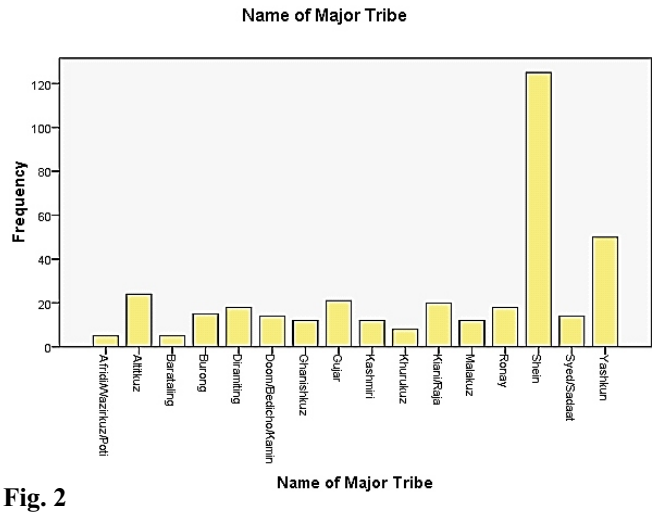

Fig. 2

collect information from 373 respondents which is almost 98% (97.90%) of an ideally designed sample size of 381.

$$ss = Z^2 x (p) x (1-p)/c^2$$

Where:

z = z value (e.g. 1.95 for 95% confidence level)

p = percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

c = confidence interval, expressed as decimal (e.g., 0.04 = ±4)

Data collection tools:

Survey was basically a structured questionnaire based. Questionnaire covered almost 20 direct and indirect but contributing towards each aspect covered. Each questionnaire took almost 45-60 minutes to complete. Questions were asked either in Urdu or in their local language to ensure that the respondents feel confident about its comprehension.

Sampling survey:

Survey design revolves around Stratified Random Sampling method, however, during selection of gender (male, female) and age groups (i.e. <30, 31-60, >61) some purposive techniques have also been used to ensure their number. Data was collected in the field following their willingness to respond.

Data processing and analysis:

Data collected using structured instrument was punched into MS Excel 2010 and then converted into Statistical Package for Social Sciences (SPSS v. 16.1). Besides descriptive statistical analysis, correlational analysis of different parameters was studied to find out their relationship and significance level.

RESULTS

Folk medicine use:

Survey results show an abnormal distribution about folk medicine use in households and personally by respondents. Folk vs allopathic medicine comparative use percentage ranges from 0% to 100% (in personal case) and 80% (in case of use by entire family) resulting in greater standard deviation than their mean value. Across families almost 68.1% (n=254) agreed to use folk medicine, however 31.9% (n=119) households do not. Similarly, 68.9% (n=257) respondents said 'yes' to use traditional medicine (Berberis) in contrast to 31.1%(n=116) who said 'no'.Histogramic comparison shows that folk medicine use has declined and only less than 20% families and individuals rely more on folk medicine as compared to allopathic medication for the ailments listed below (fig. 3).One-Way ANOVA test results show a highly significant relationship ($p < 0.000$) among age groups, folk medicine use in families and personal (respondents') use. However, Correlational analysis between age groups and folk medicine use reveals that there is a negatively significant relationship ($p < 0.006$) which means that increase of age shows an increase in use of traditional medicine exhibiting a directly proportional effect.

Ethnopharmacology of Berberis (Diseases/ ailments cured with Berberis)

Diseases/Ailments: During study respondents revealed that Berberis is used to cure at least 16 diseases (fig. 3), which show variance in citation percentages ranging from 0.44% to 33.28%. Citation percentages can easily be categorized into three percentage value zones i.e. low value zone (≤ 5%), mid value zone (5.01-10.00%) and high value zone (>10.01%).Bone or bone related ailments viz; bone injury (33.28%), backache (13.02%), bone pain (10.36%) and joint pain (10.21%) remained within the high value zone.

Raw material collection: Results and statistical analysis (Pearson correlations, 2-tailed) show that choice for raw material collection (habitat and part used) and its application (use as medicine) have highly significant relationship ($p<0.000$) (see table 1).Study revealed that root is the most frequent (95.4%) used part followed by stem (47.7%) and debarked stem (29.8%). However, there is no concept of using berries, leaves, bark and flowers as medicine in folk wisdom of these communities. Analysis shows that people never prefer any other part over root when used as traditional medicine. Similarly, communities are sensitive towards collection habitat. Table 1 reflects significance level (Pearson correlational analysis) among diseases, habitat of

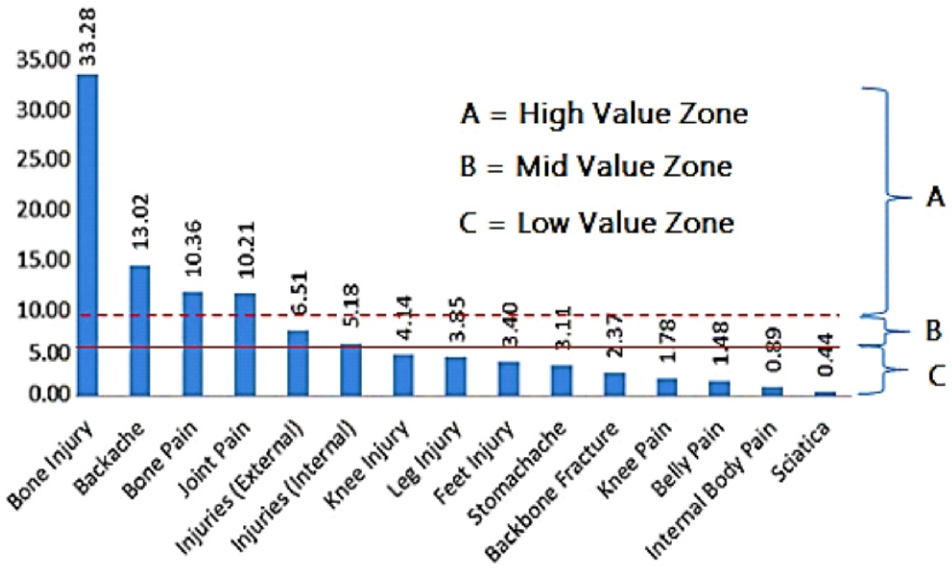

Fig. 3

Table 1: Significance relationship among diseases/ailments, collection habitat and part used to cure them. Values exhibited using correlational analysis (Pearson correlations) in SPSS v. 16.1.

Correlations (Pearson Correlation) N=373; significance 2-tailed

Ailment	Habitat of collection			Part Use		
	Xeric	Irrigated	Aquatic	Root	Stem	DeBSt
External Injury	0.000	0.009	0.045	0.000	0.021	0.003
Internal Injury	0.000	0.003	0.002	0.000	0.000	0.002
Backache	0.000	0.704	0.118	0.000	0.151	0.996
Back Bone Fracture	0.705	0.000	0.003	0.798	0.000	0.007
Feet Injury	0.000	0.095	0.000	0.000	0.004	0.000
Leg Injury	0.000	0.053	0.000	0.000	0.001	0.001
Bone Pain	0.000	0.205	0.023	0.000	0.046	0.175
Knee Pain	0.000	0.000	0.000	0.000	0.000	0.000
Knee Injury	0.000	0.068	0.000	0.000	0.001	0.002
Bone Injury	0.000	0.000	0.000	0.000	0.000	0.000
Stomachache	0.000	0.000	0.000	0.000	0.000	0.000
Joint Pain	0.000	0.001	0.722	0.000	0.000	0.000
Sciatica	0.000	0.000	0.000	0.000	0.000	0.000
Belly Pain	0.000	0.000	0.000	0.000	0.000	0.000
Internal Pain	0.000	0.000	0.000	0.000	0.000	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

collection and part use. During folk medication people strongly prefer collection of root from xeric habitat (94.6%), following a declining trend towards aquatic habitat (34.3%) through irrigated locale (60.6%).

Raw material process: Research shows that in 94.6% cases people use sun dried roots or any other part preferably collected from xeric habitat. Whereas, semi dried and fresh conditions are less preferred (7.0% each). Usually it is crushed into powder (95.4%), boiled (17.7%), soaked (0.0%), chewed fresh/dried (0.8%) or paste (7.8%; water mixed powder of toothpaste form).

Dose preparations and use: Crude form (powder, decoction or paste) is used as medicine. In very few cases (9.7%) Berberis is applied externally on the affected areas whereas; during most of cases (90.1%) it is taken orally. There is not a single report about injecting into the body. Due to its bitter/sour taste processed crude forms are not taken solely and taken with any other edible viz; water (72.1%), milk (71.0%), butter (21.4%), kernel oil (17.7%), tea (3.2%), bread (3.2%) and any other edible (1.1%).

Dose, administration and treatment: Dose quantity (one time dose) varies from 2.5 g to 12 g depending upon nature of ailment, age of patient and its application mode (externally/orally). When taken orally quantity ranges only from 2.5 g to 4.0 g, however when applied externally on the affected areas dose quantity increases up to 12 g. In case of oral use 4 g is the most frequent use has been reported and all other dose quantities reported are less frequent (<7%). In case of decoction 2 tea spoons are considered equal to 4 g of dry powder form.

Per day dose frequency and treatment length: With respect to dose frequency per day we found significant relationship with a declining linear trend towards increase frequency i.e. people have varied perception and practice ranging from once, twice, thrice and four times a day. Twice a day dose frequency (65.4%) is the most common followed by thrice a day (16.9%), once (12.6%) and four times (2.7%) which is least preferred frequency in this case (fig. 4). Dose per day frequency and ailments show highly significant relationship between them. Moreover, treatment length in weeks reported range from less than one week

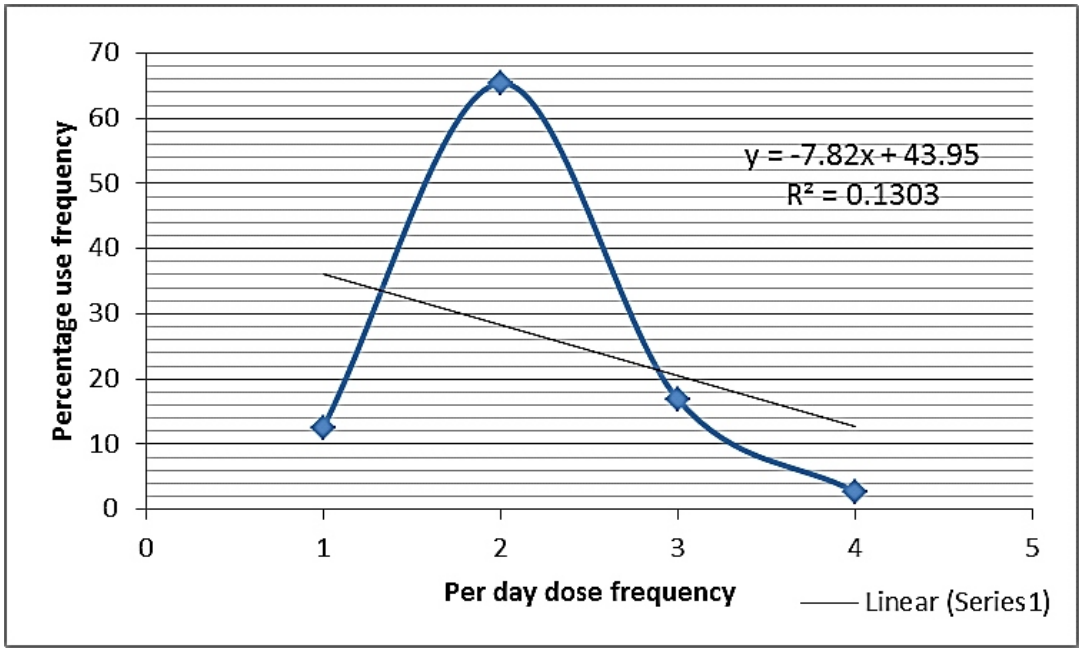

Fig. 4

to three weeks (0.7-3.0) can be categorized into three groups i.e. ≤1, >1.1 <2.0, ≥3. During the study one week (42.1%) and two week (49.3%) time duration are more pronounced and rest are less common (<2%).

Contra effects: During study we did not find any serious contra effect except that over use can lead to physical weakness (0.80%) or sometimes male potency (off the record discussion with respondents which also remains negligible).

DISCUSSION

Over the last 40-50 years, overall trend of using folk medicine in the area has declined[7,8] to less than 20% compared to 100% dependency on traditional medication. However, as compared to other surrounding areas like Hunza where only 1.4% people prefer ethnomedication[7], situation in the area given an even better picture. Hocking[5] had reported that traditional communities in the area are highly dependent[2] on ethnomedicine. Similarly, according to Pie and Manandhar[6], these communities were 70% dependent on their own resources for medicinal purposes.

Younger generation is less inclined towards ethnomedicinal practices due to several internal and external factors viz; easy and ready-made availability of allopathic medicine, established government and private health sector institutions, modern but ignorant socio-scientific educational curricula taught at educational institutions, political myopic vision towards natural and indigenous resources, rampant but unplanned desynchronized development trend etc.

Preferential use of root compliments community perceptions and previous phytochemical research showing relatively higher Berberine concentration in roots (2.418%) as compared to stem (1.522%) and other parts[24,25,26]. Besides acknowledging previous research by various scietists, present study contributed into creation and sharing of new knowledge useful for pharmacologists, microbiologists and ethnopharmacists and biologists equally.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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