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Contents

Editorial

Owing to the fact that there is a global re-surgence of interest in Unani Medicine for preservation and promotion of health, it is important to scientifically validate their strength for wider acceptance and use. In recent years, however, with the availability of new methodologies and tools, the researches on these drugs are more specific, conclusive and reproducible in terms of their quality, efficacy and safety. All these ongoing investigations in India and abroad have generated lot of new research data in recent times and there is, therefore, an enormous need for exchange of this vital information amongst academicians and researchers engaged in the scientific validation of traditional drugs, particularly the Unani medicine. In this context, Central Council for Research in Unani Medicine, through its clinical, drug research, literary research, survey & cultivation of medicinal plants programme is contributing significantly for over three decades. *Vitiligo, sinusitis, filariasis, eczema, malaria, infective hepatitis, asthma* are some of the conditions where Unani therapies have earned recognition.

The Council has been publishing the peer reviewed *Hippocratic Journal of Unani Medicine* (HJUM), mainly to bring out fundamental and applied aspects of Unani Medicine. The journal also publishes recent advances in other related sciences and traditional medicines as well as different streams of medical sciences, which have bearing on validation and scientific interpretation of various concpts and strengths of Unani medicine.

In view of an overwhelming response, the journal earlier published twice a year, its periodicity had been changed to quarterly w.e.f. January 2008 to accommodate more articles for quick dissemination of research data among scientific community. The journal has sufficient room for invited articles from luminaries of modern medicine and sciences as well as scholars of Unani medicine. The broad areas being covered include clinical research on single and compound Unani drugs, validation of regimental therapy, clinical and experimental pharmacological studies, standardization of single and compound drugs, development of standard operating procedures, ethnobotanical studies, experimental studies on medicinal plants and development of agro-techniques thereof, and literary research on classics of Unani medicine. The journal is also open for studies on safety evaluation of Unani and other herbo-mineral drugs, nutraceuticals, cosmotherapeutics, aromatics, oral health, life style disorders, sports medicine etc. and such other newer areas which are the outcome of modern day living.

The current issue of this journal provides 12 original and review papers in the areas of *clinical research, experimental pharmacology, drug standardization, pharmacy, ethnopharmacology* and allied disciplines contributed by eminent scholars in their respective fields. It is hoped that data presented will contribute significantly in R&D sector of traditional drugs and prove to be an excellent exposition of current research efforts of scientists in this direction. Council acknowledges the authors for their contributions included in this issue and hope for their continued support in this endeavor. We wish to ensure the readers to bring out the future issues of the journal on time.

We at the CCRUM have been constantly striving to reach to higher standards and make HJUM the leading journal of Unani medicine and related sciences. In this context, we thank our learned reviewers for their invaluable inputs in improving the manuscripts. We sincerely hope and trust that the mission can be accomplished with active partnership of quality-conscious individuals and institutions. Through these lines we seek your cooperation and support in materializing our dreams about the HJUM. In this regard, we request you for your as well as your colleagues' contributions for publication in and subscription to the journal. Further, we will appreciate if the journal is introduced far and wide. We would also welcome esteemed suggestions for achieving the highest standards of quality for the journal.

December 27, 2015

(Prof. Rais-ur-Rahman)
Editor-in-Chief

Evaluation of Anticonvulsant Activity of Aqer Qerha (*Anacyclus pyrethrum* DC.) Root in Experimental Animals

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Abstract

The present study was carried out to evaluate the anticonvulsant activity of hydro alcoholic extract of Aqer Qerha (*Anacyclus pyrethrum* DC.) root and validate its use as antiepileptic drug as claimed in Unani system of medicine.

Two experimental models of epilepsy viz. PTZ induced seizure test and maximal electroshock seizure test (MES) were used in the study. The rats of wistar strain were divided into four groups of six animals each. Group I served as plain control and was given distilled water 2 ml/kg orally; Group II was given diazepam 5 mg/kg i.p. and served as standard control; Animals in Group III and IV were treated with hydro alcoholic extract of Aqer Qerha in the dose of 65 mg/kg and 130 mg/kg, respectively. The hind leg extension in MES test and onset of the first seizure, clonic and tonic seizure, total number of convulsions and duration of tonic and clonic convulsion were assessed in PTZ induced seizure test. The parameters were analyzed and compared statistically for different groups.

It was found that AQ significantly ($p<0.05$) reduced tonic hind leg extensor stage in MES induced epilepsy. In PTZ induced seizures, it delayed the onset of the first seizure, clonic and tonic seizure; and decreased the total number of convulsions and duration of tonic and clonic convulsion significantly ($p<0.05$). The drug at higher dose protected all the animals from death, while the percentage of protection from death at lower dose was 33%.

The study demonstrated that the test drug possesses significant anticonvulsant activity against both PTZ and maximal electroshock induced seizures. The study validated the claim of Unani physicians of using Aqer Qerha root in epileptic patients.

Keywords: Unani Medicine, PTZ, Aqer Qarha, Epilepsy, Seizure, *Anacyclus pyrethrum* DC, Antiepileptic drug.

Introduction

The most common serious disorder of the brain in the world according to the World Health Organization is Epilepsy (Anonymous, 2005). It be falls in all parts of the world and in every country; approximately 50 million people are affected by epilepsy globally (Reddy et al., 2005). In almost all parts of the word and in every civilization attempts have been reported to be made to cure epilepsy with plant drugs and other natural products. The review of Greco Arab, Indian and Chinese medicine etc testify the fact. Epilepsy is synonymous with *Sara* or *Mirgi*, described in almost all classical books of Unani medicine (Majusi, 1889; Razi,

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1997). There are several plant preparations used by Unani physicians that are taken orally to control the seizures. Although herbs and their preparations are used since hundreds of years to control epilepsy by the physicians of Unani system of medicine, but evidence from the experimental and clinical models to determine the efficacy and safety of the described drugs is lacking. Many attempts have been made in the past to obtain anticonvulsant agents from plant drugs, and these efforts will continue till a satisfactory treatment is available (Sonavane *et al*., 2005). A number of drugs are available in allopathic medicine to treat the epileptic patients. These drugs have been reported to produce significant therapeutic effect, but various side effects consistent with these agents often render treatment difficult; so the demand for new types of anticonvulsants exists. One of the approaches to search for new antiepileptic drugs is the investigation of naturally occurring compounds, which may belong to new structural classes (White *et al.,* 1995). Classical Unani literature and some of the recent reports suggested that the roots of Aqer Qerha (*Anacyclus pyrethrum* DC.) from the Astraceae family possess antiepileptic properties and Unani physicians are using this drug to treat the epileptic patients since scores of years (Kalam *et al.,* 2015). Therefore present study was designed to study the anticonvulsant activity of hydro alcoholic extract of Aqer Qerha root in acute seizures induced by intraperitoneal administration of PTZ and maximal electroshock by electroconvulsive meter.

Material and Methods

Collection and identification of plant materials

AQ (the root of *Anacyclus pyrethrum* D C) was procured from local market of Bangalore. The drug was identified by the Regional Research Institute (RRI) of Ayurveda, Bangalore under reference No.-SMPU/NADRI/BNG/Drug, Authentication /2009-10/942. The specimen of the plant material studied was retained in the RRI for reference purpose. A similar voucher specimen of has also been submitted to the Dept of Ilmul Advia, NIUM, Bangalore for records and future reference.

Preparation of extract

The drug was pulverized in electric grinder in the form of coarse powder. The hydro alcoholic extract of the test drug was prepared with the help of Soxhlet apparatus. For this purpose 100 gm of powdered drug was extracted in 1:1 ethanol and distilled water (200 ml each) at the temperature of 70-80 ^{o}C for 7 hours. The liquid extract was cooled and filtered by Whatman filter paper 44. The filtrate was placed on a water bath until the entire solvent evaporated. The

extract was weighed and the yield percentage was calculated with reference to the crude drug. The yield percentage of the extract was found to be 16 % w/w.

Dose of the drugs and chemicals

The dose of AQ extract for rats was calculated by the method of Freirich *et al*. (1966) and was found to be 65 mg/kg. A second dose (double dose/130 mg/kg) was also taken for the study to assess the dose dependent effect. The test drug was administered by oral route with the help of gastric canula given in the form of suspension freshly prepared at the time of administration to the animals.

Pentylenetetrazole (60 mg/kg) and diazepam (5 mg/kg) were purchased from Sigma Nicolas Pharma India Ltd. The drugs were dissolved in water for injection and administered in a volume of 5 ml/kg.

Animals

Wistar rats of either sex aged between 2-3 months and weighing 150-200g, were used for the study. They were procured from Central Animal Research Facility (CARF) of National Institute of Mental Health and Neurosciences (NIMANS), Bangalore, India, and housed in Animal house Facility at NIUM, Bangalore. They were acclimatized to the laboratory condition for 5 days before experimental studies. Animals were maintained in a standard environmental condition. Food and water were provided *ad libitum*. The Institutional Animal Ethics Committee (IAEC), NIUM, Bangalore, approved the experimental protocol vide Reg. No 953/C/06/CPCSEA.

Methodology

Pentylenetetrazole (PTZ) clonic seizure test

The test was carried out by the method of Gupta (1997). Wistar rats were divided into four groups of six animals each and treated as follows:

Group I (control group): Distilled water, orally

Group II (standard control): Diazepam in a dose of 5 mg/kg i.p (Dharmesh *et al.,* 2010) Group III (test group A): Hydro alcoholic extract of AQ (65 mg/kg/1day)

Group IV (test group B): Hydro alcoholic extract of AQ (130 mg/kg/ 1 day)

Acute seizures were induced by intraperitoneal administration of PTZ. After 60 minutes of the treatment with the test drugs and 30 minutes of the standard drug, rats were injected PTZ (60 mg/kg i.p. after dissolving in normal saline). Total number of convulsion, onset of first seizure; onset of clonic convulsions, duration

of clonic convulsion, onset of tonic convulsion, duration of tonic convulsion, number of death within 30 min duration, and % age protection from death was also calculated. Just after administration of PTZ, animals were placed individually in cages and assessed for above mentioned parameters. ANOVA one way with Tuckey Kramer pair comparison test was used to analyse the data. Statistical differences was considered significant at $p<0.05$.

Maximal Electroshocks seizures test

The test was carried out by the method described by Branco *et al.* (2009). The rats were divided into four groups of six animals each and treated in similar way as in previous test.

After 30 minutes of the administration of standard drug in group II and after 60 minutes of administration of distilled water in group I and test drugs in group III and IV, seizures were induced by applying 150 mA electric shock for 0.2 second using an Electroconvulsometer in animals of all the groups. The animals observed for various components and duration of seizures specially the extensor phase of the seizure. The mean time duration of seizures in the all group were analysed statistically and comparison was made with the mean values of the control and standard groups by ANOVA one way test.

Observations and Results

Effect of AQ extract in PTZ induced seizures

Mean total number of convulsions was found to be 804.33 ± 103.74 in plain control; 686±35.15 in test group A and 247±126.96 in test group B. No convulsion appeared in animals of standard group. Mean total number of convulsion in test A and test B were significantly ($p < 0.01$) reduced when compared with mean score of plain control. Test group B showed significant ($p < 0.01$) reduction in mean number of convulsion when compared with test group A.

Mean onset of first seizure in plain control was 33.83 ± 1.76, while it increased to 57.5±4.83 and 64 ± 3.81 in test group A and B, respectively showing a significant ($p< 0.01$) delayed in the mean onset of first seizure. The effect of the two doses however was not found statistically different.

The mean onset of clonic convulsion was found to be 50.5 ± 5.59 in plain control, 68.16 ± 3.63 in test group A and 81 ± 4, in test group B ($p<0.05$).

The mean duration of clonic seizures in plain control was recorded as 11.5 ± 1.39. It decreased to 9.84 ± 0.95 and 9 ± 0.86 in test group A and respectively ($p< 0.05$).

The mean onset time of tonic convulsion was found to be 109.17 ± 8 sec in plain control which amounted to 350.33 ± 66.14 sec ($p<0.05$) and 795.66 ± 68.62 sec ($p<0.001$), respectively. A significant difference between the findings of group A and B was also recorded ($p< 0.01$).

Mean duration of tonic convulsion of control group was 18.5 ± 1.18 sec, while it was found decreased in test group A (15±1.18 sec) and B (3.33 ± 2.47sec), respectively. Group B showed significant reduction ($p<0.001$) as compared to plain control. A significant difference was also recorded between the two test drugs ($p<0.01$).

Protection from death was also assessed in all the groups. In plain control group all the animals died where as 100% protection was observed in the animals of standard and test group B. In test group A 33.33 % protection was recorded (Table 1 and Figure 2 & 3).

Effect of AQ in Maximal Electroshock Seizure (MES)

The mean duration of tonic hind limb extension in rats of group I treated with distilled water was 8.67 ± 2.20 sec, rats of group II treated with standard drug (diazepam) showed mean duration of 4.83±2.20 sec, whereas rats of group III

Table 1: Effect of AQ on PTZ induced seizures in rats

Groups	**Group I Distilled water**	**Group II Diazepam 5mg/kg i.p.**	**Group III AQ 65 mg/kg**	**Group IV AQ 130 mg/kg**
Parameters				
No. of Convulsions	804.33±103.74	0.00	686±35.5	247±126.96 [a,c]
Onset of 1st seizure (s)	33.83±1.76	0.00	57.5±4.83 [b]	64±3.80 [a]
Onset of Clonic convulsion (s)	50.5±5.58	0.00	68.17±3.63 [b]	81±3.99 [a]
Duration of Clonic convulsion (s)	11.5±1.38	0.00	9.83±0.95	9±0.86
Onset of tonic convulsion (s)	109.17±8.00	0.00	350.33±66.14	795.66±68.62 [a, c]
Duration of tonic convulsion (s)	18.5±1.18	0.00	15±1.18	3.33±2.5 [a, c]
Number of death	6	0	4	0
% of protection	0	100	33.33%	100

N=6

a– $p<0.01$ with respect to plain control, b –$p<0.05$ with respect to test A, c – $p<0.01$ with respect to test B.

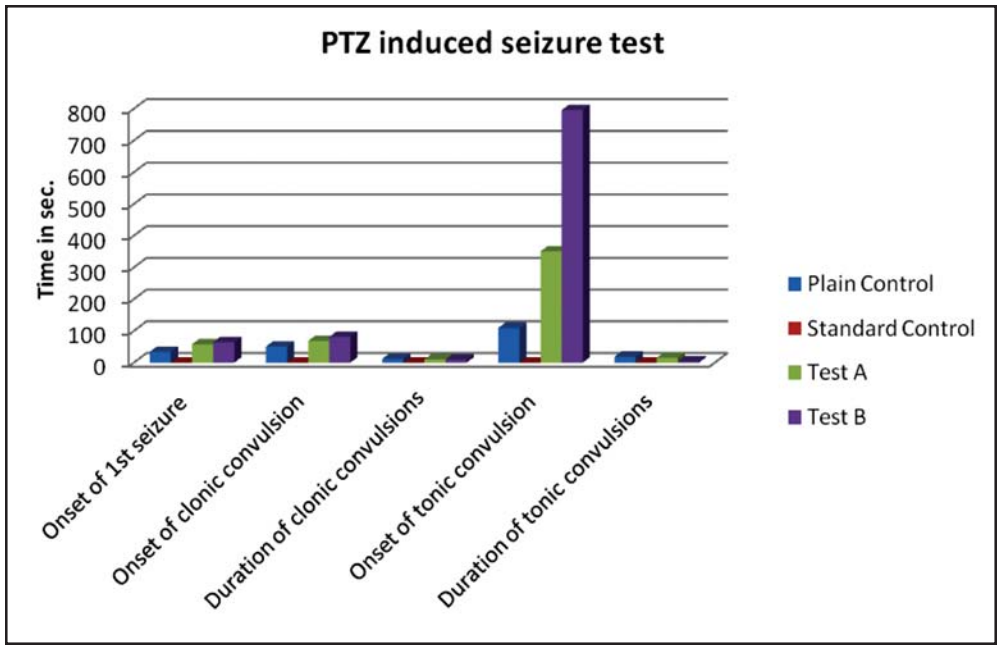

Figure 1: Effect of hydro alcoholic extract of AQ on PTZ induced seizures in rats

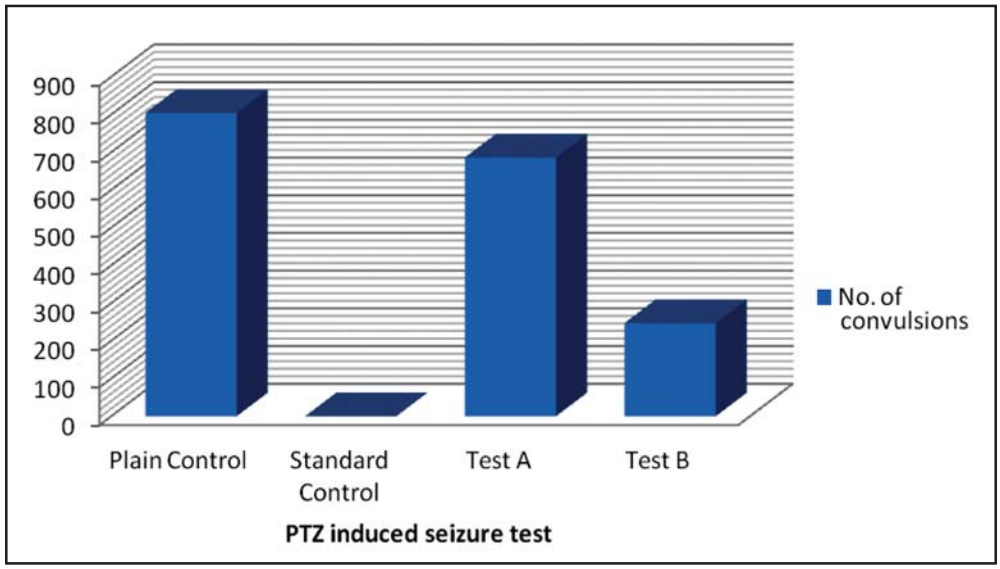

Figure 2: Effect AQ on no. of convulsion in PTZ induced seizure test in rats

and group IV treated with the AQ (65, and 130 mg/kg) exhibited hind leg extension of 5.5±.72 and 4.83±2.20 sec, respectively. When the mean hind leg extension of each group was compared with plain control group, it was found that the standard group and test group A and B significantly reduced the duration of the hind leg extension. The results are summarised in table 2 and figure 3.

Table 2: Effect of hydro alcoholic extract AQ on MES induced seizures in rats

Groups	Duration of hind leg extension (S) Mean ±SEM
Group I (Plain Control) Distilled water (2ml) p.o.	8.67 ± 2.20
Group II (Standard control) Diazepam 5mg /kg i.p.	3.67 ± .34*
Group III (Test A) HEAQ 65mg/kg p.o	5.5 ± .72*
Group IV (Test B) HEAQ 130mg/kg p.o	4.83 ± 1.20*

N=6

a – p<0.01 with respect to plain control, b –p<0.05 with respect to test A, c – p<0.01 with respect to test B.

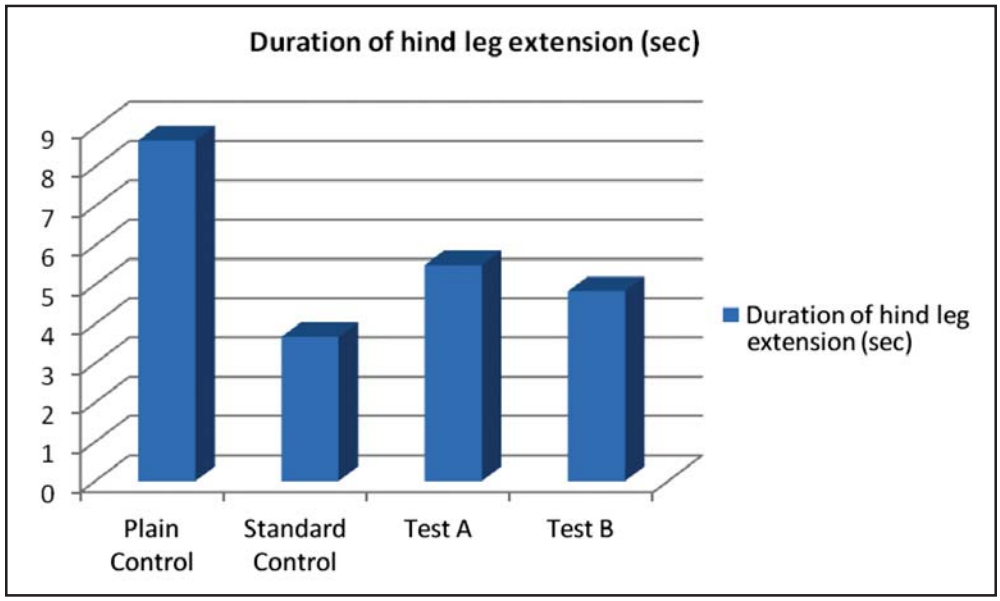

Figure 3: Effect of hydro alcoholic extract of AQ on MES induced seizures in rats

Discussion

PTZ-induced seizures test is considered as an experimental model for the "generalized absence seizures" (Oliveira *et al.*, 2001), and also a valid model for human generalized myoclonic seizures and generalized seizures of petit mal type (Loscher *et al.*, 1988). The MES test is the most frequently used animal

model for identification of anticonvulsant activity of drugs for the generalized ("grand mal") tonic-clonic seizures (Oliveira *et al.*, 2001, Loscher *et al.*, 1988). This model based on observation of the stimulation by repeated electrical pulses induced in different neuronal structures is one of the characteristic standards of epileptic activity (Quintans et al., 2002). In Pentylenetetrazole (PTZ) induced seizure test parameters like onset of first seizure, onset of tonic convulsions, clonic convulsions and duration of tonic and clonic seizures, percent protection were observed. Test group A and test group B significantly ($p< 0.01$) increased the mean onset of first seizure when compared with plain control, but no statistical difference was found between the effects produced by the two test drugs. Bothe the test groups showed significant ($p<0.05$) increase in mean onset of clonic convulsion, in comparison to plain control. In inter group comparison no difference was found between the two groups. In the mean onset time of tonic convulsion, on the comparison of test drugs with the plain control, the test drug A ($p<0.05$) and B ($p<0.001$) both showed significant effect. The test drug B was found to produce better response ($p< 0.01$) as compared to group A. The mean duration of tonic convulsion on the comparison of control with test drugs was found to be decreased only by the test drug B ($p<0.001$). Protection from death was also assessed in all the groups. In plain control group all the animals died where as 100% protection was observed in the animals of standard and test groups B. In test group A there was 33.33 % protection from death. Thus, onset of first seizure, clonic and tonic seizure in the test groups was significantly increased ($p<0.01$); the findings were comparable with that of the standard drug. The duration of tonic and clonic seizure was decreased in both the test groups and the reduction was significant when compared with the plain control group. The observations showed strong antiepileptic effect produced by the low and high doses (test drug A and B). However, test drug B was more effective than drug A.

The clinical aspect of certain generalized seizures especially absence seizures are highly correlated with experimental seizures produced in animals by the administration of PTZ (Anthony and Walter, 1998). It is proposed that PTZ induces convulsion either by inhibiting gamma amino butyric acid (GABA) pathway in CNS (Corda *et al.*, 1990) or by increasing the central noradrenergic activity (De Potter, 1980). The effect of the extract in this model, therefore suggests its involvement in GABA-ergic or noradrenergic pathways and its efficacy against generalized tonic clonic and partial seizures in rat.

Since PTZ is reported to induce convulsion by antagonizing the ã-aminobutyric acid (GABAA) receptor chloride Cl-channel complex to attenuate GABA-depending inhibition therefore the drugs protecting against tonic clonic seizures induced by PTZ are considered useful in controlling myoclonic and absence seizure in humans. Thus, demonstration of activity in this model suggested that

the test drug possesses anticonvulsant activity, which may underline its traditional use in the treatment of epilepsy in Unani system of Medicine. An earlier study on antiepileptic effect of the butanolic extract of *Anacyclus pyrethrum* (Fakir *et al.*, 2010) also strengthens its effect as anticonvulsant agent. It was found that treatment with AQ on PTZ induced epileptic rats significantly reduced the duration of convulsion and delayed the onset of clonic and tonic convulsion and also reduced the total number of convulsion, and protected treated rats from mortality. One generally accepted mechanism by which pentylenetetrazole exerts its action is by acting as an antagonist at the picrotoxin sensitive site of the GABAA receptor complex (Ramanjaneyulu *et al.*, 1984). Since PTZ has been shown to interact with the GABA neurotransmission and PTZ induced seizures can be prevented by drugs that enhance gamma amino butyric acid type A (GABAA) receptor mediated inhibitory neurotransmission such as benzodiazepines and Phenobarbital (Coulter *et al.*, 1989; Macdonald *et al.*, 1995) therefore the antagonism of PTZ- induced seizures suggests the interaction of the AQ with the GABA-ergic neurotransmission corresponding to generalized tonic-clonic seizures in humans (Kupferberg, 1989; Stables, 1995). Pentylenetetrazole is a selective blocker of the chloride ionophore complex to the GABAA receptor, and after repeated or single dose administration leads to a decrease in GABA-ergic function and to the stimulation and modification of density or sensitivity of different glutamate receptor subtype in many brain regions. It may also trigger a variety of biochemical processes including the activation of the membrane phospholipase, proteases and nucleases. Alteration in membrane phospholipids metabolism causes liberation of free fatty acids, diacylglycerols, eicosanoids, lipid peroxidase and free radicals. The tonic extensor phase is selectively abolished by the drugs effective in generalized tonic clonic seizure (Ihan *et al.*, 2006). It is likely that AQ may contain constituents that may be involved in this action. The screening for such constituents needs to be carried out as these compounds may be able to modulate the function of GABA or glutamate receptors.

In maximal electroshock induce seizure test, the mean hind leg extension of each group was compared with plain control group, it was found that standard and two doses of the test drug significantly reduced the duration of the hind leg extension. When the test drugs A and B were compared with standard control group, no significant difference in mean score was observed suggesting that the test drugs are as effective as the standard drug. The convulsion in MES method is due to the disturbed activity of GABA in the brain. Electroshock causes the inhibition of GABA release, and this in turn inhibits GABA synthesis (Sermet *et al.,* 1998). It is therefore, possible that AQ may have increase the release of GABA --(Jobe *et al.*, 1974). It is also possible that AQ may have some connection in the cascade of events in neurohumoral transmission.

It can be concluded that the administration of hydro alcoholic extract of *Anacyclus pyrethrum* root shows promising anti seizure activity in PTZ induced seizures and maximal electroshock induced seizure tests. The study thus validated the claim of Unani physicians of using Aqer Qerha root in epileptic patients. However, further studies are needed to evaluate the exact chemical ingredients and their mechanism of action responsible for antiepileptic effect, as several anticonvulsant drugs in current clinical use facilitate GABA neurotransmission by different mechanisms.

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Pelvic Inflammatory Disease in Unani System of Medicine: A Review

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Abstract

The Unani terminology for Pelvic Inflammatory Disease is "Marz-e-Warm-e-Aana". Although there is no description of 'Marz-e-Warm-e-Aana' (pelvic inflammatory disease) as such in classical; but this term has been literally translated by the contemporary physicians in an attempt to explain the disease texts entity applicable to present day etymology. 'Warm-e-Reham' (inflammation of uterus) has been described in classical books. After the study of the description of warm-e-reham by different scholars, it was found that Unani physicians have described the inflammation of cervix, uterus, fallopian tubes and ovaries collectively with the name of warm-e-reham. Moreover, the causes, clinical features and pathology of warm-e-reham described by unani scholars seems to be similar to that of pelvic inflammatory disease which is described in modern medicine. Thus, we can say that warm-e-reham described in unani texts, corresponds to the description of marz-e-warm-e-aana (pelvic inflammatory disease). This paper presents a review of Unani literature with reference to Pelvic inflammatory Disease.

Keywords: Marz-e-Warm-e-Aana, Pelvic Inflammatory Disease, Warm-e-Rahm

Introduction

Acute pelvic inflammatory disease (PID), the clinical syndrome associated with ascending infection of the female genital tract, remains a major source of gynaecological morbidity (Anonymous, 1998). PID is perhaps the most important avoidable cause of female tubal factor infertility and its association with other chronic sequelae is well documented (Mc Cormack, 1994). The general term pelvic inflammatory disease has been used to describe infection of the uterus and fallopian tubes usually occurring following ascent of bacteria present in the cervix and presents with history of abnormal vaginal discharge, fever and adnexal tenderness (Hager *et al.*, 1983; Jacobson and Westrom, 1969; Anonymous, 2002).

PID is a polymicrobial infection. Excellent data support the role of the sexually transmitted micro-organisms *Chlamydia trachomatis, Neisseria gonorrhoeae*, and facultative gram-negative and anaerobic bacteria in causing the symptoms and signs of the infection itself as well as the damage that often ensues (Anonymous, 1987; Wasserheit *et al.*, 1986; Heinonen *et al.*, 1985; Paavonen *et al.*, 1987; Brunham *et al.*, 1988; Soper *et al.*, 1994; Hillier *et al.*, 1996). Investigators have suspected for a long time that other specific agents might function prominently in the pathogenic process, although consistent reproducible evidence to support

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this contention has been lacking. Anaerobic and facultative bacteria are frequently recovered from the endometrium and fallopian tubes of women with acute PID (Sweet *et al*., 1980).

The actual burden of disease is unknown, but data from the USA suggest that > 10.0% of women of reproductive age have a history of PID (Anonymous, 1997). The majority of clinically recognized cases occur in sexually active women under the age of 25 years (Anonymous, 1998). In modern industrialized countries, the annual incidence of PID in women 15 to 39 years of age seems to be 10 to 13 per 1,000 women, with a peak incidence of about 20 per 1,000 women in the age group 20 to 24 years. The incidence of PID is correlated strongly with the prevalence of sexually transmitted diseases, although a fraction of the infections might be of endogenous origin. Use of intrauterine contraceptive devices and operations for legal abortions contribute to the increase in incidence (Westrom, 1980).

Although incidence rates may have declined, PID remains a major source of short- and long-term morbidity in women. There is no evidence to suggest that there has been any reduction in the serious reproductive complications traditionally associated with PID, which include infertility, ectopic pregnancy, and chronic pelvic pain.

A crude marker of PID in resource-poor countries can be obtained from reported hospital admission rates, where it accounts for 17% to 40% of gynecological admissions in sub-Saharan Africa, 15% to 37% in Southeast Asia, and 3% to 10% in India (Wikipedia).

Treatment goals encompass not only the amelioration of the acute inflammatory condition but also the prevention or lessening of the risk for long-term reproductive sequelae. Hence, an early and accurate diagnosis of pelvic inflammatory disease (PID) is of paramount importance for the effective management of the acute illness and for the prevention of long-term sequelae.

Current modern treatment depends on the cause and generally involves use of antibiotic therapy. Despite of the claim of modern medicine with regard to the presence of anti-bacterial, anti-parasitic medicines that there is a definite treatment of PID, the above mentioned incidence of different organisms in causing pelvic inflammatory disease is still prevailing.

Every antibacterial drug in modern medicine produces more or less adverse effects in the human body. In present era, everyone tends to become more health conscious and seeks the safer side in respect to treatment. The holistic and herbal traditional medicine is now being seen with an eye of great interest and hope. Unani medicine is one of them. This system not only provides the drugs

information in abundance but also claims that the drugs are having least adverse effects.

Although, Pelvic Inflammatory Disease (PID) has been translated into 'Maraz-e-Warm-e-Aana' but this syndrome, as such, does not exist in Unani Medicine. However, conditions corresponding to it exist which can be identified by comparing signs and symptoms. Therefore, the objective of this paper is to search classical Unani literature : (i) to identify the syndrome most closely corresponding to PID; (ii) to collect the pathology, diagnosis and treatment of the Unani syndrome corresponding to PID; (iii) these findings may be applicable for providing Unani Health-Care and also to design clinical research in this area.

Method

The classic and relevant books of Unani Medicine were studied; the literature and claims in support of this article were taken from these books. The databases utilized for obtaining information are scientific research publications from journals indexed/available through Google Scholar, Scopus, PubMed, and Science Direct. Relevant facts were also obtained from general databases such as Google.

Review of Literature

After going through the classical Unani literature, it was found that there is no such description with the name of 'marz-e-warm-e-aana' (pelvic inflammatory disease). However, 'warm-e-reham' (inflammation of uterus) has been described in classical books. After the study of the description of warm-e-reham by different scholars, it was found they have described the inflammation of cervix, uterus, fallopian tubes and ovaries collectively with the name of warm-e-reham. Moreover, the causes, clinical features and pathology of warm-e-reham described by Unani scholars seems to be similar to that of pelvic inflammatory disease which is described in modern medicine. Thus, we can say that warm-e-reham described in Unani texts, covers the description of marz-e-warm-e-aana (pelvic inflammatory disease). Therefore, in this work, the term marz-e-warm-e-aana has been referred to as warm-e-reham as have been stated above.

The inflammation of uterus occurs like that of other organs. The anatomical texture and position of uterus makes it difficult to expell out the unwanted matter. In the inflammation of uterus, the muscular layer is principally involved and it extends to other layers of the uterus (Ibn Zuhr Amam, 1986).

Classification and Etiology

Different Unani scholars classified warm-e-reham differently; Ibn-e-Zohr classified

it into four types i.e., Damvi, Safravi, Saudavi and Balghami, according to the humours (Ibn Zuhr Amam, 1986).

Most of the ancient Unani scholars such as Razi (860-925 AD), Ibn-e-Sina (980-1037 AD), Ibn-e-Nafees (1210-1288 AD), Jurjani (1878 AD), Majoosi (1160-1240 AD) have broadly classified warm-e-reham into three categories, i.e,

- Warm Haar
- Warm Balghami
- Warm Sulb

Warm Balghami and Warm Saudavi are considered Auram Barid.

Warm Haar

According to Jurjani (1878), warm haar of Reham is caused by five factors:

1) Trauma.
2) Difficulty in labour.
3) Abortion.
4) Amenorrhoea.
5) Excessive sexual intercourse.
6) Intercourse for the first time.

While Ibn-e-Sina (1992) divides the causes of warm-e-rehamhaar into two categories:

1) Asbab-e-badi (kharji)
2) Asbab-e-batini

- Asbab-e-Badi:

  Trauma, excessive sexual intercourse, carelessness of attendant during labour and abortion are the main causes.

- Asbab-e-Batini:

  1) Amenorrhoea which may be due to stagnation of blood after delivery, abortions and difficult labour.
  2) Congestion of uterine vessels.
  3) Excessive moisture.

According to Ibn Habal (Ibn Habal, 2007), warm haar is either safravi or damvi, which produces inflammation in the body of uterus.

Clinical Features (Ibn-Habal, 2007; Razi, 2001):

- Abnormal vaginal discharge.
- High grade fever with chills.
- Coated tongue.
- Nausea.
- Headache, pain in orbital area, neck and in extreme cases pain extends to arms also.
- Backache, pain in pelvic region and extends to groins, hip joints and in extreme cases to both legs. Patient feels difficulty in walking.
- If the posterior wall of uterus is involved, pain occurs in back and there is difficulty in defecation, and when anterior wall is involved, patient feels difficulty in micturition.
- Tachycardia and tachypnoea.
- Indigestion, loss of appetite and increased thirst.
- If the lower part of uterus is involved, the pain occurs in pelvic region. In extreme cases of inflammation, flatus is not passed.

Warm Balghami [Ibn-e-Sina, 1992; Ibn-Habal, 2007; Majoosi, 1898; Ibn Nafees, 1894).

The difference between warm haar and warm balghami is that warm balghami is accompanied with heaviness and pain in back. Abdominal muscles are relaxed. Pain is less severe or absent in warm-e-balghami. There is ascites like appearance in warm-e-balghami due to bulging of pelvic area. There is no fever.

Warm Sulb/Saudavi (Ibn – Habal, 2007; Razi, 2001)

Warm saudavi is also called warm muzmin or chronic inflammation. Sometimes, there is chronic inflammation from the beginning but most of the times it begins as acute and progresses to chronic inflammation. In this condition, uterus is turned to contralateral side. In other words, uterus turns away from the site of inflammation as described by Ibn-e-Sina. If the inflammation is on right lateral side, it turns towards left and vice versa. Likewise if the inflammation is on anterior wall, it turns posteriorly.

If this condition is not treated well on time, it may leads to ascites.

Warm saudavi is also called 'saqearus' in Unani terminology. The cause of this inflammation is black bile (sauda) produced in the uterus.

Clinical Features

- Dysuria and heaviness in pelvic region.
- Pain is less severe till this warm is transformed into malignancy.
- Extreme general weakness, both legs are malnourished and odematous.
- Ascites develops if firmness occurs in inflammation.
- There is bulging at pelvic and umbilical region, leucorrhoea and dysfunctional uterine bleeding.
- Loss of appetite, indigestion, constipation may also be present.

Sailan-ur-Raham (Abnormal Vaginal Discharge)

It is the most striking and the commonest symptom of all types of warm-e-raham. This discharge is derived either from the uterus itself or from other organs of the body. This discharge is mostly balghami and sticky and sometimes watery in consistency (Ibn – Habal, 2007).

Excess of vaginal discharge is abnormal and its presence signifies falling of abnormal humours on uterus. The type of humour involved in causation of abnormal vaginal discharge can be recognised, if a woman places a clean pad and when it gets filled with the discharge, it is removed and air dried. If the colour of the pad remains the same, it is of balghami humour and if it becomes reddish, it is of damvi matter. Presence of yellowish colour on drying signifies involvement of safravi matter, while that of blackish colour signifies involvement of saudavi matter (Ibn – Habal, 2007).

It involves mucous coat of uterus and is from a type of chronic inflammation, which disturbs its quwat-e-ghaziya (Ibn Nafees, 1894).

USOOL-E-ILAJ (Principles of Treatment) (Ibn – Habal, 2007; Razi, 2001; Ibn Nafees, 1894; Kabiruddin, 2007).

According to a renowned Unani physician, the local application of the drugs is more effective than the systemic (Ahmad, 1331 Hijri).

1. To remove the cause.
2. To maintain hygienic condition.
3. Use of Munzijwa Mushil-e-Balghamadvia (Concoctive and purgatives of phlegm).
4. Use of Munzijwa Mushil-e-Saudaadvia (Concoctive and purgatives of black bile)

5. Muhallilatwa Dafa-e-tafunadvia (Anti-inflammatory and Antiseptic drugs)
6. Mudire tams wa Mudire Haizadvia (Emmenogogue and diuretic drugs)
7. Ilajbil Tadabeer (Regimenal therapies)
8. For local application use of Abzan (Sitz bath), Humool (Pessary), Zimad (Paste), etc.
9. Musakkin-e alamwa Dafe Tashannujadvia (Analgesic and antispasmodic drugs)
10. If the cause is leucorrhoea, then use of Mujazzifat (dessicative drugs) in addition to other drugs.
11. Correction of generalized weakness of body.

Warm Haar

- Venesection (Fasd):

Venesection should be done firstly on basilic vein so that there should not be any further production of diseased matter (maddah), then in saphenous vein so that the present matter gets absorbed. It is important to note that the patient should be in lithotomy position while venesection is done.

Patient should not be given food immediately after venesection. For the first three days, she should be given very little food and water and should be kept in well ventilated room and should be allowed to sleep after venesection.

- Humool (Pessary), Nutool (Irrigation) and Abzan (Sitz Bath) are very helpful to minimize the symptoms related with disease.
- Emesis is also very helpful in this condition.

Warm Balghami

- Emesis is helpful to eliminate the phlegmatic matter from the body.
- Tanqiya-e-badan:

As per Unani system concepts, the health of a person depends on four basic humours (*Akhlat*) flowing in the body. Till these humours remain in proper quantity and quality, health is preserved but if there is any alteration in the composition of these *Akhlats*, disease is caused. These alterations lead to the formation of *Akhlat-e-Radiya* (unwanted matter) in the body. Therefore, to get back to health this toxic unwanted matter must be removed from the body, which is known as tanqiya-e-badan. The process of tanqiya-e-badan involves use of munzijat

(concotives) first followed by mushilat (purgatives) after a specified duration of time.

- Taqwiyat-e-reham:

It is done to make uterus healthy so that the *Akhlat-e-Radiya* (unwanted matter) do not accumulate and affect the uterus further. These drugs are known as uterine tonics. They are also used to maintain the tone of uterine muscles.

Warm Sulb

- Venesection:

Venesection should be done on basilic vein and blood should be allowed to flow to clear out sauda (black bile).

- Istafragh-e-Akhlat-e-Ghaliza (elimination of viscid humours) to evacuate sauda (black bile) from the body.
- Zimad-e-mohallil: liniments or pastes of anti-inflammatory drugs is useful to reduce the "salabat" of warm-e-saudavi.
- Huqna (enema) with anodyne drugs.

References of few successful Unani drugs (Ghulam Nabi; 2006; Anonymous, 2006; Ghani, 2010; Hafiz, 2005; Ibn Baitaar, 2003).

- Munzij wa Mushile Balghamadvia (Concoctive and purgatives of phlegm): Khatmi (*Althaea officinalis*), Arusa (*Adhatoda vasica*), Parsyaushaan (*Adiantum capillus-veneris*), Sapistaan (*Cordia latifolia*), Injeer (*Ficus carica*), Aslessoos (*Glycyrrhiza glabra*), Gauzaban (*Borago officinalis*), Maghz-e amaltas (*Cassia fistula*), Sapistan (*Cordia dichotoma*).
- Munzijwa Mushile Saudaadvia (Concoctive and purgatives of black bile): Ustukhuddus (*Lavendula stoechas*), Aftimoonvilayti (*Cuscuta epithymum*), Gauzaban (*Borago officinalis*), Unnab (*Zizyphus sativa*), Shahtra (*Fumaria officinalis*), Baranjboya (*Mellisa officinalis*), Sapistan (*Cordia latifolia*), Badyan (*Foeniculum vulgare*), Maghz Jamal gota (*Croton tiglium*), Shahme Hanzal (*Citrullus colocynthis*), Halela Siyah (*Terminalia chebula*), Turbud (*Ipomea turpethum*), Ghariqoon (*Agaricus alba*).
- Muhallilat wa Dafa-e-tafunadvia (Anti-inflammatory drugs and Antiseptic drugs): Baboona (*Matricaria chamomilla*), baranjasif (*Artemesia vulgaris*), barge kasni (*Cichorium intybus*), barge-mako (*Solanum nigrum*), izkhar (*Andropogon jawarancusa*), Hasha (*Thymus vulgaris*), hilteet (*Ferula foetida*), darchini (*Cinnamomum zeylanicum*), kafoor (*Cinnamomum camphora*).

- Mudire tams wa Mudire Haizadvia (Emmenogogue and diuretic drugs) like, Sheerakhurfa along with Sharbate Bazoori, Roghan badam talkh (*Prunus amygdalus*), Tukhme Gandana (*Allium ascalonicum*), Tukhme Shalgham (*Brassica rapa*), Darchini (*Cinnamomum zeylanicum*), Sazaj Hindi (*Cinnamomum, tamala*), Tarmas (*Lupinus albus*).
- Ilajbil Tadabeer (Regimenal therapies): Venesection (Fasad) and leeching (application of leeches): Before menstruation venesection of Rage Safin can be done. Cupping of lower limb near ankle is also advisable.
- Abzan (Sitz bath): With decoction of several drugs individually like, Baranjasaf (*Artemesia vulgaris*) and Babuna (*Matricaria chamomilla*), Murmuki (*Commiphora myrrh*), Saleekha (*Cinnamomum cassia*), Marzanjosh (*Origanum vulgare*), Podina (*Mentha arvensis*), Izkhar (*Andropogon jwarancusa*), Qust (*Saussurea lappa*), Akleelul Mulk (*Trigonella uncata*).
- Humool (Pessary): by, Zaravand mudahraj (*Aristolochia rotunda*), Chiraita (*Swertia chirata*), Podina (*Mentha arvensis*), Afsanteen (*Artemisia absinthium*) along with honey.
- Zimad (Paste): Zimad-e-Izkhar (*Andropogon jawarancusa*).
- Musakkin-e alam wa Dafe Tashannuj advia (Analgesic and antispasmodic drugs) like-.Abhal *(Juniperus communis*), Aftimun Hindi (*Cuscuta reflexa*), Asrol (*Rauwolfia serpentina*), Afyun (*Papaver somniferum*), Lehsun (*Allium sativum*) in case of spasmodic dysmenorrhea.
- To correct the generalized weakness of the patient, use of Kushta faulad along with Dawaulmisk motadil jawaherwali, Khamira Abresham Hakeem Arshad wala, Maul Laham, Sharbat Anar are indicated.
- Muhallilat advia (Resolvent drugs). Kasni (*Cichorium intybus*), Baboona (*Matricaria chamomilla*) Baranjasif (*Artemesia vulgaris*), Marzanjosh (*Origanum vulgare*)
- If the cause is leucorrhoea then Kushta sadaf, Kushta Marwareed, Majoon Suparipak, Majoon Mooslipak is indicated.
- Single herbal drugs, which are effective include Balcharea (*Nardostachys jatamansi*), Saunf (*Foeniculum vulgare*), Lehsun (*Allium sativum*), Qust (*Saussurea lappa*), Hilteet (*Ferula asafoetida*), Izkhar (*Andropogon jwarancusa*), Asrol (*Rauwolfia serpentina*), Siyah mirch (*Piper nigrum*), Babuna (*Matricaria chamomilla*), Kasus (*Cuscuta reflexa*), Podina (*Mentha arvensis*), Dalchini (*Cinnamomum zeylanicum*), Turmas (*Lupinus albus*), Hasha (*Thymus serpyllum*), Abhal (*Juniperus communis*).

- Effective Compound formulations: Majoon Dabidul Ward, Majoon Suparipak, Majoon Mocharas, Tiryaqe farooq, Marham Dakhiloon, Dawa-e-Mudir, etc.

Conclusion

Pelvic Inflammatory Disease (PID) is a very common problem among young females in reproductive age group with social stigma of infertility attached with it. After the review of different classical Unani Textbooks, it is found that PID is a modern term used for the description of "Warm-e-Reham". Unani Physicians have described the inflammation of cervix, uterus, fallopian tubes and ovaries collectively with the name of Warm-e-Reham. The causes, clinical features and pathology of "Warm-e-Reham" described by Unani scholars seem to be similar to that of Pelvic Inflammatory Disease (PID). The etiopathogenesis of the disease and the treatment beside regimental therapy and the diet have been mentioned in details in classical texts.

It can be concluded that the etiology, pathogenesis and complications of PID were known to Unani physicians. Unani Physicians have been treating this disease with success since long back. The miracle claim of Unani Medicine in the treatment of infertility may be attributed to the successful management of Pelvic Inflammatory Disease in females.

Therefore, Unani system of medicine might play an important role in curing this ailment as it contains many safe and effective medicinal herbs, various modes of ilaj-bil-tadabeer and other dietary recommendations prescribed by the famous and experienced Unani physicians to treat various disorders.

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Phytochemical Analysis and Antibacterial Screening of Gul-e-Tesu [Butea monosperma (Lam.) Taub]

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Abstract

Gul-e-Tesu (flowers of *Butea monosperma*; Family Fabaceae) has been reported to be an effective drug in Unani classical literature for treating various diseases including infectious diseases. However, it appears that no work has been done on scientific validation of its use in infectious diseases. Therefore, in the present study in-vitro screening of Gul-e-Tesu has been done for antibacterial activity against bacterial strains using Kirby Bauer's Disk Diffusion method. The efficacy was compared with the standard drug used as Positive Control and the solvent used to dissolve the test drug- Dimethyl Sulphoxide (DMSO) as Negative Control. Physico-chemical analysis was also done to confirm the presence of various phytoactive constituents present in the test drug. It was revealed that Gul-e-Tesu contains alkaloids, glycosides, flavonoids, carbohydrates, tannins, starch, saponin, resins and terpenes. The study demonstrates the in-vitro antimicrobial effect of Unani drug Gul-e-Tesu.

Keywords: Phytochemical standardization, Infectious diseases, Gul-e-Tesu (*Butea monosperma*), Antibacterial screening.

Introduction

Infectious diseases are a leading cause of death accounting for a quarter to a third of estimated 54 million deaths worldwide in 1998 (Gannon, 2000). This demonstrates that the number of multiple drug resistance microbial strains or those with a reduced susceptibility to antibiotics are increasing and this could be attributed to indiscriminate use of broad spectrum antibiotics. It has been reported that bacterial strains have developed resistance to almost all the antibiotics. Further, some antibiotics have serious undesirable effects (Rehman *et al*., 2011). This is an alarming situation and calls for serious consideration including time-tested drugs available in indigenous systems of medicine. A review of literature indicates that Unani medicine claims to possess a large number of effective and safe drugs to combat infectious diseases that are in use since centuries (Rehman and Latif, 2015). However, there appears limited efforts made to validate medical efficacy of Unani drugs based on modern scientific tools and parameters.

Gul-e-tesu (*Butea monosperma*) is a medium-sized deciduous tree, commonly known as 'Flame of forest', Palash, Mutthuga, Bijasneha, Khakara, Chichara, Bastard teak, Bengal kino (Kritikar and Basu, 1935). Bark, flowers, leaves, gum and even seeds are used to prepare herbal remedies. Medicinally the plant exhibits astringent, antidiarrhoeal, antidysenteric, insecticide, febrifuge,

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aphrodisiac, purgative and anthelmintic properties (Sehrawat, 2006; Sindhia 2010; Pal and Bose, 2011; Panda *et al*., 2008 and Nadkarni, 2002). The flowers of *B. monosperma* are used in Unani medicine as anti-stress formulation, 'Jigrine' as rejuvinator (Soman *et al*., 2004). The drug Gul-e-Tesu has also been traditionally used in many infectious diseases as influenza, coryza, scabies, skin infectious diseases, wounds (Anonymous, 1988; Nadkarni, 2002; Bhattacharjee and Das, 2005; Chopra, 1958). Therefore, present study was aimed to scientifically validate the medical efficacy of this well-known Unani drug Gul-e-Tesu to combat infectious diseases and evaluate its anti-microbial potential. The study was undertaken between 2012 and 2013 at the department of Ilmul Advia, A.K. Tibbiya College, Aligarh Muslim University, Aligarh.

Material and Methods

Plant Material: The herb was procured from the local market of Baradari in Aligarh city and was properly identified by the available literature (Fig.1)

Table 1: Qualitative Analysis of the Phytochemicals present in Gul-e-tesu

S.No.	Chemical Constituents	Test Reagents	Gul-e-Tesu
1.	Alkaloids	Dragendorff's reagent	+
		Wagner's reagent	_
		Mayer's reagent	+
2.	Carbohydrates	Molish Test	+
		Fehling Test	+
		Benedict Test	+
3.	Flavonoids	Mg Ribbon and dil. Hcl	+
4.	Glycosides	NaOH Test	+
5.	Tannins/Phenols	Ferric Chloride Test	+
		Liebermann's test	+
		Lead Acetate test	+
6.	Proteins	Xanthoproteic test	_
		Biuret test	+
7.	Starch	Iodine Test	+
8.	Saponins	Frothing with $NaHCO_3$	+
9.	Steroids/Terpenes	Salkowski Reaction	+
10.	Resins	Acetic anhydride test	+

Indications: '–' Absence and '+' Presence of constituents

Figure 1: Gul-e-Tesu (*Butea monosperma*)

(i) Preparation of Plant extracts: The test drug was dried at room temperature in a ventilated room, milled to fine powder and stored in a close air tight container in dark until use. Extraction was done according to the method described by Afaq *et al. (*1994) and Peach and Tracey (1955) with some minor modifications, keeping in mind that the thermo labile elements present in the drugs are destroyed when exposed to a higher temperature beyond 55^0C, so the heat wherever was needed was kept as low as possible to prevent the loss of thermo-labile substances present in the drugs from destruction. Strict aseptic precautions were followed throughout the process.

(ii) Aqueous extract:The coarse powdered drugs were extracted using soxhlet apparatus, by reflux method with double distilled water (DDW) as a solvent at 50^0C for 6 hours or until the extracting return in the siphon was colorless. The extract obtained was subjected to dryness in the Lypholizer (Macro Scientific Works, New Delhi) under reduced pressure.

(iii) Ethanolic extract:The coarse drug material was extracted with 95% ethanol as a solvent at 50^0C for 6 hours and dried under reduced pressure in the Lypholizer.

The stock solutions for aqueous and ethanolic extract was prepared from the dried extract so obtained in the Dimethyl Sulphoxide (DMSO) as a solvent for use. The respective stock solutions so prepared were refrigerated till further use.

Phytochemical Analysis

Phytochemical studies were carried out to confirm the presence of chemical constituents in the drug sample (Bhattacharjee and Das, 2005; Afaq *et al.*, 1994).

Antibacterial Susceptibility Testing

Antimicrobial susceptibility testing was done by Kirby Bauer's disk diffusion method (1996).

Bacterial strains used for the study are listed in table-2. The standard medium Mueller Hinton Agar, was poured to a depth of 4 mm in a 90 mm petridish (PW008, Himedia Labs Pvt. Ltd., Mumbai, India). The plate was inoculated by streaking the entire surface in three planes with a sterile cotton swab (PW041, Himedia Labs Pvt. Ltd., Mumbai, India) dipped into standardized inoculums, spreaded evenly with the help of L-Spreader (PW1085, Himedia Labs Pvt. Ltd., Mumbai, India). The bacterial inoculum was prepared from an 18 hour broth culture of the microbe to be tested and was standardized with sterile physiologic saline to contain 10^6 cfu/ml. Standardized commercial paper disk containing amounts of the antimicrobial agents to be tested were placed on the surface of the agar. The plate was incubated in an inverted position at 37^0C for 18 hours. The diameter of zone of inhibition produced by the drug was measured (Kingsbury and Wagner, 1990).

A total volume of 40 µl of test drugs from concentrations viz. 40.0 µg/ml was used and compared with the standard drug Ciprofloxacin (30µg) for Gram positive

Table 2: Microbial Strains Used

S.No.	Bacterial Strains	Type
1.	*Streptococcus mutans*	Gram Positive
2.	*Staphylococcus epidermidis*	"
3.	*Streptococcus pyrogenes*	"
4.	*Bacillus cereus*	"
5.	*Staphylococcus aureus*	"
6.	*Corynebacteriumxerosis*	"
7.	*Escherichia coli*	Gram Negative
8.	*Proteus vulgaris*	"
9.	*Pseudomonas aeruginosa*	"
10.	*Klebseilla pneuomoniae*	"

Table 2 (a): Antibacterial activity Gul-e-Tesu against Gram Positive bacterial strains

S. No.	Test strains	Zone of Inhibition (in mm) expressed as Mean ± S.E.M (S.D)Probability of error		
		Drug Extract (µg/ml)	Control (DMSO- 50µl)	Standard (Ciprofloxacin 30µg)
1.	*S.mutans*	16.0±0.54(1.22)*** (S)	6.6±0.24(0.54) (R)	21.2±0.37(0.83) (S)
2.	*S.epidermidis*	18.0±0.89(2.00)* (S)	6.4±0.24(0.54) (R)	21.6±0.24(0.54) (S)
3.	*S.pyrogenes*	7.8±0.37(0.83)*** (S)	6.4±0.24(0.54) (R)	21.2±0.37(0.83) (S)
4.	*B.cereus*	18.8±0.58(1.30)* (S)	6.6±0.24(0.54) (R)	21.4±0.24(0.54) (S)
5.	*S.aureus*	16.2±1.20(2.68)*** (S)	6.6±0.24(0.54) (R)	26.8±0.20(0.44) (S)
6.	*C.xerosis*	6.6±0.24(0.54) (R)	6.6±0.24(0.54) (R)	21.2±0.37(0.83) (S)

Table 2 (b): Antibacterial activity of Gul-e-Tesu against Gram Negative bacterial strains

S. No.	Test strains	Zone of Inhibition (in mm) expressed as Mean ± S.E.M (S.D)Probability of error		
		Drug Extract (µg/ml)	Control (DMSO- 50µl)	Standard (Gentamicin 30µg)
1.	*E.coli*	9.2±0.96(2.16)* (S)	6.4±0.24(0.54) (R)	14.8±0.20(0.44) (S)
2.	*P.vulgaris*	9.4±0.67(1.51)* (S)	6.4±0.24(0.54) (R)	14.0±0.54(1.22) (S)
3.	*P.aeruginosa*	13.8±1.31(2.95)* (S)	6.4±0.24(0.54) (R)	14.8±0.20(0.44) (S)
4.	*K.pneuomoniae*	16.6±0.24(0.54)*** (S)	6.4±0.24(0.54) (R)	14.8±0.20(0.44) (S)

(S) – Sensitive (R) – Resistant

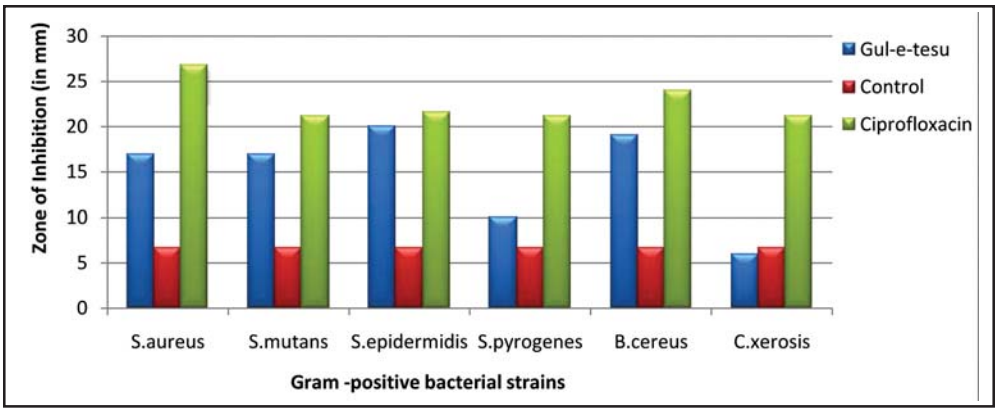

Figure 2(a): Antibacterial activity of Gul-e-Tesu against Gram positive bacterial strains

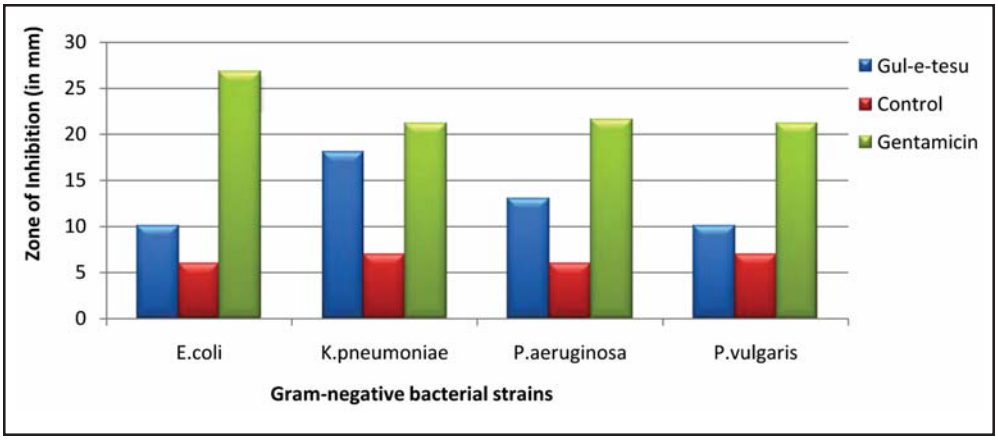

Figure 2(b): Antibacterial activity of Gul-e-Tesu against Gram negative bacterial strains

and Gentamicin (30 µg) for Gram Negative bacteria and Plane control i.e. DMSO (Dimethyl Sulphoxide).

Statistical Analysis: One way ANOVA and the post test named Bonferroni: Selected pairs of column with multiple comparison was performed with p-value <0.05.

Results and Discussion

The phytochemical analysis of the chemical constituents present in the drugs revealed that it contains alkaloids, phenol, resins, saponins, sugars and tannins. These chemical compounds may be responsible for the therapeutic efficiency of that drug. As can be realized from the fact that alkaloids possess antimicrobial and anti-inflammatory activity, this effect has been confirmed by us in our in-vitro study of antimicrobial screening.

There was an increased inhibitory activity against most of the strains. Among Gram positive strains *B.cereus* (18.8±0.58)>*S.epidermidis* (18.0±0.89)>*S.aureus* (16.2±1.20) >*S.mutans* (16.0±0.54)>*S.pyrogenes* (7.8±0.37) while it was completely resistant to *C.xerosis* ATCC 373 at all concentration. For Gram negative strain used it showed sensitivity to all strains and there was equal inhibitory activity in the order of *K.pneuomoniae* (16.6±0.24) >*P.aeruginosa* (13.8±1.31)>*P.vulgaris* (9.4±0.67)>*E.coli* (9.2±0.96). All showed a significant inhibition as compared to Gentamicin (ZOI- 14.0-14.8 mm).

This study also confirms the presence of saponin by qualitative test, as they are generally considered as the soapy substances that are general cleansers, having antiseptic properties (Hirat and Suga, 1983). Sterols either decrease the activity of *S. aureus, E. coli, P. vulgaris* and *Pseudomonas pyocyanea* or have no effect in case of *Klebseilla* and *S. dysentrica* (Anuradha and Goyal, 1995) Flavonoids along with other biological activities have also been reported to possess significant anti-bacterial activity. Presence of flavonoid in the test drug and the subsequent anti-microbial activity confirms the findings reported by other authors in respect of flavonoids (Cushnie and Lamb, 2005).These are few evidences in support of the therapeutic activity of the Unani drugs. Most of these findings were found to be helpful in showing its biological activity.

In an effort to validate the antibacterial efficacy of selected test drug all ethno-pharmacological knowledge was found to be in favor of our selection of the drug as per the guidelines (Cos *et al*., 2006). The study demonstrated that the test drug possesses significant anti-microbial activity against a number of gram +ve and gram –ve bacteria. Thus, the study revealed the use of Gule-e-Tesu by Unani physicians in the management of various infective diseases.

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Preparation of Effervescent Granules from an Antidiarrhoeal Unani Powder and Defining its Physicochemical Characters

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Abstract

Diarrhoea is worldwide health problem for which a number of drugs are available in Unani and other traditional systems of medicine. However the low patient compliance is a major problem with traditional drugs requiring the optimization of various dosage forms. In the present study an age-old Unani compound powder was converted into effervescent granules to improve its palatability and the kinetics. Further, in order to determine the quality standards of the new dosage form the physicochemical studies were also carried out. The data generated in respect of its physicochemical attributes may be used for future reference.

Keywords: Anti-diarrhoeal effervescent granules (ADEG), Standardization, Diarrhoea.

Introduction

Effervescent granules usually consist of acid substances and carbonates or hydrogen carbonates which react rapidly in the presence of water to release carbon dioxide. They are intended to be dissolved or dispersed in water before administration (Anonymous, 2007; 2009). According to the European Pharmacopoeia, the effervescent forms are defined as those granules or tablets that are to be dissolved in water before administration. Effervescent tablets or granules are uncoated and generally contain acidic substances and carbonate or bicarbonate which reacts rapidly to release carbon dioxide when dissolved in water. Disintegration of the tablets or granules usually occurs within three minutes or even less, due to the evolution of carbon dioxide (Parikh, 2005).

The first effervescent preparation was invented over two centuries ago in the official compendia. Effervescent granules and tablets have become popular as the dosage forms due to their rapid solubility and consumption just by drinking the glass of water in which they have been dissolved. Effervescent forms have many benefits over conventional pharmaceutical forms. They bear a pleasant taste and mask the bad taste of certain drugs. This could help to avoid the gastric side effect of certain drugs. Effervescent dosage form is more consumers compliant because of its easy usage and attractive form (Parikh, 2005).

A number of Unani drugs are used to manage acute and chronic diseases but in many cases patients compliance remains a problem because of the conventional dosage forms which may not be convenient to use for every patient. An important antidiarrhoeal Safoof (ADS) mentioned in Akseere Azam (Khan,

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2011) is commonly prescribed by the physicians of Unani medicine. Although physicians find it very effective in the management of diarrhoea and dysentery but they are bound to opt for other options of even low potency in case of the children, aged people and many other patients who find it difficult to swallow the powder. The present study was therefore designed to convert ADS into Anti Diarrhoeal Effervescent Granules (ADEG) with an aim to make it more palatable. This will also make the therapeutic application of the drug wider.

Materials and Methods

Procurement of raw drugs

All the raw drugs (*Aegle marmelos, Coriandrum sativum, Cuminum cyminum, Foeniculum vulgare, Vateria indica and Zingiber officinale*) were procured from the approved raw drugs dealer of Bengaluru. Identification and authentication was conducted by botanist, Prof. K. Ravikumar, Centre for Repository of Medicinal Resources (C-RMR), Trans-Disciplinary University (TDU), Attur, Bengaluru. The voucher specimens of the samples have been deposited in the museum of Institute of Trans-Disciplinary Health Sciences and Technology, Bengaluru.

Procurement of chemicals

All the excipients used in effervescent granules were procured from Bengaluru.

Preparation of ADEG

All the crude drugs/ingredients of ADEG were cleaned and allowed to dry in shade. Thereafter all the ingredients were separately put in electrical grinder to make coarse powder. The powder of all the ingredients wee then mixed together in equal proportions. After that, extract of above compound powder was prepared in distilled water by using Soxhlet apparatus at 80°C. Extracted material was filtered and then dried on water bath. After drying, percentage of extractive value was calculated. This extract was ground in pestle and mortar and stored in an air tight glass container at room temperature for further use. Sodium bicarbonate, citric acid, tartaric acid, refined sugar and flavour (Table 1) were used as excipients. Thereafter ADEG was prepared by hot melt granulation method as described in pharmacopoeias and stored in air tight glass container.

Physico-chemical Evaluation of Anti-Diarrhoeal Effervescent Granules

The physico-chemical studies of ADEG were carried out in the laboratory of Dept. of Ilmul Saidla, NIUM, Bengaluru, which included (a) Organoleptic properties like

appearance, colour, smell and taste (b) Extractive values (c) Ash values (d) Moisture contents (e) Loss of weight on drying (f) Angle of repose (g) Bulk density (h) Tapped density (i) Carr's index (j) Hausner's ratio (k) pH value (l) Effervescent cessation time (m) CO_2 gas content (n) Qualitative estimation (o) Quantitative estimation (p) Dissolution time and (q) TLC finger printing.

Determination of Organoleptic Properties

Organoleptic properties of ADEG such as appearance, colour, odour and taste were noted.

- Appearance: Small quantity of ADEG was taken and uniformity of granular size and amorphous or crystalline nature was observed.
- Colour: Five gram of ADEG was taken into watch glass and placed against white background in white tube light. The colour of effervescent granules was noted by using Pantone colour chart.
- Odour: A small quantity of the ADEG was rubbed between the thumb and index ûnger and inhaled. First, the strength of the odour like none, weak, distinct, strong etc was determined and then the odour sensation like aromatic, fruity, musty, mouldy, rancid, etc was evaluated.
- Taste: A pinch of ADEG was examined for the taste on the upper surface of the tongue and one minute time was given to decide the taste.

Determination of alcohol-soluble matter

Five gm of ADEG was placed in a glass-stopper conical flask. Macerated with 100 ml of Ethyl alcohol for six hours shaking and then allow standing for 18 hours. Shake well and filtered rapidly through a dry filter paper. 25 ml of the filtrate was transferred to a previously weighed and tarred flat-bottom petridish and evaporate to dryness on a water bath. This filtrate was dried at 105°C for six hours, cooled in a desiccator for 30 minutes and weighed without delay. The percentage of alcohol soluble matter was calculated with reference to the amount of drug taken (Anonymous, 1998; 2009).

Determination of water-soluble matter

The percentage of water soluble matter was determined as above by using chloroform water instead of ethanol (Anonymous, 1998; 2009).

Determination of successive extractive values

The extractive values of ADEG in different solvent viz. petroleum ether, chloroform and ethanol were carried out in soxhlet extractor. Five gm of Anti-diarrhoeal

Effervescent granules was successively extracted with 150 ml of each solvent for six hours. The extracts were filtered with filter paper and transferred to a previously weighed and tarred flat-bottom petridish and evaporated for complete drying on a water bath. The successive extractive values were determined with reference to the weight of ADEG (% w/w) (Anonymous, 2009).

Determination of total ash

Three samples of two gm ADEG were incinerated in tarred silica dishes at a temperature not exceeding 450°C until free from carbon, cooled and weighed. The percentage of total ash was calculated with reference to the ADEG (Anonymous, 1998; 2006).

Determination of acid insoluble ash

The total ash of ADEG was boiled with 25 ml of diluted hydrochloric acid for five minutes and filtered. The insoluble matter was collected on an ash less filter paper, washed with hot water and ignited at a temperature not exceeding 450°C for one hour and weighed after cooling. The percentage of acid-insoluble ash was calculated (Anonymous, 1998; 2006).

Determination of water soluble ash

The total ash was boiled with 25 ml of distilled water for five minutes and filtered. The insoluble matter was collected on an ash less filter paper (Whatman), washed with hot water and ignited at a temperature not exceeding 450°C for one hour. The weight of insoluble ash was subtracted from the weight of total ash, giving the weight of the water soluble ash (Anonymous, 1998; 2006).

Moisture content

The moisture content was determined by Toluene Distillation method. 10 gm of ADEG was taken in a flask and 75 ml of Toluene was added to it. Distillation was carried out for five hours. The volume of water collected in the receiver tube was noted and the percentage of moisture was calculated (Afaq *et al*., 1994).

Determination of loss of weight on drying

Four gm of ADEG was taken, spread uniformly and thinly in a shallow petridish. It was heated at a regulated temperature of 105°C for five hours, cooled in desiccator and weighed. The process was repeated many times till two consecutive weights were found constant. The percent loss in weight was calculated with reference to initials weight of ADEG (Anonymous, 1998; Afaq *et al*., 1994).

Determination of angle of repose

The angle of repose was determined by using fixed funnel method. The height of the tip of funnel was fixed two cm above the horizontal surface. A graph paper was placed below the funnel on the table. The ADEG was allowed to flow through the funnel freely on to the surface until the apex of the conical pile just touches the tip of the funnel. The diameter of the powder cone base was measured and the angle of repose was calculated by using the following formula (Anonymous, 2007).

$$\tan \theta = \frac{\text{height of funnel}}{0.5 \text{ base}}$$

Determination of bulk density

An accurately weigh ADEG was introduced into a dry 100 ml graduated glass cylinder. The test sample was carefully levelled without compacting and the unsettled apparent-volume (Vo), was observed. The bulk density was calculated by using the following formula:

$$\rho b = \frac{M}{V_0} \text{ gm/ml}$$

Where; ρb = Apparent bulk density,

M = Weight of sample,

Vo = Apparent (untapped) volume of sample (Anonymous, 2006; Gupta, 2013).

Determination of tapped density

After observing the bulk density by the above method, sample containing graduated cylinder was tapped firstly for 500 times, followed by an additional taps of 750 and 1250 times in Tapped Density Apparatus (TD 1025) Lab India, until the difference between the two succeeding measurement is less than 2% and then tapped volume (Vf), was measured to the nearest graduated unit. The tapped density was calculated in gm/ml, using the following formula:

$$\rho tap = \frac{M}{Vf} \text{ gm/ml}$$

Where: ρtap = Tapped density,

M = Weight of sample,

Vf = Tapped volume of sample (Anonymous, 2006; Gupta, 2013).

Determination of Carr's index

Carr's index was calculated by using the following formula:

$$\text{Compressibility index} = \left[\frac{\text{Tapped Densit } (\rho tap) - \text{Bulk Density } (\rho b)}{\text{Tapped Density } (\rho tap)} \right] \times 100$$

Where; ρb = Bulk Density,

ρtap = Tapped Density (Anonymous, 2006; Gupta, 2013).

Determination of Hausner's ratio (Anonymous, 2006; Gupta, 2013)

It was calculated by the following formula:

$$\text{Hausner's Ratio} = \frac{\text{Tapped Densit } (\rho tap)}{\text{Bulk Density } (\rho b)}$$

Determination of pH

Five gm of ADEG was dissolved in 200 ml purified water in a beaker. After completing the effervescence, pH was measured at 25°C ± 1°C by using pH meter).

Determination of effervescent cessation time

Five gm of ADEG was placed in 200 ml purified water containing beaker at 25°C. When a clear solution was obtained indicating that effervescence has been finished, this time was noted (Aslani, 2013).

Determination of CO_2 gas content

100 ml of 1N sulphuric acid was taken in a beaker and weighed. Five gm of ADEG was dissolved in it. After full dissolution, this solution was re-weighed and change in weight was observed. Decrease in weight, indicates the CO_2 value in a dose (Aslani 2013_a).

Qualitative Estimation

Qualitative estimation of alkaloids, tannins, flavonoids, glycosides, phenols and terpenoids was done by the methods described in Physicochemical Standards of Unani Formulations, Part IV (Anonymous, 2006).

Quantitative Estimation

Tannin Assay

Preparation of drug infusion: Three gm of ADEG was dissolved in 250 ml distilled water at room temperature and then filtered.

Quantitative estimation of Tannin

For the analysis of tannin content in ADEG, 25 ml of ADEG infusion, prepared by the method given above, was taken into one litre conical flask, then 25 ml of indigo solution and 750 ml distilled deionised water were added. 0.1 N aqueous solution of $KMnO_4$ was used for titration until the blue coloured solution changed to green. Then few drops were added until solution turned into golden yellow colour. The volume of 0.1 N $KMnO_4$ solution required for titration was recorded. For blank test the mixture of 25 ml Indigo carmine solution and 750 ml distilled water was titrated with 0.1 N $KMnO_4$ solution and the volume required for titration until solution turned into golden yellow colour was recorded.

Calculation

The tannin content (T %) in the sample was calculated as follows:

$$T(\%) \quad \frac{(V-V_0) \times 0.004157 \times 250 \times 100}{g \times 25}$$

Where:

T (%) = Tannin quantity in percentage

V = Volume of 0.1 N aq. solution of $KMnO_4$ for the titration of the test sample in ml.

V_o = Volume of 0.1 N aq. solution of $KMnO_4$ for the titration of the blank sample in ml.

0.004157 = Tannin equivalent in 1 ml of 0.1 N aqueous solution of $KMnO_4$

g = Mass of the sample taken for the analysis in gm

250 = Volume of the volumetric flask in ml (Atanassova, 2009)

TLC finger printing

For the separation of different phytochemical constituents in ADEG, the chloroform extract was spotted manually using a capillary tube on pre-coated silicagel TLC plates 60 F 254 (layer thickness 0.25). The spotted plates were put into a solvent system of toluene: Ethyl acetate (8:2). After the separation of constituents, the plate was dried at 110°C. After drying, spray of vanillin sulphuric acid reagent was used to visualize the spots. The colour of the spots was noted and R_f value was calculated.

Determination of Dissolution time

Medium: 0.1N Hydrochloric acid buffer pH 1.2 solution was prepared (8.5 ml HCl diluted in 1000 ml of distilled water) as a dissolution medium.

Preparation of standard stock solution: One gm of accurately weighed ADEG was dissolved in 100 ml of buffer medium in 250 ml beaker and filtered to make 10 mg/ ml.

Preparation of standard curve: From the above standard stock solution aliquots of 0.05, 0.1, 0.2, 0.4, 0.6, 0.8 and 1 ml was taken into different 10ml volumetric flask and diluted in buffer to get concentration from 12µg/ml- 1mg/ml.

Firstly, blank buffer solution was scanned in UV visible Spectrophotometer (LAB India) between 190nm to 900nm wavelength to get base line. Then, above prepared solutions was scanned to get ë -max.

In-vitro release study was carried out using 900 ml 0.1N Hydrochloric acid buffer pH 1.2 solution. The Basket was rotated at 100 rpm. The medium was set at 37 ± 0.50°C. At 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 minutes, 10 ml aliquot of the solution was collected from zone midway between the surface of dissolution medium and the top of rotating basket not less than one cm apart from the vessel wall of the dissolution apparatus and was replaced with fresh dissolution medium. The withdrawn samples were filtered through Whatman filter paper and analyzed by an UV spectrophotometer (Lab India) at 370 nm using hydrochloric acid buffer pH 1.2 as a blank (Basak, 2006; Tekade, 2014).

Results and Discussion

The organoleptic properties of ADEG were found to be light brown in colour, amorphous granules with acidic lemon taste (Table 2, Fig 1). These are very important for drug identification and quality assurance and also necessary for patient compliance; the acceptance among the consumers automatically gets increased if these properties are good. The alcohol and water soluble matter of ADEG were found to be 24.814 ± 0.10% and 71.574 ± 0.19%, respectively (Table 3). This shows that the constituents of the drug are more soluble in alcohol than water. The mean percentage of successive extraction values was found to be

Table 1: Composition of Anti-diarrhoeal Effervescent Granules

S.No.	Ingredients	Property	Quantity (%)
1.	Extract	Active ingredient	27.1
2.	Sodium bicarbonate	Alkalizing agent	31
3.	Citric acid	Acidifying agent	14
4.	Tartaric acid	Acidifying agent	16
5.	Refined sugar	Sweetener	11
6.	Flavour (lemon)	Flavouring agent	0.9

Table 2: Organoleptic Properties of ADEG

Appearance	Amorphous granules
Colour	Light brown (1365 on panton colour chart)
Odour	Mild pungent lemon
Taste	Acidic

Table 3: Physicochemical Parameters of ADEG

Parameters	Samples			Mean ± SEM
	1	2	3	
Alcohol soluble matter (%)	24.680	24.735	25.029	24.814 ± 0.10
Water soluble matter (%)	71.522	71.927	71.274	71.574 ± 0.19
Successive Extractive Values:				
Petroleum ether (%)	0.06	0.08	0.06	0.06 ± 0.00
Chloroform (%)	0.16	0.18	0.14	0.16 ± 0.01
Ethyl alcohol (%)	5.52	5.74	5.85	5.70 ± 0.09
Ash Values:				
Total ash (%)	25.35	25.62	27.19	26.05 ± 0.57
Acid insoluble ash (%)	3.35	2.62	3.09	3.02 ± 0.21
Water soluble ash (%)	22.30	21.37	20.95	21.54 ± 0.39
Moisture content (%)	2.50	2.99	2.49	2.66 ± 0.16
Loss of weight on drying (%)	2.769	2.950	2.850	2.856 ± 0.05
pH Value:	5.85	5.87	5.84	5.85 ± 0.00
Effervescent cessation time (sec)	135	135	140	136.66 ± 1.66
CO_2 gas content (%)	22.32	22.14	22.04	22.166 ± 0.08
Angle of repose	34.5901	34.3063	33.8692	34.2552 ± 0.20
Bulk density (gm/ml)	0.5000	0.5000	0.5000	0.5000 ± 0.00
Tapped density (gm/ml)	0.5714	0.5714	0.5687	0.5705 ± 0.00
Carr's index	12.5000	12.5000	12.0800	12.36 ± 0.14
Hausner's ratio	1.1428	1.1428	1.1374	1.141 ± 0.00
Tannins (%)	3.60	3.74	3.74	3.69 ± 0.04

Figure 1: Laboratory Sample of Antidiarrhoeal Unani Effervescent Granules (ADEG)

0.06 ± 0.00, 0.16 ± 0.01, 5.70 ± 0.09 in petroleum ether, chloroform and ethanol, respectively (Table 3). This is an important parameter to evaluate the quality and purity of the drugs. The chemical constituents of the drugs are extractable in different solvent systems. These values are high in particular solvent in which the drug constituents are maximally soluble.

The mean percentage of total ash, acid insoluble ash and water soluble ash were found to be 26.05 ± 0.57, 3.02 ± 0.21 and 21.54 ± 0.39, respectively (Table 3). Total ash includes both "physiological ash", which is derived from the plant tissue itself and "non-physiological ash" which is residue of the extraneous matter adhering to the plant surface. Acid insoluble ash includes the amount of silica present, especially as sand and siliceous earth (Bele *et al.*, 2011). The mean percentage of moisture content was found to be 2.66 ± 0.16 (Table 3). An excess of water in medicinal plant materials provides good media for microbial growth, and deterioration following hydrolysis (Bele *et al.*, 2011). The mean percentage of loss of weight on drying was found to be 2.856 ± 0.05 (Table 3).

pH value of ADEG was found to be 5.85 ± 0.00 (Table 3). The finding will help in deciding the kinetics of the drug. The effervescence time is the time that the solution becomes free of particles; the acceptable range of this time is under three minutes (Aslani, 2013). The mean value of effervescent cessation time of ADEG was found to be 136.66 ± 1.66 sec., which is in the prescribed range (Table 3). The CO_2 content changes the taste and effervescence time (Aslani, 2013). The mean percentage of CO_2 gas content was found to be 22.166 ± 0.08 (Table 3, Fig. 8). Angle of repose was found to be 34.2552 ± 0.20 (Table 3). The result shows that inter-particular friction of particles of ADEG is low which shows its good flow ability.

The mean values of bulk density and tapped density were found to be 0.5000 ± 0.00 and 0.5705 ± 0.00, respectively (Table 3). Bulk and tapped density are very important in deciding the size of containers needed for handling, shipping, and storage of raw material and blend (Sandhya *et al*, 2012). The mean values of carr's index and hausner's ratio were found to be 12.36 ± 0.14 and 1.141 ± 0.00, respectively (Table 3) which is graded as passable flow ability. In theory, the less compressible a material the more flow-able it is (Anonymous, 2006). In qualitative estimation of ADEG; alkaloids, trannins, flavonoids, glycosides, phenols and terpenoids were found to be present (Table 4).

Tannins are astringent, bitter plant polyphenols that either bind and precipitate or shrink proteins. The astringency from the tannins is that which causes the dry and puckery feeling in the mouth on consumption. Tannins may be employed medicinally in anti-diarrheal, haemostatic, and anti-haemorrhoidal compounds. Tannins have been used for immediate relief of sore throats, diarrhoea, dysentery, haemorrhage, and skin ulcers (Ashok, 2012). The mean percentage of tannin was found to be 3.69 ± 0.04 (Table 3).

TLC and the Rf value calculated on the basis of spots detected is one of the important parameters used for detecting the adulteration and deciding the quality of drugs, as there will be variation in number of spots and Rf values in case of adulteration or poor quality of the drug. Five spots were found in chloroform extract of ADEG. The R_f values of five spots were found to be 0.12, 0.25, 0.43, 0.58 and 0.65 and the colour of spots were light blue, purple, blue, sky blue and dark purple respectively (Table 5, Fig 2).

Dissolution test is required to study the drug release from the dosage form and its *in vivo* performance. Dissolution test is used to assess the batch to batch

Table 4: Qualitative Estimation of ADEG

S.No.	Medicinal constituents	Presence
1.	Alkaloids	+
2.	Flavonoids	+
3.	Glycosides	+
4.	Phenols	+
5.	Resin	_
6.	Steroids	_
7.	Tannins	+
8.	Terpenoids	+

Table 5: TLC of ADEG

Extract	Solvent	No. of spots	R_f Value	Colour
Chloroform	Toluene: Ethyl acetate (8:2)	five	0.12, 0.25, 0.43, 0.58 and 0.65	Light blue, Purple, Blue, Sky blue and Dark purple

Table 6: Dissolution Time of ADEG

S.No.	Time (min)	Absorbance at 370 nm
1.	1	0.720
2.	2	0.764
3.	3	0.910
4.	4	0.920
5.	5	0.920
6.	6	0.920

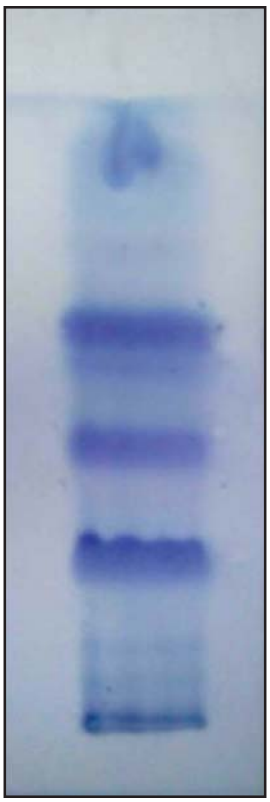

Figure 2: TLC of Antidiarrhoeal Unani Effervescent Granules (ADEG)

quality of drug product. The development and validation of dissolution procedures is of predominant importance in quality control. It is commonly used as a predictor of the *in vivo* performance of a drug product (Vaghela, 2011). The absorbance of ADEG was found maximum (0.920) at four minutes (Table 6).

Conclusion

Newly developed ADEG may be used in place of anti-diarrhoeal *Safoof,* for better patient compliance. The developed physicochemical standards of ADEG may be used for future reference.

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Management of Diabetic Micro-angiopathies Through Unani Herbal Drugs: Haemorrheo-logical Consideration*

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Abstract

Diabetes mellitus is such a complex disorder that affects the histological, biochemical as well as haemorrheological components of the body and its fluids, resulting from number of factors in which an absolute or relative deficiency of insulin or its function usually present. It has been observed that Diabetes mellitus directly affects the haemorrheological properties in addition to other pathologies. All blood constituents viz. RBCs, WBCs, Platelets and Plasma are modified in such a way that they lead to hypoxia, acidosis, capillary damage and microvascular disease. Haemodilution, the most vital measure to increase the fluidity of blood, is a way of rheological therapeutics which enhances the perfusion at multiple organ sites. This can be achieved by administration of various potential Unani drugs. This phenomenon also approves the concept of *Jila*in *Rooh* to heal up the body and mind. The aim of rheological intervention through Unani drugs is to improve the blood circulation under driving forces which has become stagnated due to either reasons. This stagnation usually caused by rauleux formation, cell deformity and changes in viscosity. Unani drugs are reported to produce haemodilution which corrects the hypoxia, haematocrit, viscosity, cellular aggregation and rigidity to enable the microcirculation to be restored. The paper deals in details, how the diabetic microangiopathies take place and by exploiting the repository of Unani drugs the haemorrheological disturbances can be corrected, which is indispensable in the management of this condition.

Keywords: Diabetic microangiopathies, Haemorrheology, Haemodilution, Unani Medicine

Introduction

Diabetes mellitus is such a complex disease which affect the anatomic as well as biochemical constituents of the body resulting from number of factors in which an absolute or relative deficiency of Insulin or it's function usually present (Harrison, 2012).

It has been observed that Diabetes mellitus with additional pathologies shows different haemorrheological properties. All blood constituents viz. RBCs, WBCs, platelets and plasma are modified in such a way that they lead to hypoxia, acidosis, capillary damage and microvascular diseases (Young *et al*., 2008).

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Patients with Diabetes mellitus experience significant morbidity and mortality from microvascular (Retinopathy, neuropathy, nephropathy) and or its complications (heart attacks, stroke and peripheral vascular diseases). Chronic elevation of blood glucose level leads to damage the blood vessel (Andrew, 2000).

Studies revealed that uncontrolled DM represent the prevalence of cutaneous microangiopathies upto 67.9%. In relation to dermopathies, it was found that 41.3% cases were reported having cutaneous microangiopathies in Diabetics and 57.1% were found having systemic microvascular complications of Diabetes mellitus. Peripheral neuropathy is considered the higher in prevalence i.e. 55.7% followed by retinopathy, 47.2% and hypertension 10.7% while least prevalence found as nephropathy i.e. 1.9% (Bashir *et al.*, 2006)

Another study in India suggests that in a tertiary care hospital, the maximum number of peripheral sensory neuropathy in poorly glycaemic controlled cases, was found 37%, whereas nephropathy in 20% and retinopathy in 17% cases (Kumar *et al.*, 2006).

The aim of rheological therapy is to improve the blood circulation under driving forces which has become stagnated due to either reason. This stagnation usually caused by rauleux formation, cell deformity and changes in viscosity. Reports are there that the haemodilution decreases, the pulmonary as well as systemic resistance which is already caused by hemoconcentration. Studies reveal that the haemodilution corrects the hypoxia, haematocrit, viscosity, cellular aggregation and rigidity to enable the microcirculation to be restored.

Effects of Diabetes mellitus on Hemorrheological Parameters (Young *et al.*, 2008).

(i) Effects of D.M. on Plasma Viscosity – It is observed that D.M. increases the plasma viscosity which contribute in slowing the microcirculation.

(ii) Effect of D.M. on Red Cell aggregation – It was found that aggregates formed faster in diabetics than non-diabetics. As the glycoselation increases the aggregation increases leading to slowing of minicirculation.

(iii) Effect of D.M. on Red cell deformability – It is reported that in diabetics the RBCs become rigid in nature and do not show the bending pattern resulting into occlusion in microcirculation.

Here, it can be concluded that :

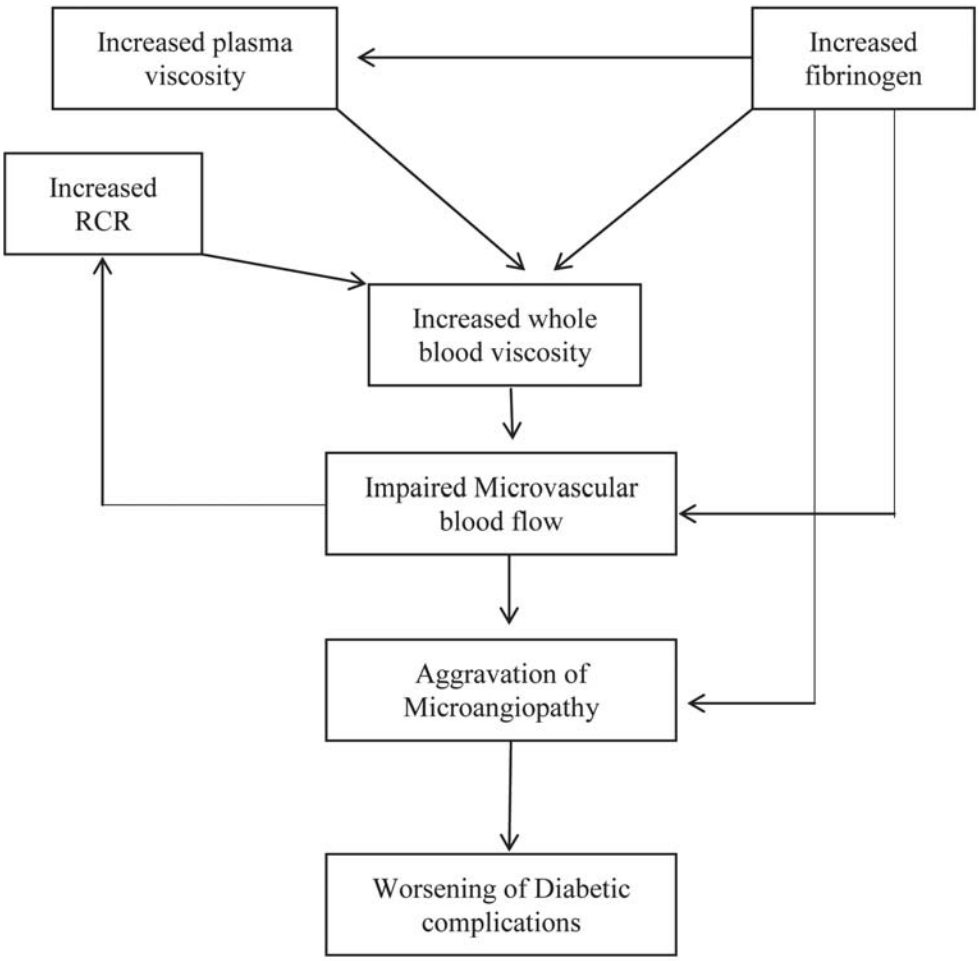
- Raised Plasma viscosity, RCA (Red Cell Aggregation) and platelet aggregation seems to be the factors responsible for diabetic microangiopathies.
- Decreased perfusion and increased hematocrit are to be said the factors responsible for microangiopathies.

- Diabetic microangiopathies may also be caused by capillary hypertension causing increased macromolecular leakage and deposition on the microvascular wall leading to increased basement membrane material synthesis.

Both these factors cause Diabetic microangiopathy

- Diabetic microangiopathies are caused due to increased RCR and hypoxia.
- Incrased HbA1C causes raised RCR (Red Cell Rigidity) and aggreability.
- Cell rigidity may be due to associated hyper cholestraemia which decreases membrane fluidity and deformability.
- Cigrette smoking also causes further cell rigidity and rise of carboxyhemoglobin.

Mechanism of Development of Diabetic microangiopathies (Jennings, 1988; George *et al.*, 1996; Casper *et al.*, 2005)



The management of Diabetic microangiopathies:

(i) Scientifically validated Antidiabetic plants (Grover *et al*., 2002)

1.	Babool	(*Acacia arabica*)
2.	Berge Bel	(*Aegle marmalos*)
3.	Busul	(*Allium cepa*)
4.	Seer	(*Allium sativum*)
5.	Sibr	(*Aloe vera*)
6.	Supari	(*Areca catechu*)
7.	Afsanteen	(*Artemisia pallens*)
8.	Boranjasif	(*Annona squamosa*)
9.	Kalmegh	(*Andrographis paniculata*)
10.	Talmukhana	(*Asteracantha longifolia*)
11.	Neem	(*Azadirachta indica*)
12.	Chuqandar	(*Beta vulgaris*)
13.	Rai	(*Brassica juncea*)
14.	Biskhapra	(*Boerhavia diffusa*)
15.	Amaltas	(*Cassia auriculata*)
16.	Karanjwa	(*Caesalpinia bonducella*)
17.	Kibr	(*Capparis decidua*)
18.	Arhar	(*Cajanus cajan*)
19.	Hanzal	(*Citrullus colocynthis*)
20.	Kundru	(*Coccinia indica*)
21.	Kishneez	(*Coriandrum sativum*)
22.	Kamoon	(*Cuminum cyminum*)
23.	Gazar	(*Daucus carota*)
24.	Jamun	(*Eugenia jambolana*)
25.	Bergad	(*Ficus bengalensis*)
26.	Gurmar	(*Gymnema sylvesteris*)
27.	Aslussoos	(*Glycyrrhiza glabra*)
28.	Gurhhal	(*Hibiscus rosa-sinensis*)
29.	Shakar Qand (leaves)	(*Ipomoea batata*)
30.	Konch	(*Mucuna pruriens*)
31.	Janglikarela	(*Momordica charantia*)
32.	Rehan	(*Ocimum sanctum*)
33.	Chirayata	(*Swertia chirata*)

34. Hulba (*Trigonella foenum graecum*)
35. Gilo (*Tinospora cordifolia*)
36. Zingibeel (*Zingiber officinale*)
37. Unnab (*Zizyphus sativa*)

The routine herbal antidiabetic drugs affect the human physiological system in various ways. The mechanism of action of these drugs are understood as follows (Marles and Farnsworth, 1996; Pulok *et al*., 2006).

- Adrenomimeticism – Pancreatic b cell potassium channel Blocking, CAMP (2^{nd} messenger) stimulation
- Inhibition in Renal Glucose reabsorption
- Stimulation of Insulin secretion from b cell of Islet or/and inhibition of Insulin degradative processes.
- Reduction in Insulin resistance

In addition to their routine antihyperglycaemic effects, these drugs play an important role in correction of haemorrheological disturbances already exist in microcirculation of the targeted tissues. Due to this mechanism, these drugs enhances the restoration of the oxygen supply and ultimately improve the healing procedure.

Brahmi (*Centella asiatica*) has been used in India for the treatment of Dermatitis, Diabetes mellitus, cough and other diseases. It is also used to improve memory. In Europe an infusion of the aerial parts of the plant was used to purify blood and treat wound, ulcer, Dermatitis and Hypertension. A study was conducted on 50 cases with Diabetic microangiopathy to assess the effect of *C. asiatica*. Thirty cases received oral Triterpine fraction of *C. asiatica* (TTFCA) 60 mg twice daily for 06 months, 10 cases received placebo and 10 cases received no treatment. Measures of microcirculation improved in cases receiving *C. asiatica* after 6 month of treatment. No change was noted in cases receiving placebo or in those receiving no treatment. It was concluded that TTFCA has a potential role in improving microcirculation in patients with diabetic microangiopathies (Cesarone *et al*., 2001)

(ii) Through Haemodilution (Young *et al*., 2008)

Haemodilution means relative increase of plasma in comparison to solid constituents of the blood. This increases the fluidity corrects the hypoxia and acidosis. Haemodilution corrects the rheological parameters like –

- Whole blood viscosity
- Plasma viscosity
- RCR (Red Cell Rigidity)

- RCA (Red Cell Aggregation)
- Platelet aggregation

This improvement restores the normal blood flow through the capillaries, also helps in cleaning out the already formed RBCs clumps. The haemodilution can be achieved by the use of various medicaments of Unani medicine such as citrus fruits, Busl (*Allium cepa*), Seer (*Allium sativum*), Zanjabeel (*Zingiber officinale*), zardchob (*Curcuma longa*), Darchini (*Cinnamomum zeylanicum*), Akhrot (*Juglans regia*), Enab (*Vitis vinifera*), Anar (*Punica granatum*), Podina (*Mentha arvensis*), Aslussoos (*Glycyrrhiza glabra*), Tarbooz (*Citrullus vulgaris*), Kheera (*Cucumis sativus*), Hulba (*Trigonella foenum-graecum*) (Hamdani, 1980; Kabir, 2002; www.naturalbloodthiningers.org)

(iii) The effects of Musaffiat,Moaddilat-e-Dam (Blood Purifiers) and antidiabetic drugs on other Haemorrheological disturbances

These drugs repair the endothelium (Ling *et al.*, 2007; Zahid *et al.*, 2007) reduces the elevated level of fibrinogen and correct the level of plasma viscosity (Kiesewetter *et al.*, 1990; Hasni-Ranjbar *et al.*, 1990). These drugs also affect the higher level of cholesterol and help in restoring the normal blood flow (Hasni-Ranjibar *et al.*, 2010; Wan *et al.*, 2007) such as –Chobchini (*Smilax china*), Sarphoka (*Tephrosia purpura*), Muquil (*Commiphora mukul*), Hulba (*Trigonella foenum-graecum*), Aslussoos (*Glycyrrhiza glabra*), Murmakki (*Commiphora myrrha*), Seer (*Allium sativum*) and Rewandchini (*Rheum ribes*) (Hasni – Ranjbar *et al.*, 2010). Unani medical literature suggests that chiraita (*Swertia chirata*), Gule mundi (*Sphaeranthus indicus*) and Gule surkh (*Rosa damascena*) normalizes the pH of blood, whereas Aftimoon (*Cuscuta reflexa*) and Bisfaij (*Polypodium vulgare*) normalizes the viscosity (Latif, 2010). *Andrographis paniculata* is also reported having antiplatelet aggregation and antidiabetic effects (Shabid, 2011).

(iv) Drugs which produce Jila in Rooh (Ibn Sina, 1996)

Avicenna in 'AdviatulQalbia' has described various drugs which according to him produces Jila in rooh and removes the darkness. This might be interpreted as the drugs which clears the saudavimawad from the blood, are helpful in producing Jila means oxygenation. In other words the drugs which checks the formation of rauleux and clear the already formed clumps, increase the fluidity, removes the hypoxia and acidosis/might be given alongwith the routine antidiabetic medicaments. Such as – Abresham (*Bombyx mori*), Bisfaij(*Polypodium vulgare*), Gulesurkha (*Rosa damascena)*, Ghariqoon (*Agaricus alba*), Nana (*Mentha arvensis*), Zafran (*Crocus sativus*), Darchini (*Cinnamomum zeylanicum*), Amla (*Emblica officinalis*), Ulraj (*Citrus limon*), Ustukhuddoos (*Lavendula stoechas*), Badranjboya (*Nepeta hindostana*), Musk (*Moscus moschiferus*).

Conclusion

Diabetes mellitus is a complex pathological condition which affect the anatomic and biochemic constituents of the body. It has been observed that Diabetes mellitus affects the various haemorrheological parameters like WBV (Whole Blood Viscosity), PV, RCA, RCR, PA etc. resulting into hypoxia, acidosis, capillary damage and microvascular diseases.

These conditions might be corrected through haemodilution by the intervention of Unani medicament which corrects various hemorrheological parameters and restore the normal microcirculation.

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Biochemical and Pathological Studies on Unani Coded Drugs UNIM-268 With UNIM-270 + UNIM-271+ UNIM-272 With and Without MM Therapy in Patients of Lymphatic Filariasis from Tropical Zone of India

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Abstract

Lymphatic filariasis is endemic in approximately 80 countries and has been targeted for global elimination as a public health problem. In this study, 154 patients suffering from lymphatic filariasis were enrolled at Regional Research Institute of Unani Medicine, Patna. This study was divided in two groups. In Group A, 84 patients were registered and only UNIM 268+UNIM 270+ UNIM 271+ UNIM 272 coded drugs were given. In group B, 70 patients were registered and MM Therapy was given followed by Unani coded drugs UNIM 268+ UNIM 270+ UNIM 271+ UNIM 272. The study reports the effect on biochemical and pathological profile of lymphatic filariasis patients treated with Unani coded drug UNIM 268 with UNIM-270+UNIM-271+UNIM-272 with and without MM therapy. In hepatic function tests, SGOT was significantly reduced ($p<0.01$) in group A and B ($p<0.05$), SGPT was significantly ($p<0.05$) reduced in group A, but in group B non-significant reduction SGPT was observed. There were no changes observed in renal function markers after the treatment of coded drugs. Absolute eosinophil count and eosinophil (%) were found increased at baseline which were significantly ($P<0.001$) reduced after the treatment of Unani drugs in both groups. ESR was also found increased at the baseline which was significantly reduced ($P<0.01$) after the treatment of coded Unani drugs in both groups when compared to the (before treatment). There were no changes observed in total bilirubin, alkaline phosphatase, urea, createnine, uric acid after the treatment of coded drugs in both groups. Total leukocyte count was significantly ($p0<0.05$) reduced in both groups and no changes were observed in differential count after the treatment of Unani coded drugs in both groups. The study advocates the safety and efficacy of Unani coded drugs and suggests these drugs beneficial for lymphatic filariasis patients.

Keywords: Lymphatic filariasis, Unani coded drugs, MM Therapy, Biochemical and Pathological studies.

Introduction

Lymphatic filariasis is a vector borne parasitic disease caused by three lymphatic dewaling nematodes parasites *Wuchereria bancrofti (90%), Brugia malayi (5%)* and *Brugia timori (5%)*, transmitted by mosquitos, preferred habitats are the lymphat-ic vessels and lymph nodes which induce the develop-ment of disfiguring elephantiasis and debilitating clinical symptoms in both genders (Ottesen et al. 1997; Sasa 1976). Lymphatic filariasis (LF) is a major tropical disease with an estimated 120 million people infected in 83 countries and some 1,300 million

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at risk of acquiring the infection (Anonymous, 2006). It has been estimated that there are more than 27 million microfilaraemic carriers, around 20.8 million cases of lymphatic filariasis and about 429 million individuals are at risk of filarial infections in India (Sabesan *et al*., 2000; Pani *et al*., 1995; Michael, 1996). The World Health Assembly resolved to eliminate lymphatic filariasis as a public health problem in 1997 (Anonymous, 1997). According to Unani physicians this disease is caused by abnormality in the humours (akhlat) especially in Phlegm (Balgham) and Black Bile (Sawda) in the body (Razi, 1962; Masihi, 1356H ; Antaki, 2009) and abnormal flow of this thick matter towards the legs as the causative factor (Qamari, 2008).

Diethyl carbamazine (DEC) is the only drug available to control filariasis (Park, 2009). However, due to its serious allergic reactions there is the need of finding safer drugs to treat the filariasis. A number of single and compound drugs are available in Unani system of medicine to treat the disease. Many researchers have reported some clinical data regarding the safety and efficacy of Unani drugs in the management of lymphatic filariasis (Sehar *et al*., 2015; Salam *et al*., 2014; Alam *et al*., 2009). These data are although of preliminary nature but are showing great potential of Unani medicine to offer effective and safe drugs to treat filariasis. Present study was planned to evaluate the effect on some biochemical and pathological markers to prove safety and efficacy of Unani coded drugs UNIM-268 with UNIM-270 + UNIM-271+ UNIM-272 with and without Munzil-Mushil (MM) therapy in the patients of lymphatic filariasis from Patna (tropical zone).

Methodology

Study Drugs

The study drug was a combination of coded drugs UNIM-268 with UNIM-270 + UNIM-271+ UNIM-272 used with and without MM therapy which were supplied by the pharmacy of Central Research Institute of Unani Medicine, Hyderabad, A.P., India.

Selection of the patients

Patients of lymphatic filariasis (Da'ul Feel) of either sex aged between 11-65 years having lower lymph oedema and having one or more symptoms such as fever with and without rigour, lymphadadenitis, dermatosclerosis, lymphangitis, and headache were selected for the study from OPD, after thorough clinical examination by Unani physician. Patients, who were suffering from other systemic disease, anaemia, malnutrition and pregnant and lactating women were excluded

from the study. Only those who fullfil the inclusion criteria were selected for the study. Total 154 patients were registered for the study at Regional Research Institute of Unani Medicine, Patna, between April 2008 and March 2014. Patients were divided into two groups i.e. Group-A and Group-B and were treated with coded drug combinations UNIM-268 used with and without M.M. therapy. The patients were clinically examined at the baseline and at regular interval for 30 days. Three follow-ups were conducted for UNIM-268 in both groups. In group B, after M.M. Therapy follow ups were conducted. Blood was collected at baseline and at the end of the study in both groups. The safety was evaluated by monitoring adverse events by the physician as well as laboratory investigation such as Liver Function Test and Kidney Function Test which were conducted at baseline and at the end of the study.

The study was designed in conformity with the principles of Helsinki Declaration II (Anonymous, 1995), and the guidelines of the Indian Council of Medical Research for bio-medical research involving human subjects (Anonymous, 2000). The study was approved by the Institutional Ethical Committee (IEC). The study was "blind" to the extent that patients, clinicians evaluating the efficacy and laboratory staff carrying out the laboratory tests, were unaware about the coded drugs.

Dosage Schedule and Duration of Treatment

The study was divided in two groups:

Group A (Treatment without M.M therapy)

In this group 84 patients were given UNIM-268 with UNIM-270 + UNIM-271+ UNIM-272 only. The duration of the treatment was 90 days.

UNIM-268 - Two tablets (500 mg each) twice daily were given orally with water on empty stomach for 90 days

UNIM-270 + UNIM-272 - 5 gram powder of UNIM 270 were mixed with 20 ml of liquid UNIM 272 and applied locally on the affected part daily at night for 90 days.

UNIM-271- 20 grams of coarse powder boiled in 1 litre of water was slowly dropped (Nutool) on the affected part daily for 10-15 minutes before applying paste at night to enhance its efficacy.

Group-B (Treatment with M.M.Therapy)

In this study, 70 patients were treated UNIM-268 with UNIM-270 + UNIM-271+

UNIM-272 with Munzij-Mushil Therapy followed by alternate day tabreed during Mushil MM Therapy

UNIM-MUNB (Munzij) - Adult dose (1 packet) boiled in 350 ml of water for 15 minutes. The prepared decoction was given orally once a day on empty stomach for 15 days or till the appearance of Nuzj.

UNIM-MUSB (Mushil) - 1 packet of UNIM (MUSB) was added to UNIM (MUNB) recipe and given in the form of decoction orally for 5 days on alternate days.

UNIM (Tabreed) - Infusion of UNIM-TAB (crude drugs) in the dose of 50 ml was given orally on empty stomach early in the morning for 5 days on alternate days with UNIM (MUSB).

After treatment of MM, this group was given the same treatment as was given to group A

Collection of Blood Sample

Blood sample was collected for biochemical and pathological study on the day 0 and after the completion the study. Serum was separated for biochemical study by centrifuging the clotted blood at 3000 rpm for 10 minutes.

Biochemical study

Diagnostic reagents kits from Span Diagnostic Pvt Ltd. were used for biochemical tests. SGOT and SGPT, bilirubin, alkaline phosphatase, blood urea, serum creatinine and uric acid were detected. All the parameters were estimated by using spectrophotometer from Systronic Pvt. Ltd India.

Pathological Study

ESR measurement

ESR, TLC, DLC and absolute eosinophil count were determined using standard procedures and parameters, recommended for respective tests.

Statistical significant

Statistically significance was measured by One-way Analysis of Variance (ANOVA) followed by Dunnett's 't' test. Probability level of less than .05 was considered as statistically significant.

Table 1: Effect Unani Coded drugs combination, UNIM 268 with and without M.M.therapy on the level of Erythrocyte Sedimentation Rate (ESR) (mm/hr), Total Leucocytes Counts (TLC) thousand/cu mm and Differential Leucocytes Counts (DLC) % before and after treatment of lymphatic Filariasis patients

Parameter		Group-A		Group-B	
		Mean ± S.E.M		Mean ± S.E.M	
		Before Treatment	After Treatment	Before Treatment	After Treatment
ESR (mm/hr)		21.70 ± 2.15	10.75 ± 0.81***	26.80 ± 3.87	14.95 ± 2.16***
Total Leukocyte count 147.32 (1000/cu.mm)		6756.63± 81.06*	6425.98± 208.54	7015.31± 155.0^{ns}	6589.51±
DLC	N (%)	57.63 ± 0.94	57.57 ± 0.7^{ns}	60.92 ± 1.14	59 ± 0.64^{ns}
	L (%)	33.75 ± 0.77	35.69 ± 0.43*	30.81 ± 1.07	34.67 ± 0.51***
	E (%)	6.46 ± 0.28	4.37 ± 0.26***	6.83 ± 0.47	4.49 ± 0.2***
	M (%)	1.45 ± 0.09	1.69 ± 0.09*	1.41 ± 0.11	1.6 ± 0.1 ^{ns}
	B (%)	0 ± 0	0 ± 0	0 ± 0	0 ± 0

***P<0.001, **p<0.01, *p<0.05 and ns=nonsignificant as compared to baseline.

ESR was significantly (***p<0.001) reduced in both groups, TLC was significantly reduced in group A and nonsignificantly reduced in group B, DLC were measured before and after treatment in which Neutrophil, lymphocytes monocytes and basophils are normal limits and remained normal after treatment of test drugs. Eosinophils was found increased at baseline which was significantly (***p<0.001), reduced in both groups after treatment of Unani coded drugs (Results were depicted in Table-1)

Table 2: Effect Unani coded drugs combination, UNIM 268 with and without M.M. therapy on Absolute Eosinophil count (AEC) (Cell/Cu mm) before and after treatment of lymphatic Filariasis patients

Day of Mesurment	Mean ± S.E.M	
	Group-A	Group-B
Before Treatment	417.19 ± 19.10	456.98 ± 25.87
After Treatment	282.07 ± 16.90 ***	302.26 ± 17.86 ***
Percentage (%) of reduction	32.38	33.86

***P<0.001 as compared to baseline. In group A significantly (p<0.01) 32% reduction of absolute Eosinophil count and in group B and 33% reduction in group B were found after the treatment of unani coded drugs (Results were depicted in Table-2)

Table 3: Effect Unani coded drugs combination, UNIM 268 with and without M.M.therapy on Liver function test before and after treatment of lymphatic Filariasis patients

Parameter		Group-A		Group-B	
		Mean ± S.E.M		Mean ± S.E.M	
		Before Treatment	After Treatment	Before Treatment	After Treatment
LFTs	S. Bilirubin (mg/100 ml)	0.72 ± 0.03	0.74 ± 0.03^{ns}	0.79 ± 0.07	0.65 ± 0.07 ^{ns}
	SGOT(IU/L)	24.23 ± 1.29	20.43 ± 0.65 **	26.99 ± 1.32	22.96 ± 1.16 *
	SGPT(IU/L)	31.52 ± 1.69	26.60 ± 1.06 *	32.02 ± 1.58	29.97 ± 1.39 ^{ns}
	S. ALP(KA)	5.84 ± 0.35	5.94 ± 0.38 ^{ns}	7.06 ± 0.57	6.02 ± 0.42 ^{ns}

**P<0.01,*p<0.05 and ns=nonsignificant as compared to baseline.

SGOT was significantly reduced in Group A (p<0.01) and group B (p<0.05) SGPT was significantly reduced in Group A (p<0.05) and non significantly in group B after the treatment of Unani coded drugs. Nonsignificant changes were observed on level of bilirubin and alkaline phosphatase after the treatment of Unani coded drugs (Table-3)

Table 4: Effect Unani coded drugs combination, UNIM 268 with and without M.M.therapy on kidney function test before and after treatment of Lymphatic filariasis patients

Parameter		Group-A		Group-B	
		Mean ± S.E.M		Mean ± S.E.M	
		Before Treatment	After Treatment	Before Treatment	After Treatment
KFTs	S. Creatinine (mg/100 ml)	0.79 ± 0.02	0.77 ± 0.04 ^{ns}	0.94 ± 0.09	0.94 ± 0.09 ^{ns}
	Urea (mg/100 ml)	21.50 ± 3.5	25.17 ± 2.7 ^{ns}	26.43 ± 2.5	20.13 ± 2.0 ^{ns}

There were no significant changes observed on Urea and createnine in both groups. It were found normal limits at baseline and remain normal after treatment of Unani coded drugs (Table-4)

Table 5: Response of the Unani Coded drugs in Lymphatic filariasis patients

Group	No. of Patients (n)	Excellent (90-100%)	Very Good (60-89%)	Good (30-59%)	Poor (< 30%)
A	84	-	35 (42%)	43 (51%)	6 (7%)
B	70	-	29 (41%)	39 (56%)	2 (3%)

In group A 42% patients showed very good response, 43% patients showed good response and 7% patients showed poor response. In group B, 41% patients showed very good response, 39% patients showed good response anly 3% patients showed poor response to the therapy (Table-5)

Results and Discussion

In the present study, the biochemical and pathological changes after the treatment of Unani coded drug with and without M.M. Therapy were estimated. There were significant changes in ESR values in group A ($p<0.001$) and group B ($p<0.001$) (Table-1), absolute eosinophil count ($p<0.001$) and total eosinophil% ($p<0.001$) (Table-1 and 2). Total leucocyte count was found significantly decreased after the treatment with Unani coded drug in both groups (Fig.-1). Biochemical test included SGOT, SGPT, bilirubin, alkaline phosphatase, urea, creatinine, uric acid. SGOT and SGPT significantly decreased in both groups. No significant change was found in total Bilrubin, alkaline phosphatase, Urea, Creatinine, Uric acid as they were normal at baseline and remained within normal limits after the treatment with Unani coded drug (Table 3 & 4).

The present study reports that the Unani coded drugs are effective as they reduced some of the pathological markers such as ESR and Absolute Eosinophil Count. It is well known fact that absolute eosinophil count is usually increased in case of lymphatic filariasis (Andrea *et al.*, 2004) which was found significantly altered after the treatment with Unani coded drugs. The ESR is a simple non-specific screening test that indirectly measures the presence of inflammation in the body. It reflects the tendancy of red blood cells to settle more rapidly in the face of some disease states, usually because of increase in plasma fibrinogen, immunoglobulins, and other acute-phase reaction proteins. In the present study, ESR was found increased in the patients of lymphatic filariasis in both groups, which significantly reduced after treatment with coded Unani drugs. Results of hepatic function test and renal function test at baseline and after treatment indicated that these drugs are safe. In Group A, out of 84 patients, 35 patients showed very good response, 43 patients showed good response and only 6 patients showed poor response of the treatment. In Group B out of 70 patients, 29 patients showed very good response, 39 patients showed good response, 2 patients showed poor response (Table 5). The study thus suggested that the test drug combination is effective and can be used in the management of filariasis.

The World Health Organization (WHO) has set the target for global elimination of lymphatic filariasis by the year 2020 (Ottesen et al., 1997). India, which has roughly 40% of the global burden had targeted for national elimination by the year 2015 (Pani *et al.*, 2002). The realization of these goals will largely depend on the use of safe, tolerable and efficacious drugs.

The findings of the study may pave the way for the development of safe and effective drug for the treatment of filarial affection.

Conclusion

We conclude that Unani coded drugs are safe and effective in reducing ESR and eosinophil count in filarial lymphoedema at the given dosage. We did not get any undesirable change in LFT and RFT. However, as the current study was limited to only 154 patients in Bihar state of north India, study with larger numbers of patients need to be carried out. This is essential for strengthening the evidence based on the use of these Unani drugs in the management of lymphatic filariasis, before recommending their use in morbidity management to the global programme for the elimination of lymphatic filariasis. These Unani drugs provide simple low cost treatments which offer relief to persons with the disease and herald a brighter future in tackling this potentially eradicable disease.

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Characterization and Comparative Chemical Analysis of Kushta-e-Faulad (Iron Calx) Prepared by Conventional as well as Modern Method

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Abstract

Kushta-e- Faulad is a common herbo-metallic preparation of Unani medicine used in anemia, liver disorders, as a tonic in general debility and convalescence. In this work the kushta-e-faulad was prepared in laboratory according to the method given in National Formulary of Unani Medicine (NFUM) and modern method to make a comparative study of the physical properties of Kushta- e- Faulad. In this study we are reporting the preparation and characterization of the finished kushta by Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Energy Dispersive X-ray Analysis (EDAX). It was observed that the Kushta-e-Faulad contained nano-particles of iron-oxide and metallic iron in the range of 06 to 49 nm. Its LD_{50} and the toxic dose was determined and was found to be 660 mg/kg b.w.

Keywords: Kushta-e-Faulad, SEM, TEM, Nanoparticle, LD_{50}

Introduction

Despite being important for the body, all metals and minerals cannot be used as therapeutic agent due to pharmacokinetic inconvenience and potential toxicity. They are therefore, first converted to carbonates or oxides. These oxides of metals or minerals are technically known as Kushta (Calx) and the process by which kushtajats are prepared is known as Taklees (Calcination). Many metals and minerals are effectively used to cure various ailments. Probably the Roman physician, Pliny and Greek philosopher, Dioscrides were the first to use gold in medicine while Hippocrates, explained the beneficial effect of silver in human system (Sudha *et al.,* 2009)

Islamic philosophers made great contributions to pharmacy. Probably the art of calcination was mainly derived from the alchemical techniques used during the Arabian era of Unani medicine (Holmyard, 1924). Jabir ibn Hayyan and Al-Razi set the foundation of modern science. Jabir described the preparation of many chemical substances such as oxides (kushta), sulphide of mercury and arsenic etc. He gave an exact description of calcination, crystallization, solution, sublimation and reduction (Anawati, 1970). Abu Bakr Mohammad Bin Zakaria Razi, in his book Sirr-al-Asrar (*Liber Seceretorum bubacaris*) described calcination, distillation and crystallization (Holmyard, 1931). Also he gave a comprehensive list of apparatus employed in alchemical work (Clagett, 1961). Razi coined the term taklees for calcination. Chemically, kushta may be defined as the calcined product of any desired metal or mineral while literally kushta means “to kill” (Sudha *et al.,* 2009). In medical terms, it is defined as the

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detoxification of the harmful properties of a metal. The calcined metals are termed as bhasmas, parpams and kushta in Ayurveda, Siddha and Unani systems of medicine, respectively (Mishra, 2003). In Unani system of medicine kushta-e-faulad is used as a tonic in general debility and in the treatment of anemia (Anonymous, 2006 and 2003). It also cures impotency if it occurs due to anaemia (Said, 1970). The normal prescribed dose of most of the kushta is about one grain of rice which is equivalent to about 10 mg. The high efficacy of kushta may be due to its very small particle size which has high propensity of absorption (Brown *et al.,* 2007). Although, kushta of various metals and minerals are in use for decades no scientific parameters have been developed for the preparation and characterization of these age old remedies (Cardarelli, 1986). It was therefore, essential to develop a standard protocol for the preparation and characterization of kushta-e-faulad by both traditional and modern techniques. We have also explored the toxic dose of kushta- e- faulad by LD_{50}.

In this paper we are reporting, for the first time, the preparation and characterization of kushta-e-faulad by Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Energy Dispersive X-ray Analysis (EDAX), Integrated Coupled Plasma Atomic Emission Spectroscopic (ICPAES) and animal toxicity studies. The particle size and solubility of the calx has also been determined. The present study conforms to the guidelines laid down by the Institutional Animal Ethics Committee (IAEC) and WHO for the testing of finished herbo-metallic drugs to restrict the heavy metal content within permissible limit.

Material and Methods

General consideration

Physicochemical tests like gravimetric analysis, HCl digestion were done in accordance with the reported methods (Vogel, 1986) whilst traditional tests were also carried out to standardize the final drug in accordance with classical parameters given in official pharmacopeias (Rasheed *et al.,* 2011 and Tariq *et al.,* 2013).

Collection of raw material

Iron powder procured from Merck (India Ltd.) was used. Sheer-e-Madar [Latex of *Calotropis procera* Ait (R.Br.)] was collected from the wild plant and Loab-e-Gheekawar (Exudate of *Aloe barbadensis* Mill) was obtained from the herbal garden of department of Ilmul Advia. Roghan-e-zard (clarified butter) was purchased from local dairy in Aligarh, India.

Preparation of Kushta-e-Faulad

Initially the iron powder was subjected to hot and cold immersion (metal quenching) in water after heating it at 600^0C in Muffle furnace. This process was repeated twenty times to make the iron brittle. Processed iron powder was used for making Kushta-e- Faulad by conventional as well as modern method.

Preparation by conventional method

The processed iron powder was ground with Sheer-e-Madar in a traditional mortar and small cakes were made. These cakes were then put in earthen discs and sealed with the process of Gil-e-Hikmat (mud coating) and subjected to a fire of 5 kg of cow dung cakes. It was heated three times each with Loab-e-gheekawar and Raughan zard. The temperature was monitored regularly by Digital Pyrometer at an interval of 15 minutes. The temperature was maintained at 800°C - 900°C for up to 2 hours (Fig.1, 2, 3). The whole material was allowed to cool on its own. The calcined material was ground and sieved through mesh number160 to get microfine powder. It was recommended that kushta should not be prepared in open to maintain the constant temperature in the traditional furnace (portable tandur).

Preparation by modern method

The iron was processed in the same way as described earlier and was then sealed in a silica crucible. It was heated in a muffle furnace. Heating rate was kept at 10°C/min. The maximum temperature was maintained at 900 °C for two hours then slowly cooled (Fig.4) to room temperature. For this we had divided the furnace combustion into three steps.

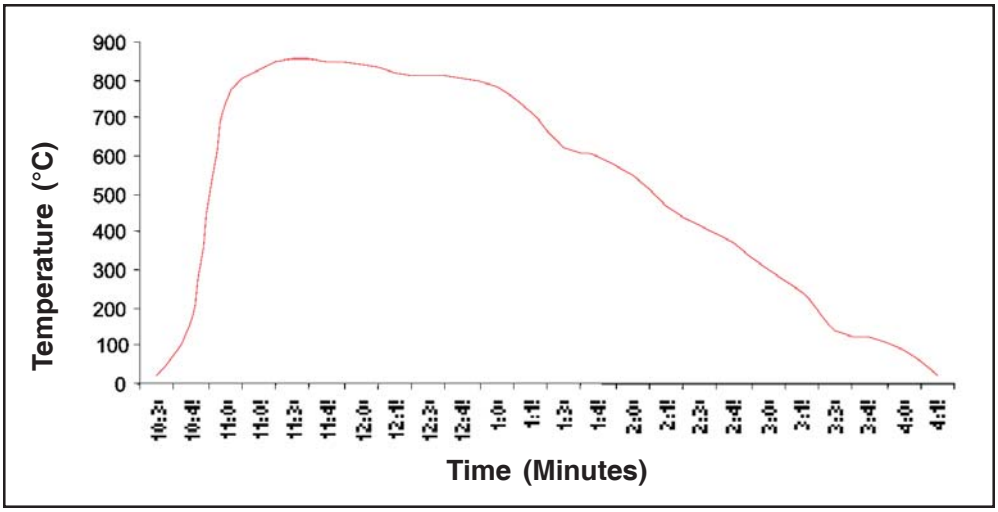


Figure 1: Heat quantification graph of kushta-e-faulad prepared by conventional method

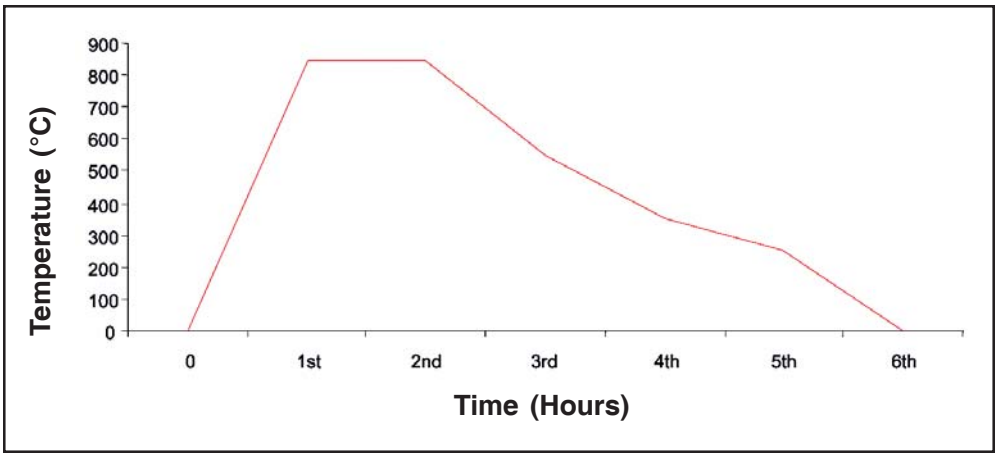


Figure 2: Heat quantification graph of kushta-e-faulad prepared by modern method

Ist step: Initial rise in temperature (25°C to 900°C in 55min)

IInd step: Maintenance of temperature (900°C for2 hours)

IIIrd step: Slow drop in the temperature (900°C to 25°C for 3 hours),

- 4th hour 900°C to 550°C.
- 5th hour 550°C to 250°C
- 6th hour 250°C to 30°C

Results and Analysis

The kushta-e-faulad is mainly iron metal in nano particulate form. The larger percentage loss in kushta-e-faulad may be attributed to more number of combustions (4 times) and many numbers of grinding steps.

Physico-chemical Tests

It includes chemical analysis of raw material (Table 1) organoleptic characters (Table. 2) and physical properties (Table.3). Loss in weight was found to be 35% and 32% prepared by conventional and modern methods, respectively. Kushta-e-faulad prepared by both the methods passes the classical physical tests of true kushta (Table 4).

Table 1: Chemical analysis of raw material

Raw Material	Density (g/ml)	Gravimetric Estimation (iron - %)
Iron powder (Merck, India Ltd.)	7.86	99.5%

Table 2: Organoleptic characters

Kushta-e-Faulad	
Colour	**Reddish Brown**
Appearance	Fine Powder
Taste	Tasteless

Table 3: Physical properties of Kushta-e-Faulad

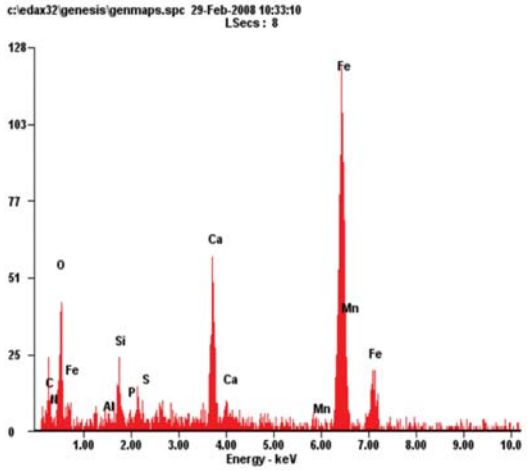
pH	6.95
Appearance	Reddish brown amorphous powder
Solubility	Light brown colour in water
% Iron (conventional)	56
% Iron (modern)	54.15

Table 4: Classical Physical tests

Kushta-e-Faulad	Metallic luster	Finger-thumb test	Still Water test
Conventional Method	Absent	+	+
Modern Method	Absent	+	+

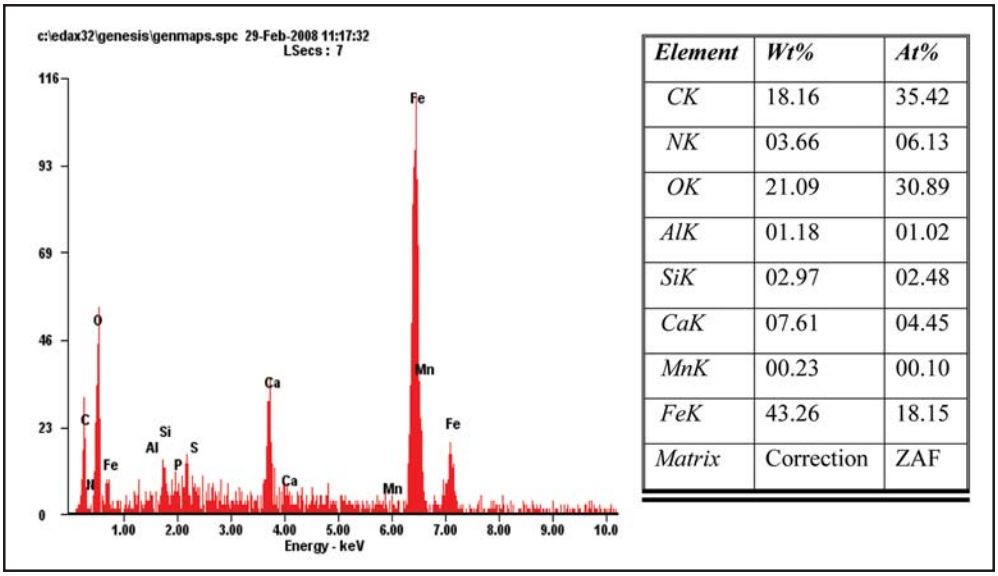
Energy Dispersive X-ray Analysis (EDAX) of Kushta-e-Faulad

Metal contents were determined by EDAX which showed that all constituents are present in the test sample. Some toxic elements have also been detected in trace amounts which are given below in the tabular and graphical form (Fig. 3 and 4).



Element	*Wt%*	*At%*
CK	04.02	10.59
OK	23.50	46.47
CuL	00.00	00.00
AsL	01.32	00.56
AlK	01.15	01.35
SiK	03.07	03.46
CaK	01.22	00.96
FeK	63.09	35.73
Matrix	Correction	ZAF

Figure 3: EDAX pattern of Kushta-e-Faulad prepared by conventional method.



Element	*Wt%*	*At%*
CK	18.16	35.42
NK	03.66	06.13
OK	21.09	30.89
AlK	01.18	01.02
SiK	02.97	02.48
CaK	07.61	04.45
MnK	00.23	00.10
FeK	43.26	18.15
Matrix	Correction	ZAF

Figure 4: EDAX pattern for Kushta-e-Faulad prepared by modern method (Muffle Furnace).

Atomic Absorption Spectroscopic (A A S) Analysis of Kushta-e-Faulad

The results show that the metals are not completely converted to oxide but major part of it remains in the elemental form. The solubility of Kushta-e- Faulad was determined by dissolving 20 mg of sample in 25 ml of aqueous hydrochloric acid at pH 4. It was found that the solubility of kushta is very poor at this pH(Table 6 and 7).

Table 5: AAS analysis of Kushta-e-Faulad prepared by conventional method

Kushta-e-Faulad	Metal	Soluble Metal Content at pH 4		Total Metal Content		Oxygen Content
		ppm	%	ppm	%	
Fe	169	0.69	514564	62.13	17.50	

Table 6: AAS analysis of Kushta-e-Faulad prepared by modern method

Kushta-e-Faulad	Metal	Soluble Metal Content at pH 4		Total Metal Content		Oxygen Content
		ppm	%	ppm	%	
Fe	203	0.76	514967	62.98	12.11	

Integrated Coupled Plasma Atomic Emission Spectroscopic (ICPAES) of Kushta-e-Faulad

ICPAES analysis shows that the samples prepared by conventional method contain impurities like Al, Mg and Ca in larger quantities as compared to the raw material. It may be due to the mixing of small parts of mud (buta) during the processing. The analysis is in agreement with the AAS analysis (Table 8).

Table 7: ICPAES results of Kushta-e-Faulad

Elements Measured	Kushta Faulad Prepared by Conventional method (in ppm)	Kushta Faulad Prepared by Modern method (in ppm)	Raw material (in ppm)
Al	4414.3	1922.95	2527.83
As	BDL	BDL	BDL
Ca	19451.52	2434.22	2817.66
Cu	561.21	414.14	406.91
Fe	481946.56	524662.81	561165.05
Hg	.....	.....	.....
Mg	7812.93	411.47	590.98
Mn	4091.09	4133.23	4333.97
Pb	254.54	216.52	249.33
Zn	688.54	682.39	1591.94

Scanning Electron Microscopic (SEM) Analysis of Kushta-e-Faulad

The surface of the particles of the Kushta-e-faulad appears to be rough and porous which increases the solubility and absorption in the living system. This is well reflected from the SEM images obtained at room temperature (Fig. 5 and 6). It has been observed that micro cracks are developed at the particle boundaries during processing. It is believed that microfine product quickly reacts with digestive juices and absorbed.

Transmission Electron Microscope (TEM) Analysis of Kushta-e-Faulad

The particle size of Kushta-e-Faulad prepared by conventional method was found to be smaller (6-11 nm) than those prepared by modern method (14-49 nm) (Fig. 7 and 8).

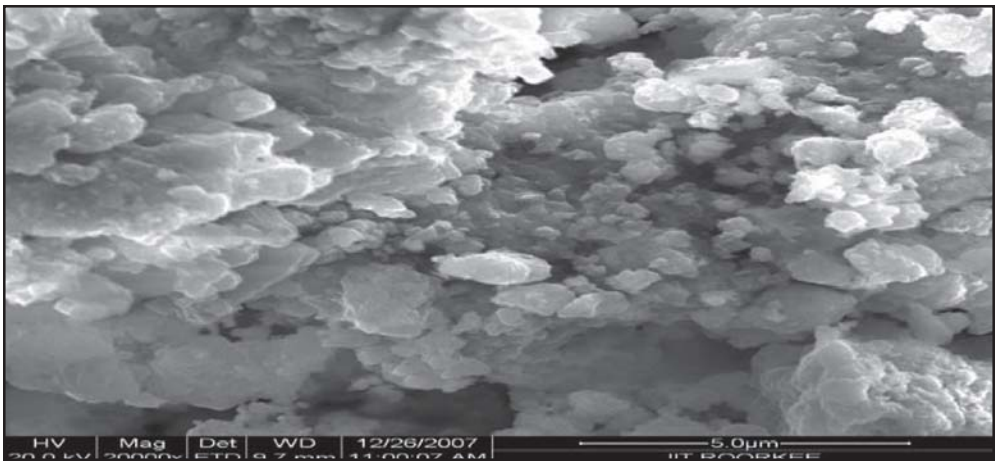


Figure 5: Scanning electron micrograph of Kushta-e-Faulad prepared by conventional method

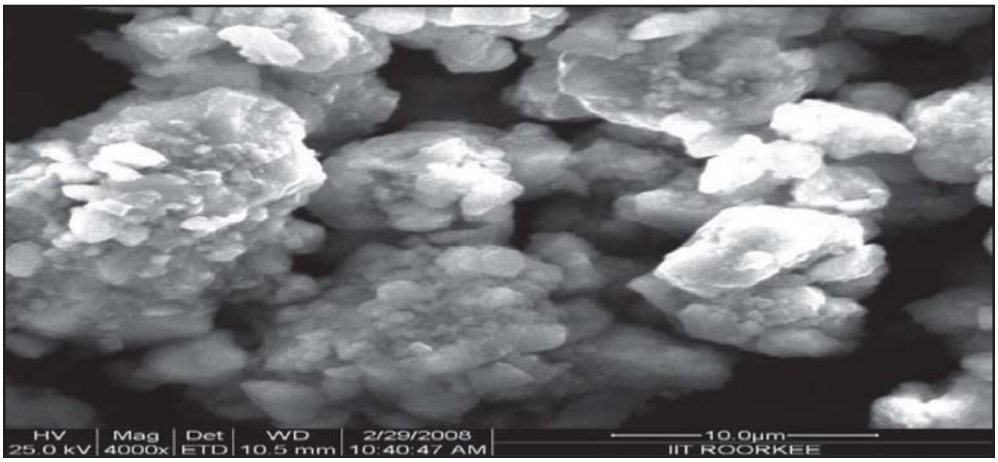


Figure 6: Scanning electron micrograph of Kushta-e-Faulad prepared by modern method

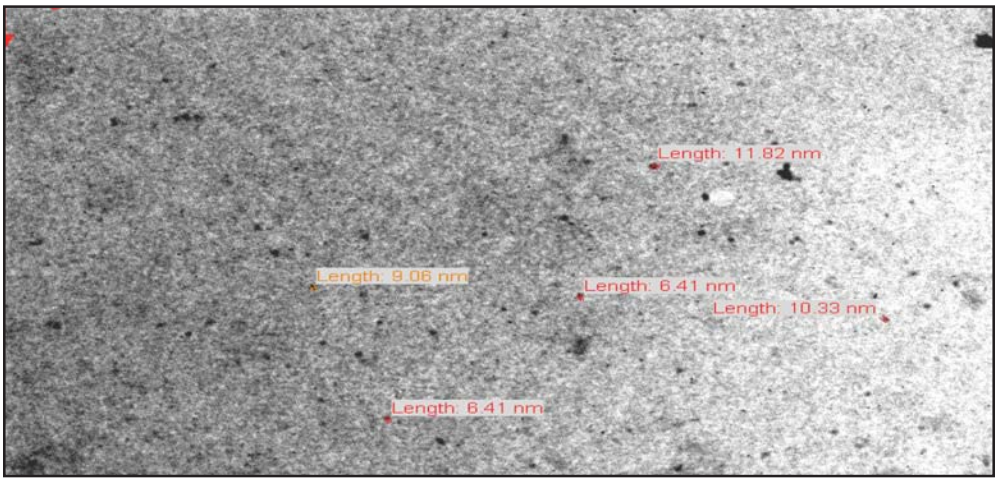


Figure 7: TEM micrograph of Kushta-e-Faulad prepared by conventional method, magnification of 11K. (Particle size: 6-11nm)

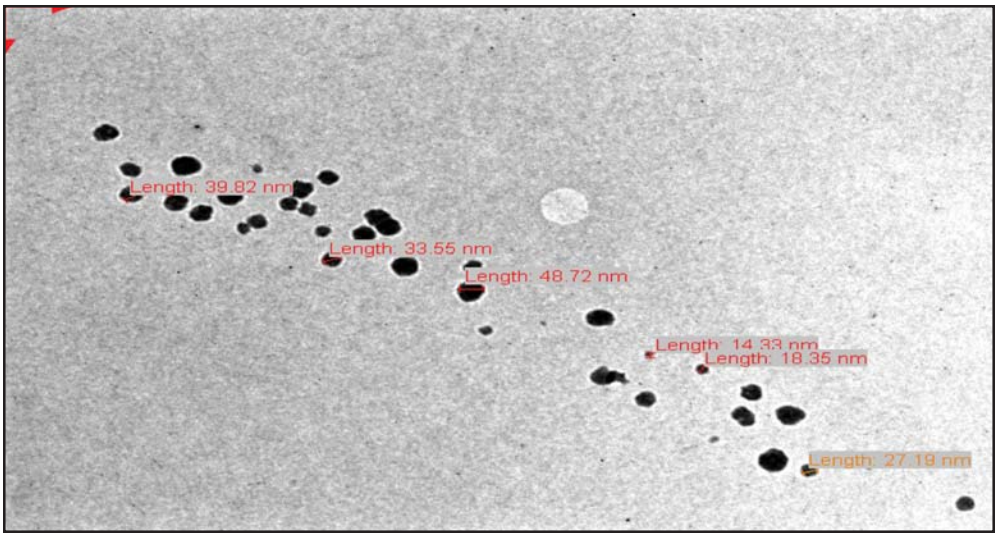


Figure 8: TEM micrograph of Kushta-e-Faulad prepared by modern method, magnification of 11K. (Particle size: 14-49nm)

Determination of LD_{50} of Kushta-e-Faulad prepared by conventional method

The results of LD_{50} of Kushta-e-Faulad prepared by conventional method were analyzed by graphical method of Miller and Tainter (1944). It was found to be 660 mg/kg body weight which means that Kushta-e-Faulad is 22 times more tolerable than its prescribed dose (Table-8 and Fig. 9).

Table 8: LD_{50} of Kushta-e-Faulad

Group	Dose (mg/kg)	Log Dose	Dead/ Total	Dead %	Corrected %*	Probit
1.	480	2.68	0/6	0	4.2	3.25
2.	540	2.73	1/6	16.7	16.7	4.05
3.	600	2.77	2/6	33.3	33.3	4.56
4.	660	2.81	3/6	50	50	5.00
5.	690	2.83	4/6	66.7	66.7	5.44
6.	840	2.92	6/6	100	95.8	6.75

* Corrected formula: for the 0% dead: 100 (0.25/n); for the 100% dead: 100[(n-0.25)/n], where n is the number of animals in the group.

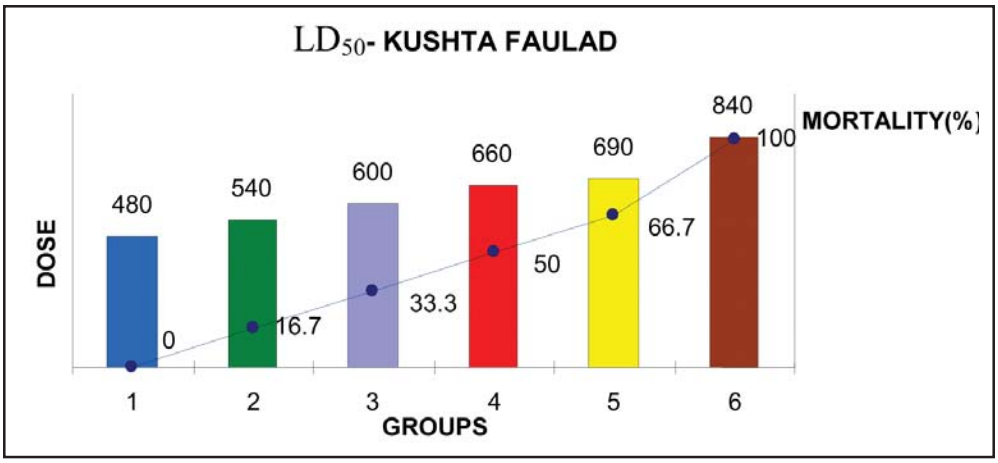


Figure 9: Depiction of LD_{50} of Kushta-e-Faulad

Discussion

Kushta-e-Faulad is a mixture of all oxides namely FeO, Fe_2O_3, Fe_3O_4 and elemental iron. The solubility also varies with pH of the solution. However, it was found that the conventional method is superior to modern method in this particular kushta preparation, as the particle size is smaller (6-11nm, Fig.8) than those prepared by modern method (14-49nm, Fig.9). It is therefore concluded that it may be more effectively absorbed when given to human subject for treatment. However, iron as such can be absorbed only if it dissolves in stomach although soluble iron salts like iron sulphate is highly soluble in biological system and easily absorbed.

Conclusion

Kushta-e-faulad prepared by both the conventional and modern method exhibit the same chemical and physical properties although there is a distinct difference in particle size. The kushta is a mixture of metal oxide and elemental metal in nano particulate form which has greater surface area due to which the absorption is enhanced.

Acknowledgement

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Ethnomedicinal Plants Used for Respiratory and Musculo-Skeletal Disorders in Spiti Valley of Trans-Himalayan Region of India*

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Abstract

Spiti valley is situated in cold desert of Trans Himalayan region of India and inhabited by *Bhot* or *Bhotia* tribal community. The average elevation of Spiti valley is about 4000 m and climate of the area is rugged, desolate and inhospitable. Many respiratory disorders such as cough, cold, asthma, pneumonia, chest infection, chronic bronchitis etc. and musculo-skeletal disorders such as joint pain, body pain, headache, muscular pain, backache are common in the area. Local people have strong belief in traditional system of medicine and still prefer to the use of herbal medicines prescribed by local herbal healers (*Amchi*). In order to study the traditional medicinal plants used for respiratory and musculo-skeletal problems in Spiti valley, the area was surveyed from 2009 to 2014. First-hand information on ethnomedicinal plants were gathered by taking interviews of local knowledgeable residents, women, elderly people, village headmen and *Amchi* (traditional doctors). A total of 88 plant species belonging to 69 genera and 30 families are reported from the study area which are used to cure various respiratory and musculo-skeletal diseases and conditions as folk treatment.

Keywords: Cold desert, Traditional folk knowledge, Medicinal plants, Trans-Himalayan region, Spiti valley.

Introduction

The Indian Himalayan Region (IHR) accounts for more than 50% of India's forest (Bahuguna *et al*., 2010 and Rodgers & Panwar, 1988). The typical topography, large altitudinal range (200-8000 m), and unique climatic conditions of the area support 18,440 species of plants out of which 1748 species are medicines (Hasan *et al*., 2009 and Samant *et al*., 1998).

The cold arid region of the Himalayas is called "Trans Himalayan region". It comprises Ladakh in Jammu and Kashmir, Lahaul and Spiti, Kinnaur, Pangi Valley of district Chamba in Himachal Pradesh, and Niti and Nelong Valley of Uttarakhand (Murti, 2001 and Srivastava, 2010). Spiti valley is a desert mountain valley in the Trans-Himalayan belt of cold desert of Himachal Pradesh which covers 7591 Km^2 area and lies between 31^0 42'-33^0 N latitudes and 77^0 37'-78^0 85' E Longitudes of India (Aswal and Mehrotra, 1999 and Negi, 1995) (Fig. 1). This Himalayan mountain fall into the region with mean altitude of 4000 m above mean sea level. It is borders Tibet on its eastern border and the Ladakh region of India on its north. The area is known for its specific topography, severe

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climate and unique vegetation (Aswal and Mahrotra, 1999; Balokhra, 2003; Murti, 2001). The area is covered with snow for more than six months in the year. The principal vegetative growth starts at the commencement of summer, when melting snow provides abundant moisture. The main type of vegetation in Spiti is dry alpine scrubs and alpine meadows; more prominent in July and August, but disappears by the end of September or by early October. Highly peculiar climate and topographical conditions of Spiti provided a wide range of medicinal, aromatic and other important plants (Kala, 2002; 2006). Spiti is a home to a purely homogenous Buddhist society who shares similarities with their neighbors in Tibet and Ladakh. The region inhabited by indigenous tribal community *Bhotia or Bhot* (Negi, 1995; Verma, 1997). Being very close to the nature tribal people possessed good knowledge of surrounding medicinal plants and their curative properties. They have ûrm belief in traditional medicines system known as the *Amchi System of Medicine* in Spiti and commonly known as *Sowa-Rigpa*. Majority of people rely on them to cure various diseases. All the villages of Spiti have at least one traditional herbal healer (*Amchi)*. *Amchis* have enjoyed high respect and social status among the local communities since time immemorial.

In recent past, efforts were made by various workers to document traditional medicine knowledge of the cold desert (Chandra Sekar and Srivastava, 2003; Devi and Thakur, 2011; Devi *et al*., 2014; Kala, 2002, 2006, Phani *et al*., 2009; Seth and Devi, 2014; Sharma *et al*., 2006; Sharma *et al*., 2011 and Singh *et al*., 2009; Singh, 2012; Singh *et al*., 2012 and Sood *et al*., 2001) in which few studies have been focused on particular ailments (Ballabh and Chaurasia, 2007, 2009; Ballabh *et al*., 2008; Chandra Sekar and Srivastava, 2005 and Lal and Singh, 2008; Singh and Lal, 2008). However, no comprehensive information has been brought out so far on the traditional uses of plants to cure respiratory and musculo–skeletal disorders. Keeping in view of rich traditional knowledge among local tribes and their high dependency on local medicinal plants, the main purpose of the present study is to document and assess the present status of traditional medicinal plants used against respiratory and musculo–skeletal problems by the tribal community of Spiti valley.

Materials and Methods

A series of ethnomedicinal surveys of the study area were carried out from 2009 to 2014 during season months May to September when the area is snow-free. Different localities of valley from altitude 3000 m to 4500 m were visited to document the traditional medicinal plants. During field surveys standard procedures were adopted for collection, preserving and identifying the specimens (Jain and Rao, 1977). Most of the plants were identified on spot and the rests were brought to the laboratory and identified through local floras flora (Aswal

and Mehrotra, 1999; Chandra Sekar and Srivastava, 2009; Chowdhery and Wadhwa, 1984; Dhaliwal and Sharma, 1999; Polunin and Stainton, 1984; Singh and Rawat, 2000). The voucher specimens were matched and compared with the authentic specimens lying with the herbarium of Botanical Survey of India (BSI), Dehradun (BSD) and deposited in the Laboratory herbarium of HPU, Shimla as reference material**.** Altitude of the area was noted down with the help of GPS (Make; Garmin GPSmap76CSx).

First-hand information on traditional knowledge related to respiratory and muscular–skeletal disorders was gathered by taking interviews of local knowledgeable residents, women, elderly people, village headmen and *Amchi* (traditional doctors). Information about the local names of the plants, part(s) used, ailments treated, mode of administration, and curative properties were recorded. The information is given in a tabular form includes scientific names of plants along with family, local names, locality with altitude, habit, parts used, ethnomedicinal uses reported, names of ailments, and modes of administration/ formulations (Table 1).

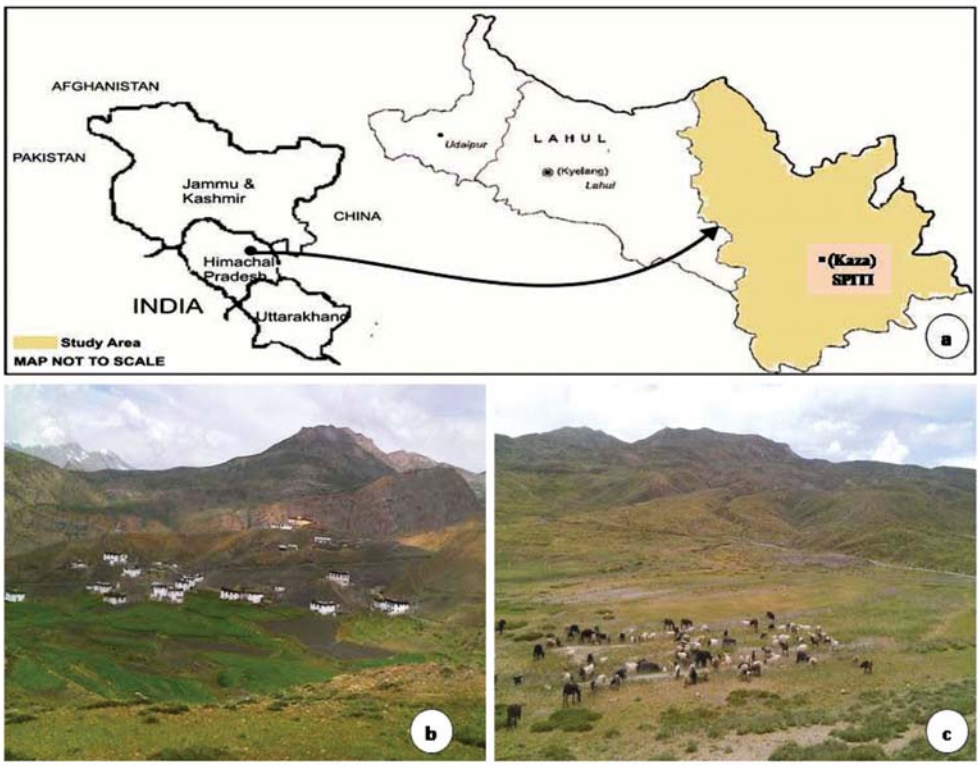

Figure 1 (a-c): (a) Map of Spiti Valley showing its position in India and Himachal Pradesh; (b) Village of study area; (c) Alpine pasture of study area

Table 1: Ethnomedicinal plants of Spiti valley used to cure respiratory and musculo–skeletal disorders

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
	Alliaceae					
1.	*Allium carolinianum* DC.	Laot	Kibber (4200 m)	H	Wp, Fl	Whole plant powder is used for body pain and swelling. Powder of flower head is used for cold.
	Amaranthaceae					
2.	*Amaranthus spinosus* L.	Zansho	Tabo (3000 m)	H	Wp	Decoction of whole plant is used for cough.
	Apiaceae					
3.	*Bupleurum falcatum* L.	Thonpu	Tackcha (4100)	H	Rt	Decoction of root is used for cold.
4.	*Bupleurum hamiltonii* Balakr.	–	Kunzum pass (4500 m)	H	Rt	Root decoction is taken for cough and influenza.
5.	*Carum carvi* L.	Mao	Lossar (4080 m)	H	Sd	Powder of seed is used for joint pain. The seed tied in cloth and socked in warm oil of Chuli (seed oil of *Prunus armeniaca* L.) and applied on the nasal area to get relieve of cold.
6.	*Ferula jaeschkeana* Vatke	Tunak, Ye	Attargo (3300 m)	H	Sd, Rt	Powder of seed and root is used for joint pain.
7.	*Heracleum candicans* Wall. Ex DC.	Chogot	Kibber (4200 m)	H	Rt	Root paste is used to get relieve from joint pain.
8.	*Semenovia thomsonii* (C.B.Clarke) Manden	Karpo	Mud (3900 m)	H	Fr	Decoction of fruits is taken for headache.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
	Asteraceae					
9.	*Anaphalis royleana* DC.	Kirchee mentok	Kunzum pass (4500 m)	H	Lf	Leaves paste is used for body pain.
10.	*Artemisia biennia* Willd.	Sar-Bung-Karpo	Tabo (3000 m)	H	Wp	Powder of whole plant is used for cough and cold.
11.	*Artemisia capillaris* Thunb.	Khamtso	Kungri (3700 m)	H	Inf	Decoction of inflorescence used to cure pneumonia. The leaves powder mixed with cow ghee and massaged on painful joint to get relief.
12.	*Artemisia maritima* L.	Atonge-carpo	Hansa (3800 m)	S	Lf	Decoction of leaves is used to cure joint pain and cough.
13.	*Centaurea depressa* M.Bieb	Pashakha	Shego (3400 m)	H	Ap	Decoction of aerial part is used for cough.
14.	*Chrysanthemum pyrethoides* (Kir. & Kir.) B. Fedtsch.	Burse	Kunzum pass (4500 m)	H	Wp	Smoke of whole plant inhaled for asthma. The whole plant as poultice is used externally for joint pain.
15.	*Cicerbita macrorhiza* (Royle) Hook. f.	Thumpu	Gulling (3600 m)	H	Ap	Powder of aerial part is used for headache.
16.	*Cousinia thomsonii* Clarke	Tawa	Dhankar (4270 m)	H	Cotton wool, Rt	Cotton wool of plant is used as acupressure for body pain and muscular pain. Root paste is used for joint pain.
17.	*Erigeron alpinus* L.	Achak	Komic (4500 m)	H	Wp, Ap	Decoction of whole plant is used for cold and cough. Powdered of aerial plant part is given to cure joint pain.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
18.	*Inula racemosa* Hook.f.	Poshakar	Mane (3600 m)	H	Rt	The roots decoction is used for cough cold and chronic bronchitis.
19.	*Lactuca orientalis* (Boiss) Boiss.	Nechak	Gette (4270 m)	S	Fl	Paste of flower is used for headache.
20.	*Leontopodium himalayanum* DC.	-	Kunzum pass (4500 m)	H	Wp	Whole plant is used as acupressure for body stress.
21.	*Saussurea bracteata* Decne.	Pang-chi-towo	Demul (4360 m)	H	Inf	Decoction of inflorescence is used for cold.
22.	*Saussurea costus* (Falc.) Lipsch.	Kusth, Pachak	Mane (3600 m)	H	Rt	Root is used for joint pain. It is also used in asthma, bronchitis and cough.
23.	*Saussurea jacea* (Klotz.) Clarke	Pang-chi	Kibber (4200 m)	H	Inf	Smoke of inflorescence is inhaled for respiratory problem (asthma).
24.	*Taraxacum officinale* Weber	Sarchen-Metok	Kibber (4200 m)	H	Ap	Aerial part in powder form is given for cough and throat infection.
25.	*Waldheimia tomentosa* (Decne.) Regel.	Lukmik	Kunzum pass (4500 m)	H	Fl & Lf	Powder of flower and leaves is given for backache.
26.	*Youngia glauca* Edgew	Seertik	Kunzum pass (4500 m)	H	Ap	Powder of aerial part is taken for headache.
	Betulaceae					
27.	*Betula utilis* D.Don	Takpa	Chhatru (3360 m)	T	Bk	Decoction of bark is used for joint pain

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
	Boraginaceae					
28.	*Arnebia euchroma* (Royle ex Benth.) I.M. Johnston	Khamet	Gette (4270 m)	H	Rt	Powder of root is used to control cough and lung problem.
29.	*Arnebia guttata* Bunge	Dimok	Tabo (3000 m)	H	Rt	Powder of root is also used for cough.
30.	*Lindelofia stylosa* (Kar. & Kir.) Brand	Shora	Hikkim (4200 m)	H	Wp	Past of whole plant is used on swelling.
31.	*Lepidium latifolium* L.	Chulti	Gulling (3600 m)	H	Ap	Aerial part powder is used for joint pain.
32.	*Sisymbrium irio* L.	Khubkalan	Gulling (3600 m)	H	Sd	Seeds powder is used in asthma, throat and chest infection.
	Campanulaceae					
33.	*Codonopsis clematidea* (Schrenk) Clarke	Ludud- nakpo	Kibber (4200 m)	H	Ap	Powder of aerial part is used for joint pain.
34.	*Codonopsis ovata* Benth	Ruchukpa	Gulling (3600 m)	H	Rt, Lf	Powder of root is used for joint pain. Roots and leaves poultice is applied to swollen joint.
	Capparaceae					
35.	*Capparis spinosa* L.	Chileep	Poh (3300 m)	S	Fr	Fruit is use to cure joint pain.
	Caprifoliaceae					
36.	*Lonicera spinosa* (Jacq. ex Decne) Walp.	Trapa	Kyoto (3850 m)	S	Fl	Decoction of flower is used for headache.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
	Caryophyllaceae					
37.	*Cerastium cerastoides* (L.) Britton.	Suppa	Kibber (4200 m)	H	Wp	Powder of whole plant is used for cough.
	Chenopodiaceae					
38.	*Chenopodium botrys* L.	Zanchi	Hull (3800 m)	H	Wp	Extraction of whole plant is used for headache.
	Crassulaceae					
39.	*Rhodiola cretinii* (R. Hamet) H. Ohba.	Solo-marpo	Kunzum pass (4500 m)	H	Rz	Decoction of rhizome is used for asthma.
40.	*Rhodiola himalensis* (D. Don) S. H. Fu	Solo mukpo	Tackcha (4100)	H	Wp	Whole plant is used for asthma.
	Cuperaceae					
41.	*Juniperus recurva* Buch.-Ham. ex D.Don.	Thellu	Mane (3600 m)	S	Sd	Seed oil is massage on painful joint.
	Elaeagnaceae					
42.	*Hippophae rhamnoides* L.	Chharma, Tarpo	Shego (3400 m)	S	Fr	Extraction of fruit is used against cough.
43.	*Hippophae tibetina* Schlecht	Chharma	Losar	S	Fr	Extraction of fruits is used for cough.
	Ephedraceae					
44.	*Ephedra gerardiana* Wall. ex Stapf.	Chhedum	Tabo (3000 m)	S	Ap, Fr	The decoction of aerial part is given for joint pain, asthma, pneumonia and chronic bronchitis. Juice of berry is given in affection of respiratory passage.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
45.	*Ephedra intermedia* Schrenk et C.A. Meyer	Khaut	Kibber (4200 m)	S	Ap	Decoction of aerial part is used for relieving bronchial spasm.
	Fumariaceae					
46.	*Corydalis govaniana* Wall.	Togsil	Demul (4360 m)	H	Rt	Decoction of root is used for joint pain.
	Gentianaceae					
47.	*Gentianopsis paludosa* (Hook.) Ma	Tikta	Kibber (4200 m)	H	Ap	Decoction of aerial part is used in headache.
48.	*Lomatogonium carinthiacum* (Wulf.)A.Br	—-	Kunzum pass (4500 m)	H	Fl	Powder of flower is used for cough, cold and joint pain.
49.	*Swertia cuneata* D. Don	Tikta	Kungri (3700 m)	H	Wp	Decoction of whole plant is used for cough, cold and headache.
50.	*Geranium pratense* L.	Pollo-Mendok	Sagnam (3650 m)	H	Wp	Powder of whole plant is used for cough.
	Lamiaceae					
51.	*Dracocephalum heterophyllum* Benth.	Toksa, Jibkar	Lhalung (3660 m)	H	Wp	Whole plant is used for cough and headache.
52.	*Hyssopus officinalis* L.	Tyangu	Sagnam (3650 m)	H	Wp	Paste of crushed herb is used for muscular rheumatism.
53.	*Mentha longifolia* (L.) Huds.	Khoit	Lidang (3470 m)	H	Lf	Leaves powder is used to treat headache. A fine paste of leaves is used on the painful joint.
54.	*Nepeta discolor* Royle. ex Benth	Khot	Kunzum pass (4500 m)	H	Lf	Leaves powder is used for cold and cough.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
55.	*Nepeta longibracteata* Benth.	Gipachi	Chichum (4200 m)	H	Lf, Fl	Powder of leaves and flower is used for joint pain.
56.	*Nepeta podostachys* Benth.	Ribusksu	Kunzum pass (4500 m)	H	Ap	Aerial part decoction is used for cough.
57.	*Thymus linearis* Benth.	Pedumba	Kyoto (3850 m)	H	Wp	Decoction of whole plant is used for whooping coughs, cold and headache.
	Malvaceae					
58.	*Malva verticillatta* L.	Chyamba	Poh (3300 m)	H	Wp	Extraction of whole plant is used for cough, cold, irritation of throat and joint pain.
	Morinaceae					
59.	*Morina coulteriana* Royle	Achakser	Gue (3200 m)	H	Fl	Decoction of flowers is used for joint pain.
	Orobanchaceae					
60.	*Orobanche alba* Steph.	Bongtosigcha	Sagnam (3650 m)	H	Ap	Decoction of aerial part is given for joint pain.
	Fabaceae					
61.	*Oxytropis cachemiriana* Camb.	Sumuk	Lossar (4080 m)	H	Lf	Extraction of leaves is used for cold and cough.
62.	*Thermopsis lanceolata* R. Br. ex Aiton	Chuthup	Komic (4500 m)	H	Fl & Sd	Flower and seed powder is used for joint pain.
63.	*Trigonella pubescens* Edgew. ex Baker.	Pusukhang	Rangrik (3715 m)	H	Lf & Fl	Powder of leave and flower used to cure chest infection.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
	Polygonaceace					
64.	*Bistorta affinis* (D.Don.) Greene	Retheram	Tackcha (4100)	H	Lf, Fl, Rt	Leaves and flower dried and ground in to a fine powder. One table spoon of powder is taken to cure cough and cold. Root chewed for throat irritation.
65.	*Rheum australe* D.Don. Wall.	Chhucha	Mane (3600 m)	H	Rt	Root powder is used for asthma and bronchitis. The dry root powder mixed with mustard oil and massage on painful joint. Root paste is used for muscular swelling.
66.	*Rumex nepalensis* Spreng.	Chuomsa	Kibber (4200 m)	H	Rt	Root powder is used for joint pain.
67.	*Rumex patienta* L.	Shyomang	Sagnam (3650 m)	H	Rt	Roots paste is used for swelling and joint pain.
	Primulaceae					
68.	*Androsace mucronifolia* Watt	Zingsolo	Mud (3900 m)	H	Lf	Powder of leaves is used for cough.
69.	*Primula denticulata* Smith	Mendok-Karpo	Mud (3900 m)	H	Wp	Whole plant is used for headache.
70.	*Primula reptans* Hook.f. ex Watt.	Sangtik	Kunzum pass (4500 m)	H	Fl	Powder of flowers is used for headache and cough.
	Ranunculaceae					
71.	*Aconitum heterophyllum* Wall. ex Royle	Bhonga	Mane (3600 m)	H	Rt	Root powder taken orally for cough.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
72.	*Aconitum rotundifolium* Kar. & Kir.	Bonkar	Chichum (4200 m)	H	Rt	Root powder is used for cough and headache.
73.	*Aconitum violaceum* Jacq. ex Stapf	Ponkhar	Chichum (4200 m)	H	Rt	Decoction of root powder is used for cold, cough and joint pain.
74.	*Aquilegia fragrans* Benth.	Ludud-dorge	Ki (3800 m)	H	Ap	Powder of aerial part is used for joint pain.
75.	*Aquilegia moorcroftiana* Wall. ex Royle	Semok	Rangrik (3715 m)	H	Ap	Powder of aerial part is used for joint pain.
76.	*Thalictrum minus* L.	Chaka-chu	Langza (4400 m)	H	Ap	Decoction of aerial part is used for joint pain.
	Rosaceae					
77.	*Potentilla bifurca* L. (Rosaceae)	Lande-mentho	Kiber (4200 m)	H	Lf	Extraction of leaves is used for headache.
78.	*Potentilla multifida* L. (Rosaceae)	Seetaka	Rangrik (3715 m)	H	Lf	Decoction of leaves is used for cold.
79.	*Prunus armeniaca* L. (Rosaceae)	Chuli, Chult	Tabo (3000 m)	T	Sd	The warm seed oil is massaged for joint pain.
80.	*Rosa webbiana* Wall. ex Royle	Siamendo	Lidang (3470 m)	S	Fr	Powder of fruit is used for headache.
81.	*Sibbaldia parviflora* Willd.	Padam	Kunzum pass (4500 m)	H	Lf	Extraction of leaves is used for joint pain.

S. No.	Taxa with family	Local name	Locality with altitude	Life form	Part Used	Traditional uses
	Saxifragaceae					
82.	*Bergenia stracheyi* (Hook. f. & Thoms.) Engle.	Khilche	Kunzum pass (4500 m)	H	Rt	Paste of root is used for joint and body pain.
	Scrophulariaceae					
83.	*Pedicularis bicornuta* Klotzsch ex Klotzsch and Garcke	Lukru-karpo	Sagnam (3650 m)	H	Ap	Aerial part Powder is used for joint pain.
84.	*Pedicularis pectinata* Wall. ex Benth.	Lugru Marpho	Lossar (4080 m)	H	Wp	The whole plant in powder form is used for body ache, cold and cough.
85.	*Picrorhiza kurrooa* Royle ex Benth.	Honglen	Demul (4360 m)	H	Rz	The paste of fresh rhizome is applied to cure joint pain. Powder of dried rhizomes used for joint pain, cold, cough and asthma.
86.	*Vebascum Thapsus* L.	Nho Sarje	Kurith (3200 m)	H	Lf	The paste of leaves is used for joint pain.
	Solanaceae					
87.	*Hyoscyamus niger* L.	Thuklang	Dhankar (4270 m)	H	Sd, Fl	Smoke of seed inhaled for asthma and whooping cough. Leaves paste externally employed for joint pain.
	Tamaricaceae					
88.	*Myricaria germanica* (L.) Desv. ssp. *alopecuroides* (Schrenk) Kitamura	Umbo	Schlichillig (3365 m)	S	Lf	Leaves powder is used for chronic bronchitis. Paste of aerial part is used for joint pain.

Abbreviation: Ap: Aerial part, Fl: Flower, Fr: Fruit, H: Herb, Inf: Inflorescence, Rt: Root, Rz: Rhizome, S: Shrub, Sd: Seed, T: Tree, Wp: Whole plant

Figures 2(a-p): Some ethnomedicnal plants of Spiti valley

Figure (a-p): (a) *Aconitum heterophyllum* Wall. ex Royle; (b) *Aconitum violaceum* Jacq. ex Stapf; (c) *Allium carolinianum* DC.; (d) *Arnebia euchroma* (Royle ex Benth.) I.M. Johnston; (e) *Artemisia maritima* L.; (f) *Aquilegia fragrans* Benth.; (g) *Capparis spinosa* L.; (h) *Ephedra gerardiana* Wall. ex Stapf.; (i) *Hippophae rhamnoides* L.; (j) *Hyssopus officinalis* L.; (k) *Hyoscyamus niger* L.; (l) *Lomatogonium carinthiacum* (Wulf.)A.Br; (m) *Rhodiola cretinii* (R. Hamet) H. Ohba.; (n) *Rosa webbiana* Wall. ex Royle; (o) *Pedicularis bicornuta* Klotzsch ex Klotzsch and Garcke; (p) *Verbascum thapsus* L.

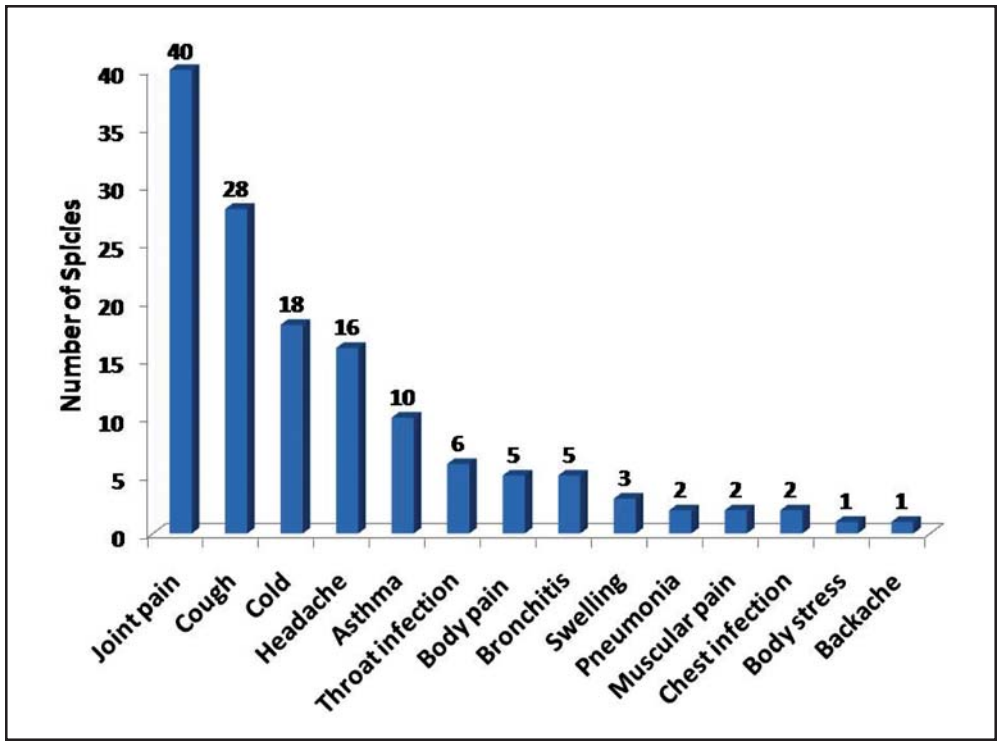

Figure 3: Number of plant species used to cure different ailments.

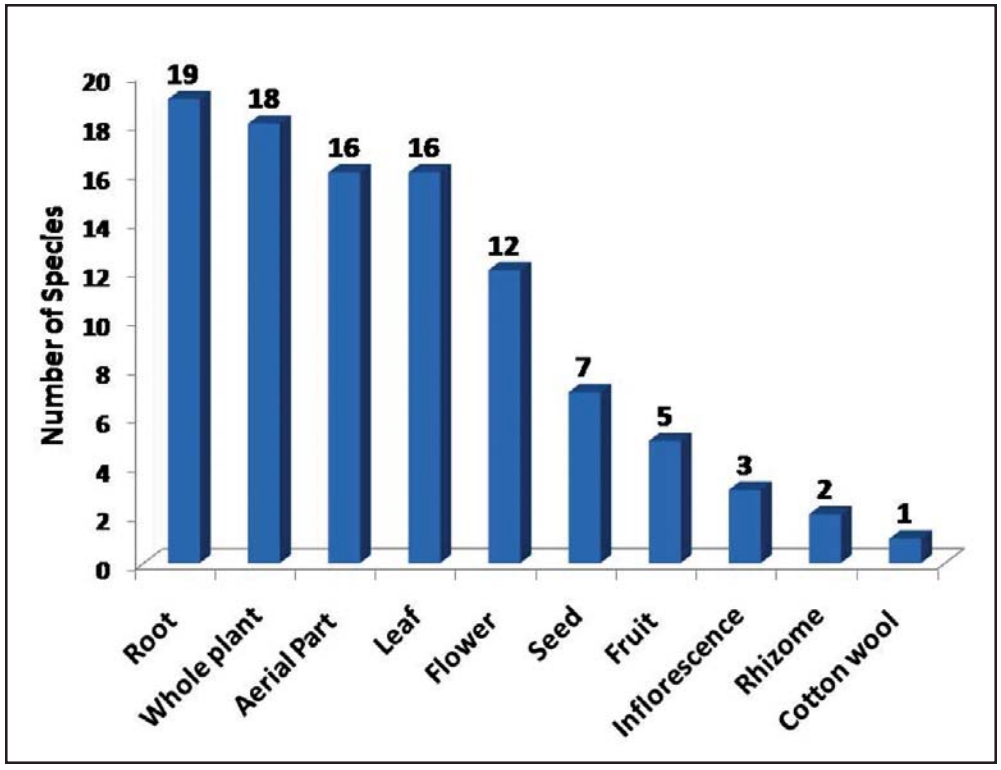

Figure 4: Different plants part used for herbal medicine preparation.

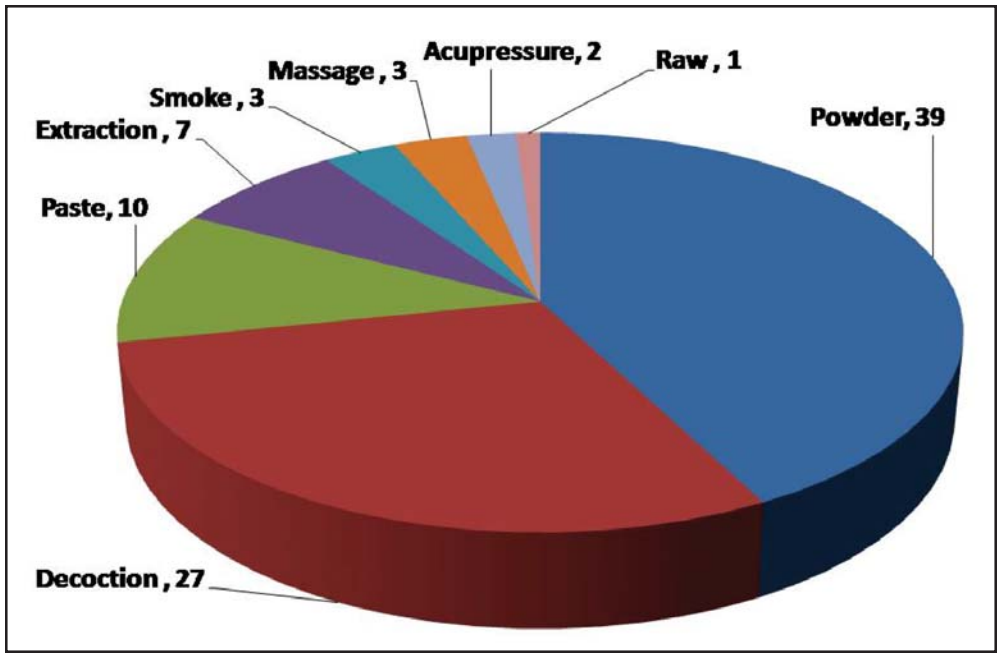

Figure 5: Pie diagram showing different form of herbal medicine preparation.

Results and Discussion

The present studies have revealed that the tribes of the Spiti valley possess good amount of indigenous knowledge on medicinal plants. Tribal lifestyles of the study area have blended harmoniously with the surrounding nature, and they are considered as "eco-friendly people''. They have made use of maximum surrounding plants resources to cure various diseases. Almost every third plant growing in the area is used by the people in one form or the other. Traditional herbal medicine remains the ûrst choice for primary healthcare for many diseases, especially for the inhabitants who cannot afford expensive pharmaceuticals. Respiratory problems such as cough, cold, asthma, pneumonia, chest infection, chronic bronchitis and musculo–skeletal disorders such as joint pains, body pain, swelling, headache, muscular pains, body stress and backache are very prominent in the study area. Due to cold and harsh environment ailments like cough, cold, asthma, pneumonia, joint pain are very common among all of above, if not treated properly in the initial stages, the problem may become chronic. The traditional healer (*Amchi)* possess good knowledge about the diagnosis of diseases and their treatment. They use various types of herbs, shrubs and trees available in their surroundings for treatment of diseases. The medicines are prescribed only after proper check-up the sign-symptoms and stage of the disease. In the present study, some 88 plant species belonging to 69 genera and 30 families were collected which are used to cure various respiratory and musculo–skeletal disorders (Table 1 & Fig. 2). Plant species of Asteraceae family are maximum used for herbal preparations (18 spp.), followed

by Lamiaceae (7 spp.), Apiaceae (6 spp.), Ranunculaceae (6 spp.), Boraginaceae (5 spp.), Rosaceae (5 spp.). Rest of the families are represented by less than five species. As area falls under alpine zone, herbs (75 spp.) are dominated and easily available for medicinal use followed by shrubs (11 spp.) and tree (2 spp.).

Of these, 63 species are used for musculo-skeletal disorders and 45 species for respiratory disorders, out of which 41 species are only used for musculo–skeletal disorders, 23 species only for respiratory disorders and 22 species for both problems. Highest number of plant species (40 spp.) are used for joint pain followed by cough (28 spp.), cold (18 spp.), headache (16 spp.), asthma (10 spp.), throat infection (6), body pain and bronchitis (5), swelling (3 spp.). Rest of ailments are cured by either one or two species (Fig. 3). The highly interesting findings for joint pain, cough, cold and asthma in present study need detailed analyses and validation. Many of the plant species used by local healers are of great importance and found in Ayurveda and Unani, the traditional health care systems of India (Chauhan, 2003; 2009; Dey, 1980; Kapoor, 1990 and; Kritikar and Basu, 1981).

The different plant parts used for medicinal purposes are root (19 spp.), whole plant (18 spp.), leaf and aerial part (16 spp. each), flower (12 spp.), seed (7 spp.), fruit (5 spp.), inflorescence (3 spp.), rhizome (l 2 spp.), cotton wool of plant (1 spp.) (Fig. 4). Both fresh and dried parts of the plant are used for the preparation of medicine. Generally, for winter season, when the areas covered by snow and fresh plant parts are not available, the herbal products are dried, and preserved for future use. In the present study maximum 39 species are used in powder form followed by decoction (27 spp.), paste (10 spp.), extraction (7 spp.), smoke form (3 spp.), massage (3 spp.), aqua pressure (2 spp.), consumed raw (1 spp.) (Fig. 5). The administration of the herbal medicinals is mostly internal in the form of powder, decoction and extraction. Paste is applied topically specially for joints pain, body pain and headache. Most of the formulations of herbal plants are taken once or twice a day as a full dose, depending on age, health and types of ailment. Sometime, to cure some respiratory problem, such as asthma and whooping cough, smoke of the plant part is inhaled viz., *Chrysanthemum pyrethoides* (Kir. & Kir.) B. Fedtsch, *Hyoscyamus niger* L., *Saussurea jacea* (Klotz.) Clarke. In case of body stress, body ache and muscular pain, the rounded ball of cotton wool obtained from surface of stem and branches of *Cousinia thomsonii* Clarke and sometime whole cottony plant (*Leontopodium himalayanum* DC) is used in the form of aqua pressure to get relief from the ailment. The root of *Bistorta affinis* (D.Don.) Greene is consumed raw for throat irritation.

During the study it is observed that the tribal peoples of Spiti valley inherit a rich traditional knowledge and documentation of this knowledge provides novel

information from the area. However, this medicinal plant diversity is being constantly severely affected due to modernization, destruction of forests, urbanization, and overgrazing. Moreover, high percentage use of underground parts (root and rhizome) and whole plant use is, in fact, a negative note, as over extraction of underground parts and whole plant may badly affect the population status of the species. Furthermore, existing knowledge on traditional uses of medicinal plants is fast declining due to lack of interest of local youth. Therefore, in order to conserve medicinal plants and their use from becoming disappear, some management measures are to be taken jointly with the participation of local communities, via village administrative council etc. Most of the high altitude medicinal plant species have great importance in pharmaceutical industry of the country (Chauhan, 2011). Therefore, information regarding commercial use of medicinal plants may be disseminated among the local farmers. This would be a viable option of income generation as well as species conservation which can help to reduce the pressure on wild stocks. Thus, the present documentation of traditional knowledge will not only help in its conservation but could also be of great use from pharmaceuticals point of view.

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Pharmaco-Botanical Studies on Some Powdered Herbal Drugs for Their Diagnostic Characteriza-tion-II

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Abstract

The identity of ingredients is basic requirement to establish the quality of a herbal formulations. To identify a powdered herbal drug organoleptic, macro and microscopic evaluation is essential requirement diagnostic characteristics for reference. In the present studies powdered herbal drugs *viz*. *Acorus calamus* Linn., *Asparagus racemosus* Willd., and *Calotropis procera* R.Br. are subjected for pharmaco-botanical studies leading to their diagnostic characterrization.These findings can be employed to establish the identity of powdered herbal ingredients in a formulation or dosages form.

Keywords: *Acorus calamus* Linn., *Asparagus racemosus* Willd., *Calotropis procera* R.Br.. Powdered herbal drug.

Introduction

The identity of ingredients in a herbal formulation is utmost requirement to ensure the quality, safety and efficacy of medicine. Ayurvedic, Siddha and Unani formulations consists majorly ingredients of plant origin. A number of classical and patent and proprietary medicines are available in powdered form. Churna, Kvatha Churna (in ayurveda), Churnam and Kudineer Churnam (in siddha) and Sufoof (in unani) are classical dosages in powdered form. Other dosages forms such asVati, Gutika (in ayurveda),Mathirai,Vadagam (in siddha), Huboob,Aqras (in unani),tablets and capsules also comprise powdered ingrdients which are indenticale.The identity of powdered herbal drug either as an independent ingredient or in a dosages form can be established by pharmaco-botanical studies (macroscopic, organoleptic and microscopic evaluation). In this communication diagnostic characteristics of powdered herbal drugs derived from of *Acorus calamus* Linn. (rhizome), *Asparagus racemosus* Willd. (root) and *Calotropis procera* R.Br. (root) are studied. These herbal drugs are specifically used in a number of formulations of Ayurveda, Siddha and Unani medicines.

Acorus calamus Linn. (Family-Araceae) is botanical source of ayurvedicdrug 'Vacha'. It is an aromatic marshy herb and its rhizomes are credited with a number of medicinal properties in different pathies viz. ayurveda, siddha, unaniand modern medicine. It is official in Ayurvedic, Siddha and Unani Pharmacopoeia of India. It is the *Calamus aromaticus* of mediaeval writers and possibly the 'Acorn' of the Greek physicians. The derivation of generic name of the plant is supposed to be form *Acorn* (a-primitive), *kore* (pupil of the eye), with reference to its medicinal properties. It is a native of Eastern Europe and Central Asia, but has become widely diffused by cultivation. It was introduced in India

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at a very early time. Besides medicinal utility of the plant, the leaves and rhizomes are employed for flavouring drinks, for perfumery and for insecticides. The rhizome possess insecticidal activity against bed bugs, moths, lices etc. The plant is described in classical texts of Ayurveda such as Abhidhanmanjari, Ashtang Hridya, Bhav Prakash Nighantu, Charak Samita, Haridayapriya, Raj Nighantu, Sushruta Samhita etc. The drug is often adulterated with *Alpinia galanga*Willd. (Family-Zingiberaceae) and *A. officinarum* Hence (Herman, 1868; Watt, 1889-93; Anonymous, 1948, 1978; Chunekar, 1972).

Asparagus racemosus Willd. (Family-Liliaceae), a straggling undershrub is source of 'Shatavari' which is an official Ayurvedic drug. The generic name of the plant is derived from *A*(-intensive) and *sparasso*(-to tear) due to some of the species being armed with strong prickles. It is native of East Indies. The plant is reputed for a number of medicinal properties and is also employed in veterinary practices as a demulcent. In ancient literature of Ayurveda e.g. Abhidhanmanjari, Ashtanghridaya, Bhav Prakash Nighantu, Chakradutta, Charak Samhita, Kabhidhanmanjari, Nighantu Ratnakar, Raj Nighantu, Shaligram Nighantu, Sharangdhar, Shushruta Samhita etc. The drug is prescribed for a number of aliments. The source of the drug is referred from different species of *Aspargus*. The other species attributed for the source of 'shatavari' are *A. adscendens* Roxb., *A. currilus* Buch.-Ham., *A. fillicinus* Buch.-Ham.,*A. gonoclados* Baker, *A. sarmentosus* Linn. etc. These species are generally substituted for the prescribed official species in commerce (Herman, 1868; Anonymous, 1948, 1978; Chunekar, 1972).

Calotropis procera R. Br. (Family-Asclepiadaceae) is equated with 'Arka' which is regarded as an official Ayurvedic drug. It is an evergreen, hardy undershrub and in traditional medicine. It is used as a substitute for Ipecacuanha (*Cephaelis ipecacuanha*(Stokes) Baill, Family-Rubiaceae) in dysentery. The fresh milk of the plant is said to be employed for infanticide. The generic name *Calotropis* taken from *Kalos*(-beautiful) and *tropis* (-a keel), alluding to the keel of the flower. The plant is native of Persia. The plant is attributed medicinal in number of classical texts of Ayurveda e.g. Astang Hridaya, Bhav Prakash Nighantu, Dhanvantari Nighantu, RajNighantu,Shaligram Nighantu,Sushruta Samhita etc. The roots of the *C. gigantea* Ait. are substituted for drug (Herman, 1868; Anonymous, 1950, 1978; Nadkarni, 1854; Chunekar, 1972).

Material and Methods

The herbal drugs *Acorus calamus* Linn. (rhizome), *Asparagus racemosus* Willd. (root) and *Calotropis procera* R.Br. (root) selected for present study were collected from the natural habitats and authenticated by complying the

macroscopoical characteristics of these drugs with that of standard reference drug samples available in the museum-cum-herbarium of the Pharmacopoeial Laboratory for Indian Medicine, Ghaziabad, India. To study the powder microscopy, the drugs were first washed thoroughly under running tap water to remove any dust or soil particles and then air dried for few days at room temperature or in shade. The dried drugs were then powdered and pass through 120 µm sieve. The fine powder obtained through sieve 120 µm was then subjected to various histo-chemical tests and the temporary mounts of powder prepared to observe under light microscope (Jackson and Snowdon, 1968; Johansen, 1940; Youngken, 1951).

Results and Conclusion

Powdered herbal drugs derived from *Acorus calamus* Linn. (rhizome), *Asparagus racemosus* Willd. (root) and *Calotropis procera* R.Br. (root) were subjected for evaluating organoleptic characteristics (Table-2).Powdered herbal drug were

Table 1: Status of Herbal drugs in different official compendium and systems of medicine

S. No.	Botanical Name	Official Name	Pharmacopoeia	Formulary
1.	*Acorus calamus* Linn.	Vaca	Ayurvedic Pharmacopoeia of India, Part-I, Vol.-II	Ayurvedic Formulary of India, Part-I
		Waj Turki	Unani Pharmacopoeia of India, Part-I, Vol.-V	-
		Waj-e-Turki	-	National Formulary of Unani Medicine, Part-I
		Vasambhu	-	Siddha Formulary of India, Part-I
2.	*Asparagus racemosus* Willd.	Satavari	Ayurvedic Pharmacopoeia of India, Part-I, Vol.-IV	Ayurvedic Formulary of India, Part-I
		Tannirvittan kilanku	Siddha Pharmacopoeia of India, Part-I, Vol.- II	-
		Thannirvittan	-	Siddha Formulary of India, Part-I
		Satawar	Unani Pharmacopoeia of India, Part-I, Vol.-VI	-
		Satawar	-	National Formulary of Unani Medicine, Part-I
3.	*Calotropis procera* R.Br.	Arka	Ayurvedic Pharmacopoeia of India, Part-I, Vol.-I	Ayurvedic Formulary of India, Part-I
		Aak	Unani Pharmacopoeia of India, Part-I, Vol.-IV	-

examined under microscope and characteristics cellular elements and ergastic contents observed in these drugs are given in Table-3.The characters observed may serve as diagnostics for identification of these drugs in a various powdered formulation.TLC/HPTLC are frequently used for detecting and identifying herbal

Table 2: Organoleptic characteristics of herbal drugs

S. No.	Botanical Name	Organoleptic Characteristics	
		Entire drug	**Powdered drug**
1.	*Acorus calamus* Linn.	The drug consists of dried rhizome which are sometimes scrapped or peeled. The rhizome is dark brown in colour, sub-spongy, cylindrical, slightly flattened and branched. It is longitudinally splitted into sub-cylindrical pieces which are 7.9-10.5 cm in length and 1.0-3.5 ci in dimeter. The surface of the unpeeled drug has annulate nodes due to remanents of bud scales. Upper surface exhibits the triangular leaf scars and hair like fibers.The unsurfaced of the rhizome has the remanents of root which are prominent. The older rhizome is marked with alternately arranged broadly triangular large transverse leaf scars which almost encircle the rhizome. The rhizome after drying is much shrunken and deeply wrinkled longitudinally. The peeled rhizome is cream-yellow in colour and root scars are comparatively fewer. The rhizome breaks easily with sharp, short fracture exhibiting porus, whitish interior differentiated into central and peripheral region.	The powder drug is brownish in colour with characteristics strong aromaticodour. It has bitter slightly acrid in taste.
2.	*Asparagus racemosus* Willd.	The drug comprises of dried tuberous succulent roots which arise adventitiously from the root stock. The tuberous dry roots are cylindrical in the middle, tapered towards the ends and brown in colour. Surface of fresh roots are easily removable cover glistening material inside. The drugs are either entire roots or longitudinally broken pieces. The drug in dimension measure 10.0-24.0 cm in length and 0.5-2.5 cm in dimeter. Surface of dried roots exhibit deep irregular longitudinal furrows and minute transverse wrinkles due to shrinkage during drying. The broken pieces of the drug have irregular uneven transverse surface and hollow cavity in the center. The broken pieces of the drug have tapering end or middle portion of the drug devoid of tapering ends. The drug is hard, however, it breaks with a short fracture.	The powdered drug is brown in colour, odourless and slightly mucilaginous in taste. The taste retain bitter blend if chewed for a little time.

S. No.	Botanical Name	Organoleptic Characteristics	
		Entire drug	Powdered drug
3.	*Calotropis procera* R.Br	The dried matured tap roots are used as drug. The roots designated as drug are either in entire form or without bark. Sometimes root bark is also utilized as drug. The roots are simple, whitish-grey in colour with wrinkles, curved woody appearance and exhibit marks of sap exudation on the surface. The covering bark is spongy, more or less fissured lengthwise and longitudinally furrowed imparting rough appearance to root. The inner portion of peeled bark is smooth and mucilaginous. The roots are generally cut into pieces with vary in sizes, generally measure 6.0-18.0 cm in length and 1.5-6.0 cm in diameter. The pieces of root of upper origin nearby to stem are with prominent and somewhat rounded top and rest of the portion is spirally curved bearing scars or remains of root branchlets. The roots exhibit characteristic short transverse cracks on the outer side of the bends. It has incomplete fracture and the bark gets easily separated from the root.	The powder drug is pale yellowish in colour with bitter taste and has no specific odour.The root is bitter in taste and has no specific odour.

Table 3: Diagnostic microscopic characteristics of powdered herbal drugs

S. No.	Botanical Name	Diagnostic Microscopic Characters		
		Cellular elements	Ergastic contents	
			Starch Grains	Calcium Oxalate Crystals
1.	*Acorus*	Fragments of thick-walledepidermis, a few fibers of fibro vascular bundles, abundant spherical to oval thin walled parenchymatous cell of ground tissue of cortex and stele containing starch grains occasionally, some cells are also filled with yellow globules of volatile oil, lignified vessels are either single or in groups, often fragmented and have annular, reticulate, scaliriform or spiral thickening. A few fibers which are thin walled and pitted are also found in fragments and some of them are partially associated with an inconspicuous calcium oxalate prism sheath.	Starch grains are small, spherical to ovoid and fairly abundant.	Calcium oxalate crystals are prismatic in nature and are found independently or enclosed in cells.

S. No.	Botanical Name	Diagnostic Microscopic Characters		
		Cellular elements	Ergastic contents	
			Starch Grains	Calcium Oxalate Crystals
2.	*Asparagus racemosus* Willd.	Fragments of piliferous layer, occasionally with remains of root hairs; abundant thick walled, irregularly outlined, compact, parenchymatous cells of outer cortex, thin walled, circular to oval parenchymatous cells with intercellular spaces of inner cortex and pith. Occasional pitted stone cells which are in either single or in groups of two to three cells or associated with parenchymatous cells are also present, lignified vessels with reticulate or pitted thickening are fragmented and found singly or in small groups.	–	The acicular crystals of calcium oxalate; which are fairly common are found scattered either complete or in fragments. Most of the crystals in raphide form fill some of the parenchymatous cells.
3.	*Calotropis procera* R.Br	Fragments of phellem cells, abundant parenchymatous cells of phelloderm, some of them containing starch grains or occasionally crystals of calcium oxalate, very occasional fragments of phloem showing patches of small celled sieve tubes embedded in phloem parenchyma and a few medullary ray cells filled with starch grains, vessels which are singly or in groups are fragmented and have bordered pits or occasionally scalariform thickening, fibers are not very common and wherever observed were found to be fragmented or singly or in groups, lactiferous vessels which did not commonly occur, appeared as slender anastomosing stared containing fine granular material.	Starch grains are fairly abundent, which are either simple with simple with distinct hilum or compound with two components.	The prismatic and rosette crystals of calcium oxalate which are not fairly common, are also found scattered or occasionally in the parenchymatous cells.

ingredients in formulations, but the pharmaco- botanical evaluation to confirm the presence or absence of the herbal ingredients in the formulations have advantage over chemical methods as later is simple and inexpensive. In addition, the pharmaco-botanical evaluation of herbal preparations is also helpful to detect any deviation from the official formulation not declared on the label.Microscopical examination of herbal drugs also reveals the presence/absence of adulterant, substitute, foreign matter and contamination in drug. Pharmaco-botanical evaluation of powdered herbal drugis a rapid and simple test to establish the identity utilizing less amount of sample.

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Exploration of Unani Medicinal Plants in Jammu & Kashmir and Strategy for Their Conservation and Cultivation

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Abstract

Based on a series of medicinal plants exploration trips conducted in different forests of Jammu & Kashmir for over two decades, the paper highlights 28 taxa of important Unani drugs. Each taxa enumerated has been provided with information on botanical name, Unani and English name(s), voucher specimen number, locality and the therapeutic action and uses as mentioned in Unani text. Some of the important medicinal species for the area studied are; *Achillea millefolium* Linn. (Biranjasif), *Aconitum heterophyllum* Wall. (Atees), *Artemisia maritima* L. (Darmana), *Bergenia ciliata* (Haw) Sternb. (Pakhanbed), *Colchicum luteum* Baker (Suranjan), *Delphinium denudatum* Wall. ex H & T (Jadwar), *Picrorhiza kurroa* Royle ex Benth. (Kutki), *Saussurea lappa* (Dcne) Sch. Bip (Qust) etc. (Fig. 1). Study reveals that some of these species are on the verge of extinction on account of their over-exploitation by drug industry and in local use; therefore, strategy for their conservation and protection has been suggested.

Keywords: Medicinal plants, Conservation, J&K., Unani drugs.

Introduction

Forests have been a source of invaluable medicinal plants wealth since man realized the preventive and curative properties of plants. It is estimated that about 80% of world's population depends on plants or plant products in traditional forms of medicine for primary health care needs. However, more than 70% medicinal plants collection from forests involves destructive harvesting. Consequently, there has been a serious threat to their genetic stock and biodiversity. Under such situation, there is a need for systematic exploration of plants in different parts of the country and suggest measures for their conservation. Besides, there is also an upsurge in the investigation on ethnopharmacological uses of medicinal plants from different forests and rural areas, particularly the tribal pockets to record this fast disappearing wisdom to discover new therapeutic agents unknown to medical science. Based on this rationale, the present paper deals with 28 taxa of highly important Unani drugs collected from J&K forests. Need for conservation and protection of such medicinal plants which are on the verge of extinction because of their over-exploitation has been re-stressed.

The Study Area:

The state of Jammu and Kashmir belongs to the northern part of India. It is situated in the western part of great Himalaya. The valley of Kashmir, in the state

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is known to the world as 'Paradise on the Earth'. The hilly and mountainous forests in the state harbor diverse type of natural flora. Botanical exploration in Jammu and Kashmir state dates back to the close of the first quarter of the last century. Different researchers and academicians have undertaken floristic studies in forest areas of the state (Sapru *et al*., 1975; Dar *et al*., 1983a, 1983b; Dhar & Kachroo, 1979; 1980; 1982; 1983a; 1983b; Dhar & Siddiqui, 1986; Dhar e*t al*., 1999; Yousuf *et al*., 1986; Jee *et al*., 1989). But none of the workers have recorded comprehensive data on medicinal plants used in Unani system of medicine. Moreover, in the lesser and inner Himalaya, there are certain places which are either unexplored or under-explored. This is perhaps, because of the rough and dangerous terrain and also due to rigorous weather conditions, like heavy snowfall and rainfall and frequent landslides, which blocks the risky tracks for most part of the year. As a result these areas become difficult to approach.

Material and Methods

Data presented in this paper is based on series of medicinal plants collection trips conducted in the study area for over two decades. All species of plants available during survey were collected alongwith information on their local name, habit and habitat, flower colour & hue, ethnopharmacological uses (where available) and other such characters which can not be deduced in the laboratory from inspection of herbarium sheets. In the laboratory all voucher specimens have been processed in customary may (Jain & Rao, 1976), botanically identified and deposited in the herbarium of Survey of Medicinal Plants Unit of Regional Research Institute of Unani Medicine, Srinagar (J&K), for future reference and study.

The medicinal plants specimens have been further screened for their use in Unani Medicine with the help of available text (Ibn-e-Sina, 1887; Majusi, 1889; Ghani, 1926; Ibn-e-Baitar, 1985; Kabeeruddin, 2007). Of these, present paper deals with 28 such important taxa that are widely used in Unani medicine.

Enumeration

The important plants species collected and identified from the study area are arranged in alphabetical order by their botanical name. Data on each species is presented in the following sequence: botanical name, family; Unani name; English name; locality and voucher specimen number followed by therapeutic action and uses as per Unani text.

Figure 1-6: Important Medicinal Species of the Study Area

1. *Achillea millefolium* L. (Biranjasif)

2. *Aconitum heterophyllum* Wall ex Royle (Atees)

3. *Berberis aristata* DC. (Zarishk)

4. *Bergenia ciliata* (Haw) Sternb. (Pakhanbed)

5. *Colchicum luteum* Baker (Suranjan)

6. *Crocus sativus* L. (Zafran)

Figure 7-12: Important Medicinal Species of the Study Area

7. *Cydonia oblonga* Mill. (Behi)

8. *Delphinium denudatum* Wall. ex H & T (Jadwar)

9. *Orchis latifolia* Linn. (Salab Misri)

10. *Picrorhiza kurooa* Royle ex Benth (Kutki)

11. *Saussurea lappa* (Dcne) Sch. Bip (Qust)

12. *Viola odorata* L. (Banafsha)

Achillea millefolium L. (Asteraceae)

Unani name: Biranjasif

English name: Yarrow

Locality and Voucher specimen no.: Tunnel top, 113

Therapeutic action and uses as per Unani texts: Diaphoretic, stimulant, tonic, emmenagogue. Useful in cold, obstructed perspiration and fever.

Aconitum heterophyllum Wall. ex Royle (Ranunculaceae)

Unani name: Atees

English name: Aconite

Locality and Voucher specimen no.: Kargil, 1068

Therapeutic action and uses as per Unani texts: Antiperiodic, aphrodisiac, astringent, retentive, nervine tonic. Used in bronchitis, fever, diarrhoea, dysentery, piles, polymenorrhagia, facial paralysis, hemiplegia, tremor.

Adiantum capillus-veneris L. (Adiantaceae)

Unani name: Parsiaoshan

English name: The Maidenhair Fern

Locality and Voucher specimen no.: Prang, 2236

Therapeutic action and uses as per Unani texts: Anti-Inflammatory, lithotriptic, expectorant, diuretic, desiccant. Useful in catarrh, cold, cough, fever.

Althaea officinalis L. (Malvaceae)

Unani name: Khatmi

English name: Marsh Mallow

Locality and Voucher specimen no.: Zabarwan, 1900

Therapeutic action and uses as per Unani texts: Root demulcent, emollient; Infusion of flowers; given in bronchial catarrh and in bronchitis.

Artemisia absinthium L. (Asteraceae)

Unani name: Afsanteen

English name: Wormwood

Locality and Voucher specimen no.: Prang, 1196

Therapeutic action and uses as per Unani texts: Flowers: vermicide, tonic. Used in intermittent fever.

Artemisia maritima L. (Asteraceae)

Unani name: Darmana

English name: Wormseed

Locality and Voucher specimen no.: Naranag, 1571

Therapeutic action and uses as per Unani texts: Flower head-exhilarant, deobstruent, diuretic, vermicidal, demulcent, expectorant. Useful in intestinal worm, asthma, hiccough, dysentery and fever.

Atropa accuminata Royle (Solanaceae)

Unani name: Luffah

English name: Indian Belladonna

Locality and Voucher specimen no.: Gulmarg, 179

Therapeutic action and uses as per Unani texts: Sedative, anesthetic, anti-inflammatory. Used in rheumatism, gout, muscular pain, chronic cough, palpitation.

Berberis aristata DC. (Berberidaceae)

Unani name: Darhald, Rasaut, Zarishk

English name: Indian Burberry

Locality and Voucher specimen no.: Sonmarg, 1007

Therapeutic action and uses as per Unani texts: repellent, sedative, constipative. Useful in fever and conjunctivitis.

Bergenia ciliata (Haw) Sternb. (Saxifragaceae)

Unani name: Pakhanbed

English name: Bergenia

Locality and Voucher specimen no.: Apharwat, 1894

Therapeutic action and uses as per Unani texts: Diuretic. Useful in renal and vesicular calculus.

Cichorium intybus L. (Asteraceae)

Unani name: Kasni

English name: Cichory

Locality and Voucher specimen no.: Harwan, 1139

Therapeutic action and uses as per Unani texts: De-obstruent, diuretic, blood purifier. Useful in swelling of liver and spleen.

Colchicum luteum Baker (Liliaceae)

Unani name: Suranjan

English name: Colchicum

Locality and Voucher specimen no.: Kupwara, 332

Therapeutic action and uses as per Unani texts: Sedative, anti-inflammatory. Useful in joint pain, piles.

Crocus sativus L. (Iridaceae)

Unani name: Zafran

English name: Saffron

Locality and Voucher specimen no.: Pampore, 1134

Therapeutic action and uses as per Unani texts: Anti-inflammatory, detergent, cardio-tonic, brain tonic. Useful for liver inflammation.

Cydonia oblonga Mill. (Rosaceae)

Unani name: Behi

English name: Quince

Locality and Voucher specimen no.: Dhara, 1147

Therapeutic action and uses as per Unani texts: Exhilarant, diuretic, tonic for heart, brain, liver and spleen. Useful in palpitation, bilious diarrhoea.

Delphinium denudatum Wall. ex H & T (Ranunculaceae)

Unani name: Jadwar

English name: Delphinium

Locality and Voucher specimen no.: Poshkar, 1445

Therapeutic action and uses as per Unani texts: Antidote to poison, exhilarant tonic for vital organs, anti-inflammatory, demulcent, coctive, antipyretic, lithotriptic, sedative. Useful in phlegmatic and bilious fevers.

Hyoscyamus niger L. (Solanaceae)

Unani name: Ajwain Khorasani, Bazrulbanj

English name: Henbane

Locality and Voucher specimen no.: Mahadev, 1174

Therapeutic action and uses as per Unani texts: Sedative, anesthetic, haemostatic. Useful in cough and joint pain, sciatica, toothache, gout.

Iris ensata Thunb. (Irridaceae)

Unani name: Irsa

English name: Iris

Locality and Voucher specimen no.: Dhara, 1945

Therapeutic action and uses as per Unani texts: Anti-inflammatory, demulcent, emetic, expectorant, desiccant, diuretic, antidote. Useful in phlegmatic disorders, catarrh, coryza, asthma, jaundice.

Mentha arvensis L. (Lamiaceae)

Unani name: Pudina, Nana

English name: The March Mint

Locality and Voucher specimen no.: Hazratbal, 1141

Therapeutic action and uses as per Unani texts: Coctive, anti-inflammatory, demulcent, vermicidal, sedative, diuretic, emmenagogue, diaphoretic, carminative, stomachic. Useful in abdominal disorders, loss of appetite.

Morus alba L. (Moraceae)

Unani name: Shahtoot

English name: White Mulberry

Locality and Voucher specimen no.: Batapora, 1743

Therapeutic action and uses as per Unani texts: Diuretic, laxative, deobstruent, appetizer, aphrodisiac, deobstruent, renal tonic, brain humectant, liver corrective. Used in palpitation, throat pain.

Nepeta cataria L. (Lamiaceae)

Unani name: Badranjboya

English name: Catmint

Locality and Voucher specimen no.: Naranag, 155

Therapeutic action and uses as per Unani texts: Exhilarant, cardio-tonic. Used in cardiac disorders.

Orchis latifolia Linn. (Orchidaceae)

Unani name: Salab Misri

English name: Salep

Locality and Voucher specimen no.: Tunnel, 127

Therapeutic action and uses as per Unani texts: Nervine tonic, aphrodisiac, spermatogenic, inspissate to semen.

Paeonia emodi Wall. ex Hk. f. (Paeonaceae)

Unani name: Ood Saleeb

English name: Himalayan Peony

Locality and Voucher specimen no.: Verinag, 31

Therapeutic action and uses as per Unani texts: Antispasmodic, nervine tonic. Useful for epilepsy, convulsion, neurasthenia.

Picrorhiza kurooa Royle ex Benth (Scrophulariaceae)

Unani name: Kutki

English name: Gentian

Locality and Voucher specimen no.: Gumri, 674

Therapeutic action and uses as per Unani texts: Stomachic, carminative, laxative, vermicide, antipyretic, useful in indigestion, fever, intestinal worms, dropsy.

Plantago major L. (Plantaginaceae)

Unani name: Bartang

English name: Plantain

Locality and Voucher specimen no.: Koulpathri, 2064

Therapeutic action and uses as per Unani texts: constipative, retentive useful in diarrhoea dysentery, piles and polymenorrhagia.

Polygonum viviparum L. (Polygonaceae)

Unani name: Anjabar

English name: Bisstort

Locality and Voucher specimen no.: Wangat, 1534

Therapeutic action and uses as per Unani texts: Constipative, styptic, stomachic, intestinal tonic, antiseptic. Useful in diarrhoea, bleeding, anorexia, bleeding piles, nausea.

Salix caprea L. (Salicaceae)

Unani name: Bed Mushk

English name: Musk Willow

Locality and Voucher specimen no.: University campus, 57

Therapeutic action and uses as per Unani texts: Cardio-tonic, demulcent, exhilarant. Useful in palpitation, weakness of heart, liver and abdomen.

Saussurea lappa (Dcne) Sch. Bip (Asteraceae)

Unani name: Qust

English name: Costus Root

Locality and Voucher specimen no.: Razdhani, 2162

Therapeutic action and uses as per Unani texts: Detergent, anti-inflammatory, desiccant, nervine tonic, expectorant, analgesic, carminative, vermicide, diuretic, emmenagogue. Useful in facial paralysis, hemiplegia, trembling, rheumatism, gout, inflammation of spleen worm infestation, amenorrhoea.

Solanum nigrum L. (Solanaceae)

Unani name: Enabus-Salab, Mako

English name: Black Night Shade

Locality and Voucher specimen no.: Dharwanee, 1221

Therapeutic action and uses as per Unani texts: Anti-inflammatory, repellent, desiccant, sedative. Used in swelling of liver, spleen, intestine, uterus, pharyngitis, tonsillitis.

Viola odorata L. (Violaceae)

Unani name: Banafsha

English name: Sweet Violet

Locality and Voucher specimen no.: Gulmarg, 174

Therapeutic action and uses as per Unani texts: Alterative, demulcent, diaphoretic. Used in fevers, coryza, catarrh, pneumonia, cough, sore throat.

Results and Discussion

Data included in the paper reveals that 28 plants species used in Unani system of medicine were found mostly growing wild as well as under cultivation. During the course of field studies it was observed that numerous plants are commonly used by the natives as folk drugs. Based on the therapeutic action and uses recorded from the Unani text, it was observed that most of the species included in the paper have been duly reported exhibiting potential effect on the diseases prevalent among the inhabitants of the state due to cold climatic conditions, such as cold & cough and other respiratory disorders, joints pain, fever etc. It has been found that majority of the plants species reported in the paper have effective role to treat such ailments in local population of the study area.

It was observed that forests, the major amass of medicinal plants diversity have considerably declined in recent decades for various reasons including rapid industrialization and urban development, over grazing and heavy extraction of crude drugs, fuel and fodder etc. These activities have resulted into deterioration of potential habitats of medicinal plants. Hence, some important medicinal species have become scarce e.g., *Aconitum heterophyllum* (Atees), *Artemisia maritima* (Darmana), *Inula royleana* (Rasan), *Saussurea lappa* (Qust), *Picrorhiza kurrooa* (Kutki) etc. It is felt that many more plants species of medicinal value in the area may be decreased in number soon, if such activities continue to be practiced.

As already stressed by earlier workers, there is an urgent need of combined efforts, to protect and conserve the biological diversity of the area. In view of this some measures are suggested for protecting and conserving diversity of medicinal plants.

1. Public awareness programme about conservation of wild medicinal plants species may be intensified.
2. Sensitive habitats of the threatened flora should be protected on priority basis.
3. Illegal extraction of medicinal plants from the wild should be checked.
4. Social forestry operation of fuel, fodder and fibers species should be encouraged.
5. Agro-techniques for cultivation and preservation of high demand medicinal plants of the area should be developed.
6. Promoting the rationale and sustainable utilization of medicinal plants.
7. In order to protect and propagate the threatened species, botanical gardens should be established at different agro-climatic zones.
8. Large scale cultivation of scarce, endangered and threatened species may be planned, particularly to meet the demand of plant material for medicinal and other commercial purposes to reduce the pressure on existing wild population of the flora.
9. Local farmers should be encouraged to take up cultivation of medicinal plants particularly in wastelands and orchards.
10. Local medicine men should be involved in the conservation efforts, since they use plant remedies in their homes and are generally respected by the villagers.

As far as the status of Unani medicinal plants in the state of Jammu and Kashmir is concerned, no specific report(s) is available so far. Therefore, it is suggested that;

1. The forest areas of the state may be explored extensively to record maximum number of Unani medicinal plants.
2. The species collected may be properly identified botanically as well as for Unani nomenclature.
3. Controversy, if any, regarding Unani/Tibbi name may be ruled out.
4. An update and comprehensive data on the findings may be compiled.

As a result, the database so prepared on plant materials in systematic and scientific manner will be of immense importance to the scientists, researchers, academicians, pharmaceutical industries and others interested in Unani Medicine.

Acknowledgements

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Ethnopharmacological Uses of Medicinal Plants in Jannaram Forest Division of Telangana, India

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Abstract

The present study is based on an ethno-medico-botanical survey of Jannaram forest division in Adilabad district of Telangana, conducted in November 2012. The survey revealed forty contemporary folk-medicinal claims comprised of thirty-nine plants taxa extensively used by the Gonds, Nayakapodus, Kolams, Pardhans and Lambadas tribal communities for the treatment of various ailments like; jaundice, urinary tract infections, rheumatic pains, cough, intermittent fevers and bone fractures etc. Information on botanical name, family, Unani name(s), collection number with locality, name of the tribe, part(s) used, name of the diseases against which the plants are used and mode of administration with dosage are given for each claim discussed. The data provided could be utilized to discover new drugs of natural origin by the systematic intervention of pharmacological and clinical trial studies.

Keywords: Ethnomedicobotanical survey, Jannaram forest, Folk medicine, Tribes, Telangana.

Introduction

India has a rich legacy of utilization of medicinal plants in the healthcare system since centuries. It varies greatly within the country and region. The knowledge of folk medicines has been generated by the various ethnic/indigenous communities during the adaptation and survival process, and accumulated through generations by virtue of traditions (Husain *et al*., 2015). The tribal communities are the megastore of traditional knowledge. The use of the plants as folk-medicine for the cure of various ailments among the tribal people is truly commendable and phenomenal. Proper documentation of the information is need of the hour as the traditional knowledge about the folk-medicine is gradually declining from generation to generation. Based on this rationale, the present work was undertaken and deals with the information on folk medicinal plants of the area studied.

The Study Area

The area of study was Jannaram forest division which lies in the central portion of Adilabad district between latitudes 18^0 55' 21" and 19^0 09' 5" N and longitudes $78^0$55' 10" and 79^0 14' 5" E. Geographical area of the division is 925.27 Km^2, which is 5.7 % of the area of the district. The temperature varies from 15^0C to 40^0C. Average annual rainfall of the division is 750 mm, received mainly from south-west monsoons. The notified forest area of the division is 617.94 Km^2,

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which is 66.78 % of the geographical area. As per Champion and Seth's classification (Champion and Seth, 1968), the forests division falls under Tropical Dry Deciduous and Bamboo Mixed Forests.

The areas explored (Fig. 1) during the present study includes Maruthi Nagar, Jannaram, Kawwal, Alinagar, Dongapalli, Balanpur, Kolam gudem, Gandi Gopala Puram and Islampur. Various tribal groups like Gonds, Nayakapodus, Kolams, Pardhans and Lambadas etc inhabit all these areas. These tribal people are living in thick forest zones and have their own religious and social traditions. The older generation possesses very useful knowledge of the local flora as folk-medicine as they acquired this knowledge from their ancestors.

Methodology

Extensive field work was conducted in the study area during November 2012. The information were collected through questionnaires, interview and discussions

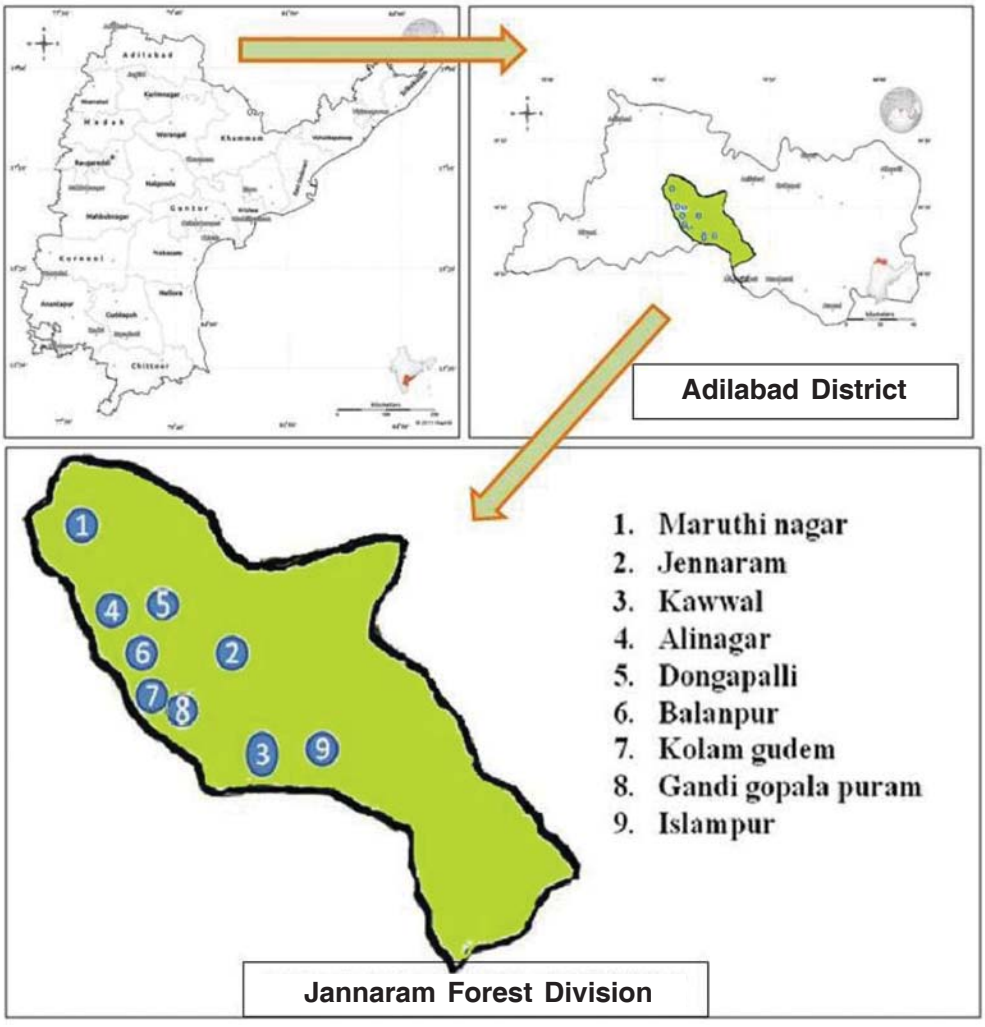

Figure 1: Map of the study area

in the local Telugu language with the reliable informants such as tribal traditional healers and villagers. The questionnaire allowed responses on the plant, medicinal uses of its part, method of preparation (i.e., decoction, paste, powder and juice), mode of the administration, dosage, form of usage (either fresh or dried) and whether the plants used either singly or in combination of other plants. All the plants were identified with the help of related flora "The Flora of Presidency of Madras" by Gamble (1936) and other authentic literature. Voucher herbarium specimens of collected plants were prepared and deposited in the herbarium of Survey of Medicinal Plants Unit of Central Research Institute of Unani Medicine (CRIUM), Hyderabad, for future reference and study.

Enumeration of Folk Medicinal Species

The taxa used as folk-medicine are arranged in alphabetical order in the sequence: botanical name, family, voucher specimen number, Unani name (wherever available), local name, habit, name of the disease(s), method of preparation, administration and name of informant and his community are given as;

Abrus precatorius L. (Fabaceae) SMPU/CRI-Hyd 11181, Ghunchi, Guriginja; Leaves; Dental disorders; Climber; Chewing the leaves strengthens the gums. (Gonds/Misram isru)

Albizia lebbeck (L.) Benth. (Mimosaceae); SMPU/CRI-Hyd 11146; Siras; Dirisana; Leaves;Antidote; Tree; Leaves powder is claimed as antidote for scorpion sting. (Gonds/ Sidem Chandu)

Anisomeles indica (L.) O.Kuntze. (Lamiaceae) SMPU/CRI-Hyd 11123, Adabeera; Leaves; mosquito repellent; Herb. Whole plant is claimed as mosquito repellent. (Gonds/ Sidem Chandu)

Anogeissus latifolia Wall. ex. Guill. & Perr. (Combretaceae) (Fig. 2) SMPU/CRI-Hyd 11145, Gul-e-Dhawa, Chirumaanu; Root bark; Obesity; Tree. Daily consuming of root bark powder decreases the body weight (Gonds/ Sidem Chandu)

Aristolochia elegans Mast. (Aristolochiaceae), SMPU/CRI-Hyd 11169 Nagamalli; Root; Antidote; Climber. Root powder is claimed as essential drug for snake bite, especially for the bite of Black Cobra (Gonds/ Bheem)

Bacopa monnieri (L.) Pennell. (Scrophulariaceae) SMPU/CRI-Hyd 11166, Neeri Sambraani Mokka; . Whole plant; Hydrocephalus; Herb. Whole plant is claimed to reduce Hydrocephalus (Gonds/ Bheem).

Anogeissus latifolia

Cassia auriculata

Diospyros melanoxylon

Cleome gynandra

Figure 2: Important Unani Medicinal Plants of Jannaram Forest division

Bambusa arundinacea Willd. (Bambusaceae) SMPU/CRI-Hyd 11133, Tabasheer; Seeds; Cough; Tree. Bongu-veduru. Seeds are made into powder and administered orally to relieve cough (Kolams/ Maruthi rao)

Basella alba L. Var. Rubra (L.) Stewart. (Basellaceae), SMPU/CRI-Hyd 11172, Poh, Bachali; Young leaves; Impotency; Climber. In-taking of young leaves daily increases sperm count (Gonds/Badhi Rao).

Cassia auriculata L. (Caesalpiniaceae) (Fig. 2), SMPU/CRI-Hyd 11159 Tarwar, Tanghedu; Leaflets; Ascariasis; Shrub. Daily consuming of 3-5 leaflets, works as *vermifuge (*Gonds/ Telanga Rao*)*

Cassia occidentalis L. (Caesalpiniaceae) SMPU/CRI-Hyd 11129 Kasondi, Kasinta; Rheumatic pains; Seeds; Shrub. Seeds are made into paste and same is kept externally on affected area to get immediate relief from rheumatic pains (Kolams/ Maruthi rao).

Cissus quadrangularis L. (Vitaceae) SMPU/CRI-Hyd 11193, Hadjode, Nallaeru; Whole plant; Bone fracture; Climber. Whole plant is ground into paste and same is kept on affected area by bandaging with a cloth, is a best remedy for bone fracture (Gonds/ Misram Maru).

Cleome gynandra L. (Cleomaceae) (Fig. 2) SMPU/CRI-Hyd 11141, Hulhul, Vaaminta; Leaves; Headache; Herb. External application of leaf juice on forehead relieves severe headache (Gonds/ Sidem Chandu).

Clerodendrum phlomides L.f. (Verbenaceae) SMPU/CRI-Hyd 11135; Tekali; Oedema; Root; Shrub; Root paste, about 3-5gr., is given orally, and stops accumulation of extra body fluid in oedema patients (Gonds/ Sidem Sankar|).

Dichrostachys cinerea Wight & Arn. (Mimosaceae) SMPU/CRI-Hyd 11138, Veluthuru Chettu; Roots; Rheumatic pains; Small Tree; Shade dried roots are pounded into powder. This powder is mixed with lime water to get jelly appearance and finally applied on joints to get immediate relief from rheumatic pains (Gonds/ Sidem Chandu).

Diospyros ferrea (Willd.) Batch. f. (Ebenaceae); SMPU/CRI-Hyd 11138; Uti; Leaves; Acidity; Small Tree; Shade dried leaves are pounded to powder and administered orally, about 5-8gm., daily once, relieves acidity.

Diospyros melanoxylon Roxb. (Ebenaceae) (Fig. 2); SMPU/CRI-Hyd 11179; Beedi Aaku; Fruits; Ascariasis; Tree. Fruits are edible and work as *vermifuge (*Gonds/Misram isru).

Emilia sonchifolia (L.) DC. (Asteraceae); SMPU/CRI-Hyd 11149; Muyalccevi; Leaves; Night blindness; Herb. Leaves are made into powder and administred orally, about 4gm., daily, for six months stops Night blindness (Gonds/ Sidem Chandu).

Ficus microcarpa L.f. (Moraceae); SMPU/CRI-Hyd 11131; Yerrajuvvi; Roots; Wounds; Tree. Roots are pulverized and powder is applied externally on wounds, to heal them (Kolams/ Maruthi rao).

Heliotropium indicum L. (Boraginaceae); SMPU/CRI-Hyd 11174; Nagadanti; Ringworm infections; Whole plant; Herb. Whole plant is ground and applied externally to relieve ringworm infections (Gonds/ Badhi Rao).

Hemidesmus indicus (L.) Schult. (Asclepiadaceae); SMPU/CRI-Hyd 11189; Ushba; Sugandhi; Root; Blood diseases; Climber. Root powder of this plant is claimed as blood purifier (Gonds/ Misram Maru)

Hibiscus rosa-sinensis L. (Malvaceae); SMPU/CRI-Hyd 11140; Gul-e-Gurhal; Mandara; Petals; Dandruff; Shrub. Dried flowers are powdered and made into paste. (Gonds/ Sidem Chandu).

Holarrhena antidysenterica (Roth.) A.DC. (Apocynaceae); SMPU/CRI-Hyd 11158; Inderjao Shireen; Chedukodise; Roots; Lactation deficiency in mothers; Tree. Roots are pulverized and given orally for pregnant ladies, works as a galactagogue (Gonds/ Telanga Rao).

Holoptelea integrifolia (Roxb.) Planch. (Ulmaceae); SMPU/CRI-Hyd 11188; Pedanevili; Bark; Tree. Bark powder is claimed as Piscicide (Gonds/ Misram Maru).

Indigofera linnaei Ali. (Fabaceae); SMPU/CRI-Hyd 11134; Yerrapalleru; Whole plant; Oliguria; Leucorrhea; Herb. Oral administration of whole plant powder is claimed to relieve oliguria and increases urination. The same recipe is also claimed to relieve leucorrhea (Gonds/ Sidem Sankar).

Ipomoea aquatica Forsk. (Convolvulaceae); SMPU/CRI-Hyd 11152; Thootikoora; Leaves; Rheumatic pains; Herb. Leaves are used as vegetable and the same relieve rheumatic pains (Gonds/ Sidem Chandu).

Maerua oblongifolia (Forsk.) A.Rich. (Capparaceae); SMPU/CRI-Hyd 11150; Bhoochakramu; Tuberous root; frequent heart attacks; Climber. Tuberous root is edible. Daily consuming of 10 gm., root stops frequent heart attacks (Gonds/ Sidem Chandu).

Melia azedarach L. (Meliaceae); SMPU/CRI-Hyd 11142; Bakain; Konda-Vepa; Leaves; Headache; Tree. Leaves are ground and paste is applied externally on fore head to get immediate relief from severe headache (Gonds/ Sidem Chandu).

Nicotiana tabacum L. (Solanaceae); SMPU/CRI-Hyd 11175; Tanbaku; Poga Aku; Leaves; Laxative; Herb. 4-7 ml. infusion prepared from the leaves is administered orally, works as laxative (Gonds/Badhi Rao).

Phyllanthus reticulatus Poir. (Euphorbiaceae); SMPU/CRI-Hyd 11127; Nalla-Purugudu; Fruits; Burning sensation; Shrub. Fruits are edible and relieve burning sensation during urination (Kolams/ Maruthi rao).

Pseudarthria viscida Wight & Arn. (Fabaceae) SMPU/CRI-Hyd 11120; Nayakuponna; Seeds; Intermittent fevers; Climber. Seeds are powdered and administered orally, about 6-9 gm., relieves intermittent fevers in children (Kolams/ Maruthi rao).

Solanum melongena L. var. incanum Kuntze. (Solanaceae); SMPU/CRI-Hyd 11178; Verri Vanga; Herb. Curry prepared from the fruits is claimed as anthelmintic (Gonds/Misram isru).

Solanum nigrum L. (Solanaceae); Mako; SMPU/CRI-Hyd 1116; Kamanchi; Herb. Whole plant powder is administered orally, about 4-6 gr., daily 2 times stops intermittent fevers (Gonds/ Telanga Rao).

Solanum xanthocarpum Schrad & Wendl. (Solanaceae); SMPU/CRI-Hyd 11121; Katai-kurd; Nelamulaka; Ascariasis; Fruits; Herb. Unripened fruits are made into paste and the same is applied on gums to kill the germs (Kolams/ Maruthi rao).

Streblus asper Lour. (Moraceae); SMPU/CRI-Hyd 11128; Bajar Danthi; Young twigs; Dental disorders; Tree. Young twigs are used as toothbrushes to strengthen the gums. (Kolams/ Maruthi rao).

Tamarindus indica L. (Caesalpiniaceae); SMPU/CRI-Hyd 11155; Emli; Chinta; Seeds; Antidote; Tree. Paste is prepared from the seeds of unriped fruits, applied externally on the sight of scorpion sting and works as best antidote (Gonds/ Telanga Rao).

Thespesia lampas (Cav.) Dalz. Ex. Dalz. (Malvaceae); SMPU/CRI-Hyd 11124; Adavipatti; Leaves; Antidote Shrub. Leaf juice is administered orally, about 10 ml., works as a best antidote for scorpion sting. (Kolams/ Maruthi rao).

Ventilago madraspatana Gaertn. (Rhamnaceae); SMPU/CRI-Hyd 11125; Errachiratali; Root bark; Jaundice; Tree. Root bark is pounded and administered orally, about 4-7gm., daily once for ten days, relieves jaundice (Kolams/ Maruthi rao).

Zizyphus oenoplia Mill. (Rhamnaceae); SMPU/CRI-Hyd 11118; Paraki; Bark; Dysentery Shrub. Oral administration of bark powder, about 8 gm. relieves severe dysentery (Kolams/ Maruthi rao).

Zizyphus vulgaris Lam. (Rhamnaceae); SMPU/CRI-Hyd 11164; Konda regi; Fruits; Sexual impotency; Tree. Fruits are edible and aphrodisiac (Gonds/ Bheem).

Results and Discussion

The potentiality of ethno-botanical knowledge acts as an essential resource for developing new kinds of pharmaceuticals and other medicinally important products. The present study has brought to light and discussed the age old therapeutic methods currently employed by the tribal people of Jannaram forest division. Gupta *et al*. (2008) had earlier reported forty one (41) folk-medicine taxa from three forest division of the Adilabad district including Jannaram forest division.

Out of eighty five (85) taxa of medicinal plants collected and identified, nearly forty (40) are used locally as folk-medicine by Gonds, Nayakapodus, Kolams, Pardhans and Lambadas. Out of these claims, nearly 75% are used internally and 25 % externally. Majority of external applications are for rheumatic pains, severe headache, skin diseases, bone fracture and as antidotes. The internally used drugs are for dysentery, intermittent fevers, toothache, jaundice, urinary problems, cough, leucorrhea, oedema, gastric problems, night blindness, heart problems, hydrocephalus, antidote for cobra bite, infertility; and also used as laxative, galactagogue, vermifuge and aphrodisiac.

The ethno-medico-botanical data collected from the tribal people of Jannaram forest division pertaining to the treatment of various ailments by plant parts which are used for medicinal preparations were bark, roots, leaves, fruits, flowers, stem, seeds and the whole plants. The most ascendant families of ethno-botanical importance are Solanaceae (04), Rhamnaceae (03), Fabaceae (03), Caesalpiniaceae (03), Ebenaceae (02),Malvaceae (02),Mimosaceae (02),Moraceae (02), Vitaceae (02). The most frequently utilized plant parts were leaves (30 %), followed by the roots (22.5 %), whole plant (15 %) seeds (10 %), stem bark (5 %), young twigs (2.5 %), flowers (2.5%), in the form of decoctions, extracts, paste, juices and powders. Among the different plant parts used for the preparation of medicine the leaves were the most important and frequently used part. The oral administration of the leaves prescribed in majority of the remedies is reported in the present study (Fig. 3 & 4).

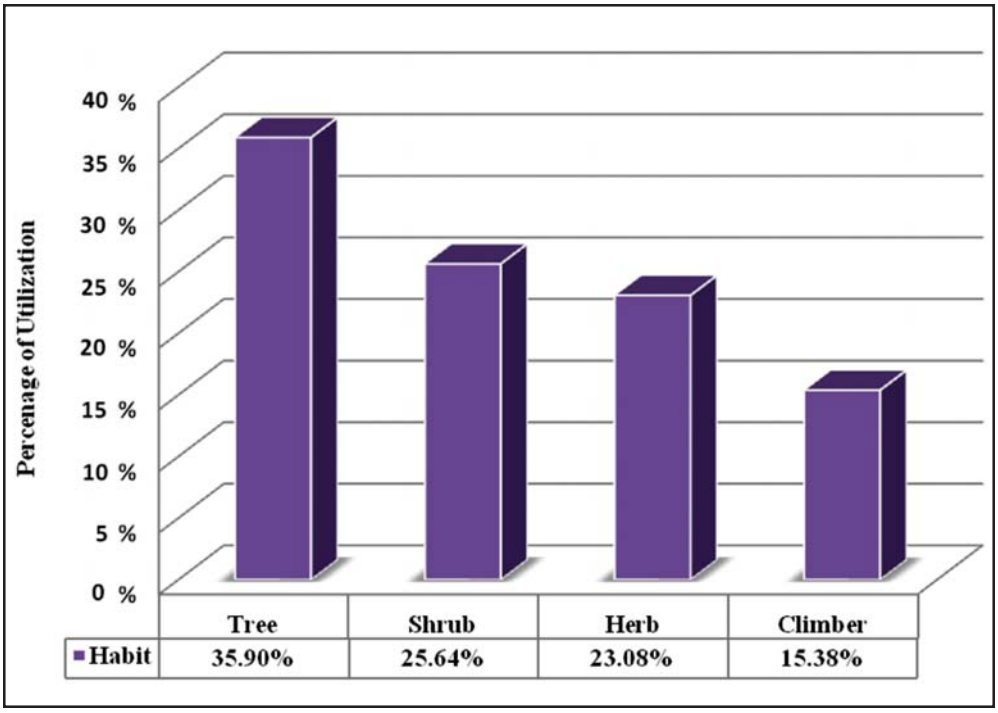

Figure 3: Habit of the Folk-Medicine Utilization (%)

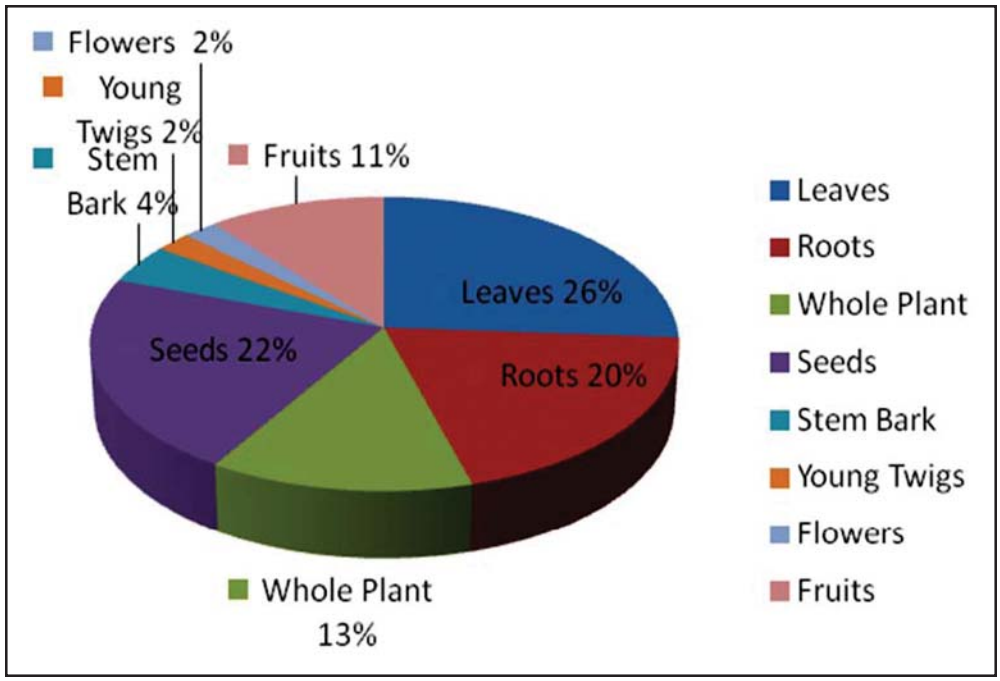

Figure 4: Frequency (%) of Used Plant Parts

The data presented have also been compared with recent and past available literature (Aminuddin *et al.*, 2013; Anonymous, 1976, 1992; Hussain *et.al.,* 1992; Jain *et al.,* 1991; Rastogi and Mehrotra, 1990; Chetty and Rao, 1989; Hemadari, 1987, 1988, 1991; Vijaykumar and Pullaiah, 1998; Nagaraju and Rao, 1990; Balaji Rao *et al.*, 1995; Gupta *et al.*, 1997, 2008; Suryanarayana 1996; Hussain *et al.*, 2000; Vedavathy, 1998; Madhu and Swamy, 2010; Murthy, 2012; Lingaiah and Nagaraju, 2013 and Rama *et al.*, 2014). It has been found that most of the folk-medicinal claims reported in the present study are already known, however, their mode of application, ingredients and parts used are different in earlier published literature. Therefore, present work represents contemporary uses of medicinal plants by the tribals of the study area. It would be worthwhile to subject all these folk-medicinal claims to scientific investigations through pharmacological and clinical studies. It is likely that through such investigations new drugs of natural origin may be discovered for treatment of many of the diseases for which there are no satisfactory cure in modern system of medicine.

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Ethnomedicines of Mussoorie Forest Division, Dehradun (Uttarakhand)

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Abstract

The results of an ethnobotanical survey carried out recently in Mussoorie forest division, Dehradun are presented in this report. A total of 26 species belonging to 24 genera and 22 families of angiosperms, with medicinal use(s) has documented. For each plant species the current scientific and prevalent local name(s), the part used, medicinal use(s) and mode of administration are listed. The study has provided new information on many folk medicinal plants and their local uses. Potential of ethnomedicines with particular reference to discovery of new compounds and biological activities has been highlighted.

Keywords: Ethnobotanical survey, Ethnomedicines, Mussoorie, Dehradun, Uttarakhand.

Introduction

The district of Dehradun in Garhwal region of Uttarakhand possesses an interesting climate and varied flora (Babu, 1977; Gupta, 1928; Kanjilal, 1911; Raizada and Saxena, 1978). It is inhabited by various tribal communities. Among them Bhoxas, Vangujjars and Jaunsar-Bawar are predominant. In spite of increasing healthcare facilities, rural populations of the area have retained their reliance on herbal healing. From different parts of this district, the use of diverse native floras in traditional medicine of many cultures has been reported (Chantia, 2003; Bhatt and Negi, 2006; Bist and Bhatt, 2012; Bist and Pundir, 2008; Gairola *et al*., 2013; Jain and Puri, 1984; Negi *et al*., 1992; Rana and Datt, 1997; Sharma *et al*. 1979; Sharma and Painuli, 2011; Singh and Pundir, 2004; Singh, 1997; Singh *et al*., 2008; 1989, 1984; Upadhyaya, 2014). Therefore, survey team of the Regional Research Institute of Unani Medicine, Aligarh has conducted an ethnobotanical survey in different forests of this region. The main objective of this field study, besides recording folk medicinal claims prevalent among the indigenous communities, was to prepare an inventory of existing medicinal plants especially those used in Unani medicine. In this communication, some useful ethnomedicinal information gathered recently from the Mussoorie forest division, Dehradun is presented. The study represents a contribution on our existing knowledge on the contemporary herbal pharmacopoeia of the indigenous communities of this part of Garhwal.

The study area forms a part of Dehradun and Tehri Garhwal districts of Uttarakhand and lying between 30° 35´ N latitude and 77° 18´ E longitude in the

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foothills of the Garhwal Himalayan ranges (Fig. 1). The division is bounded by the Upper Yamuna Forest Division in the north and north east, Tehri Forest Division in the east, Dehradun Forest Division in the south and Chakrata Forest Division in the west. The entire division is mountainous. Mussoorie, the queen of the hill stations, is famous for its scenic beauty and excellent climate. The division comprises of six forest ranges viz. Badrigad, Deolsari, Jaunpur, Kempty, Mussoorie and Raipur which have dense tracts of intact natural forests. There are some scattered settlements of Vangujjars (a nomadic forest dwelling tribe). Other castes and cultural groups found here include Chauhans, Kandaris, Negis, Panwars, Tomers, Rais, Rawats, Gaurs, Joshis, Sharmas, Pandeys, Tiwari, etc. Their elders still possess good knowledge of the healing properties of local flora, acquired in the course of long experience and association with the forests.

Methodology

Fieldwork was carried out in March 2015 and information on folk medicinal uses of plants was obtained through direct field interviews with local medicine men and other knowledgeable villagers. Data on the common name of the plant or crude drugs, medicinal use(s), part used, other ingredients added (if any), method of drug preparation, mode of application, dosage and duration of treatment were recorded for each claim. Plant specimens were collected with the help of informants and later identified by the authors. All voucher specimens were prepared and deposited in the Herbarium of the Survey of Medicinal Plants Unit, Regional Research Institute of Unani Medicine, Aligarh (U.P.), India.

Observations

In the following listing, plants are arranged in alphabetical order by their botanical name together with respective family between parentheses, local name, locality and voucher specimen number, followed by claimed medicinal use(s) and mode of administration. As far as possible, duration of these crude drugs are also given.

Ageratina adenophora (Spreng.) R.M. King & H. Rob. (Asteraceae), 'Kalabansa', Deolsari (ZAA 9946). Fresh leaf juice is applied on cuts for healing.

Ajuga parviflora Benth. (Lamiaceae), 'Neelkanthi', Badrigad (ZAA 9996). A freshly made paste of the leaves, obtained by crushing is given orally once a day to improve eye vision. It is also given to relieve stomach-ache.

Asparagus adscendens Roxb. (Liliaceae), 'Kujer', Badrigad (ZAA 9928). Boiled roots are mixed with fodder and given as refrigerant in cases of cattle.

Berberis asiatica Roxb. ex DC. (Berberidaceae), 'Kingora', Deolsari (ZAA 10014). Root sap is used to wash the eyes suffering from conjunctivitis.

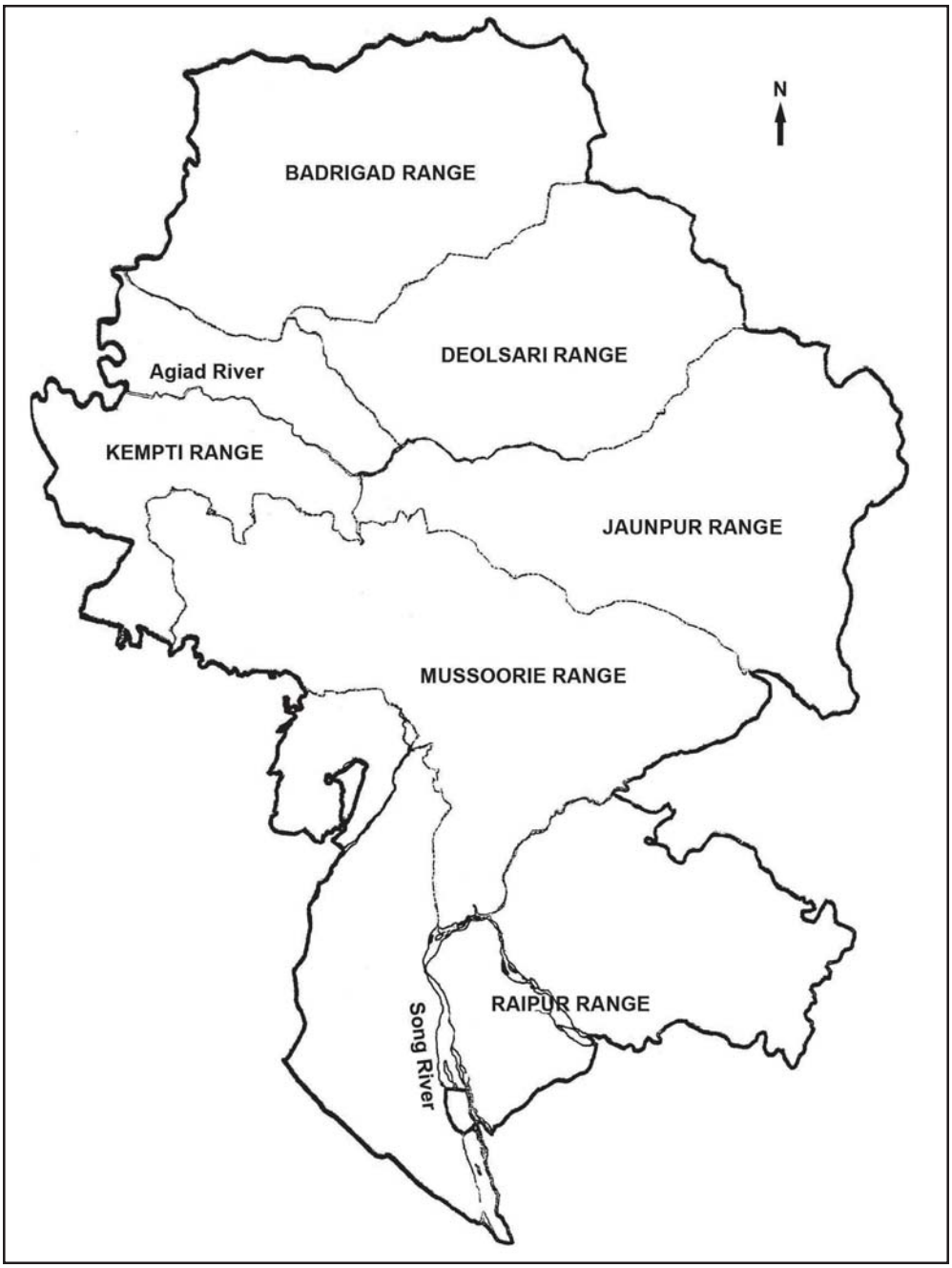

Figure 1: Map of the study area: Mussoorie Forest Division, Dehradun

Berberis lycium Royle (Berberidaceae), 'Kashmoi', Badrigad (ZAA 10018). Root infusion is given once daily to control diabetes.

Bergenia ciliata (Haw.) Sternb. (Saxifragaceae), 'Pattharchoor', Mussoorie (ZAA 9893). Root of this well-known herb is used to treat kidney stones. The paste of fresh root obtained by crushing is taken in a dose of 10 g twice a day to dissolve and expel small stones.

Calotropis gigantea (L.) Dryand. (Asclepiadaceae), 'Akawa', Raipur (ZAA 10037). Fresh latex is applied locally on corn of the sole to soften the tissues and remove it.

Capparis zeylanica L (Capparaceae), 'Bindara', Raipur (ZAA 10038). Fresh fruits are given to cows for inducing conception.

Cotoneaster microphyllus Wall. ex Lindl. (Rosaceae), 'Bhidara', Lasergaon (ZAA 10006). Roots are crushed and boiled; the liquid is strained and given orally for joint pain.

Cuscuta reflexa Roxb. (Cuscutaceae), 'Akashbel', Deolsari (ZAA 10004). Patients are advised to take daily bath in lukewarm decoction of crushed stems as a treatment of scabies.

Cynoglossum lanceolatum Forssk. (Boraginaceae), 'Hatang', Lasergaon (ZAA 10005). Whole plants are dried and ground to make a powder. About 10g of this powder are given once daily in renal calculus.

Fumaria indica (Hausskn.) Pugsley (Fumariaceae), 'Kerua', Badrigad (ZAA 9995). Decoction of whole plant is given orally for scabies.

Girardinia heterophylla (Vahl) Decne (Urticaceae), 'Bichhu', Thatyur (ZAA 9926). In winter season, vegetative buds are cooked and taken to prevent from cold.

Holarrhena pubescens Wall. ex G. Don (Apocynaceae), 'Kura', Badrigad (ZAA 9984). Stem bark powder is boiled in water till it become semisolid. One spoon of this is given with '*tirphala*' (a mixture of the powdered fruits of *Terminalia bellirica* (Gaertn.) Roxb., *T. chebula* Retz. and *Phyllanthus emblica* L.) for treating chronic constipation.

Justicia adhatoda L. (Acanthaceae), 'Rinchhain', Badrigad (ZAA 9893). Leaf decoction is given for cough.

Leucas lanata Benth. (Lamiaceae), 'Guma', Badrigad (ZAA 9974). Decoction of aerial parts is given for common fever.

Punica granatum L. (Punicaceae), 'Darimb', Deolsari (ZAA 9990). A mature fruit is hollowed and cut into two equal halves. One half pieces is filled with powdered catechu with little water. It is heated on fire directly for a short while then cooled and the material is given to lick for treating cough of children.

Rumex dentatus L. (Polygonaceae), 'Kharans', Badrigad (ZAA 9965). Leaf paste is applied externally on scabies.

Rumex hastatus D. Don (Polygonaceae), 'Bhilmora', Lasergaon (ZAA 9967). Fresh root piece is chewed and then swallowed for treating stomach-ache.

Some Important Folk Medicinal Plants of the Study Area

Figure 2: *Viola pilosa* Blume

Figure 3: *Justicia adhatoda* L.

Figure 4: *Bergenia ciliata* (Haw.) Sternb.

Figure 5: *Berberis asiatica* Roxb. exDC.

Salvia aethiopsis L. (Lamiaceae), 'Buddain', Lasergaon (ZAA 9998). Leaf paste is applied locally to treat dhobi- itch.

Smilax aspera L. (Smilacaceae), 'Kukurdara', Badrigad (ZAA 10006). Stem twig is used daily in the morning as toothbrush for oral hygiene.

Solanum incanum L. (Solanaceae), 'Kantkari', Thatyur (ZAA 9922). In cases of jaundice, a rosary of dried fruits is tied around the neck of the patient.

Thalictrum foliolosum DC. (Ranunculaceae), 'Morechhapi', Jaunpur (ZAA 9930). Root paste is applied on boils to speed up suppuration and healing.

Verbascum thapsus L. (Scrophulariaceae), 'Ekalbeer', Lasergaon (ZAA 9925). Fresh leaf juice is instilled in the eye suffering from pterygium.

Viola pilosa Blume (Violaceae), 'Banafsa', Badrigad (ZAA 10015). Leaf and flower decoction is given for catarrh.

Zanthoxylum armatum DC. (Rutaceae), 'Timur', Mussoorie (ZAA 9971). Fruits are mixed with dried pieces of the root of '*banj*' (*Quercus oblongata* D. Don) and ground to make a powder. This powder is used as dentifrice for oral hygiene.

Discussion

This paper provides a report on folk medicinal uses of 26 plant species revealed by the indigenous people of the Mussoorie forests. Data on medicinal uses were analyzed and compared with the available literature (Anonymous, 1948-1976; Chopra et al., 1956; Jain, 1991; Kirtikar and Basu, 1935; Nadkarni, 1954; Watt, 1889-1892) and it was found that uses of some species were similar to information already published in the literature. However, majority of these claims are new and imperfectly known and enrich our existing traditional knowledge on phytotherapy. These uses of medicinal plants are based on ancestral knowledge and empiric experience. Therefore, these species deserve scientific screening and evaluation for exploring their active constituents of therapeutic potential. Such studies may yield useful leads needed for the search of new biodynamic compounds of potential therapeutic value. As many modern drugs have their origin in Indian traditional medicine and ethnopharmacology (Mukherjee *et al*., 2007; Patwardhan, 2005).

In the course of fieldwork it was observed that this ancestral knowledge of medicinal plants is in danger of being lost because younger generation does not show interest in traditional medicine. It is, therefore, desirable to conduct extensive field surveys of other ethnobotanically important areas of the state to protect and conserve the traditional ethnobotanicalknowledge.

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