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Determination of toxic heavy metals in indigenous medicinal plants used in Rawalpindi and Islamabad cities, Pakistan

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ABSTRACT

Ethnopharmacological relevance: History of medicinal plants used in local healthcare systems dates back centuries as the user considers them safe from toxic effects. Present study was aimed to document the commonly used indigenous medicinal plants and to investigate the metal toxicity and impact of pollution load in most frequently used medicinal plants from study area.

Material and methods: Semi-structured interviews and rapid appraisal approach were employed to record the ethnomedicinal information and toxic metals were analyzed through flame atomic absorption spectrophotometer.

Results and discussion: A total of 21 wild medicinal plants was reported, and 7 were screened for toxic metal analysis. Oral mode of application (93%) was the chief route of herbal remedy administration, and leaves were found to be used as major plant part against different diseases. Main sources of remedies were wild herb (68%) followed by wild trees (18%), wild spiny shrubs (09%) and wild shrubs (5%). Trend of metal concentration was found as Fe > Ni > Cr > Pb > Cu > Zn > Mn > Cd. Indigenous medicinal plants of both cities posed the toxicity risk for Ni, Cu, Fe and crossed the safety limits set by WHO.

Conclusion: Medicinal plants of Rawalpindi were more toxic compared to the medicinal plants of Islamabad. Prolonged intake or over dose of these medicinal plants may lead to chronic accumulation of various elements that may cause severe hazardous effect upon human health.

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1. Introduction

Presently, indigenous knowledge of medicinal plants gained considerable attention in the segment of the scientific world (Heinrich, 2000). Unaffordable costs of allopathic medicines promoted the interest of pharmacists to synthesize new plant derived drugs (Hoareau and DaSilva, 1999). In the past, the healthcare system was relying on plant oriented drugs; almost all the medicinal preparations were derivative of plants. These drugs were economic and had few side effects as compared to the allopathic drugs (Iwu et al., 1999). According to the WHO about 80% of developing countries population depends on medicinal plants (Calixto, 2005). In Pakistan, same percentage of population is relying on indigenous medicinal plants (Mahmood et al., 2012). A total 50,000 plants are used for primary healthcare (Schippmann et al., 2002), out of the total plant species, 422,000 species have

been reported all over the world (Govaerts, 2001). From these reported plant species, maximum plants have not been subjected to toxicological or pharmacological screenings. Indigenous medicinal plants have been overlooked by government healthcare authorities. In Pakistan, researchers are now paying attention to those herbs, which are employed in common medicinal remedies for the treatment of common disorders (Mahmood et al., 2011a, 2011b). Scientists have accepted this need to study the medicinal plants and herbal preparations to evaluate their standard according to the WHO guidelines. These studies are planned to present scientific information on quality, safety and efficacy of widely used Pakistani indigenous medicinal plants. Unfortunately; quality, safety and efficacy data on indigenous medicines is lacking (Springfield et al., 2005). Medicinal plants can uptake the toxic substances/metals, which can route to the human body via herbal preparation. These toxins may cause serious health hazards to human life. So, there should be a proper check and balance in the quality and safety of medicinal plants. In the presenting context, this study was conducted to determine safety parameters of selected Pakistani indigenous medicinal plants. Seven medicinal

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plants were selected on the basis of their use value and frequency of citation to investigate the heavy metals contents and to document the traditional uses, efficacy and safety of traditional medicinal plants.

2. Material and Methods

2.1. Study area

Joint cities of Pakistan, Rawalpindi and Islamabad were selected as the study area (Fig. 1), Islamabad the capital of Pakistan with 1,151,868 populations; Rawalpindi the fourth-largest city of Pakistan with 3,252,123 populations. Local inhabitants of these cities, directly or indirectly, dependent on the natural resources for their basic healthcare needs. From study area, a number of medicinal plants have been practiced by herbalists; directly, against different ailments and also in preparation of herbal remedies. Local people supply medicinal plant to the herbal market, as, medicinal plants are easily available from study area. To evaluate the toxic level and safety parameters of commonly used medicinal plants by local inhabitants, four sites were selected from each city of study area. Site selection was made on the basis of medicinal plant's diversity, use of medicinal plants by local people and trade of plants in the local market. A detail description of study area is shown in Fig. 1.

2.2. Ethnomedicinal data collection

Fig. 2 Ethnomedicinal survey was conducted in the month of August 2011 in Rawalpindi and Islamabad, Pakistan. Collection sites were identified with the help of Mrs. Sadia Rashid, who was aware of the language and local community of the study area. Rapid appraisal approach was used to collect the information along with the interviews of local people having knowledge about indigenous medicinal plants and herbal specialists were conducted. Use of a local language (Pothohari) permitted the accurate recording of subtle nuances that could be lost during translation. During the course of study 17 females, 31 male and 21 herbalists were interviewed (Table 1). Information regarding to vernacular name, therapeutic use, route of application and dosage, drug preparation, plant part(s) used to prepare drug and status of medicinal plant was recorded in the field. Plant's specimens were collected from study area and brought to the Environmental Biology Laboratory, Quaid-I-Azam University, Islamabad, Pakistan.

Plants were pressed for dryness, poisoned with $HgCl_2$ solution and mounted on herbarium sheets. Prof. Dr. Rizwana Aleem Qureshi (Plant Taxonomist, Quaid-I-Azam University, Islamabad, Pakistan) identified these plant species and voucher specimens were submitted in the herbarium of Pakistan Faculty of Biological Sciences, Quaid-I-Azam University, Islamabad after matching the plant species with the Flora of Pakistan (Ali and Nasir, 1989–1991; Ali and Qaiser, 1993–2011).

2.3. Data analysis

Use value of medicinal plants was calculated as:

$$UV_i = \sum U_i / N_i$$

where, U_i is the number of reports cited by each informer for a

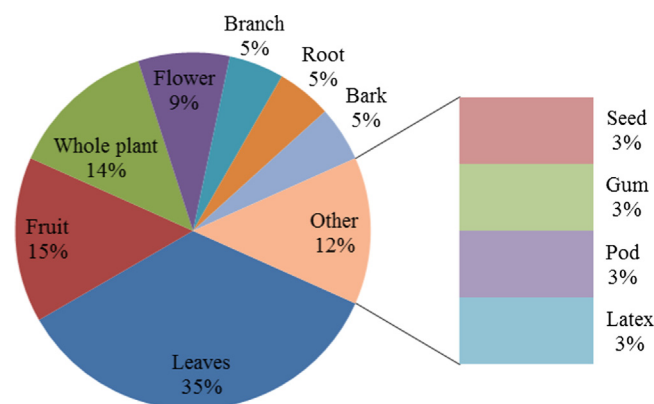


Fig. 2. Plant parts used in preparation of herbal remedies.

Table 1

Age characteristics of local people and herbal specialists interviewed in Rawalpindi.

Informants	Age (years)		Total persons interviewed
	35–55	≥60	
Female	09	08	17
Male	12	19	31
Herbalists	14	07	21
			69

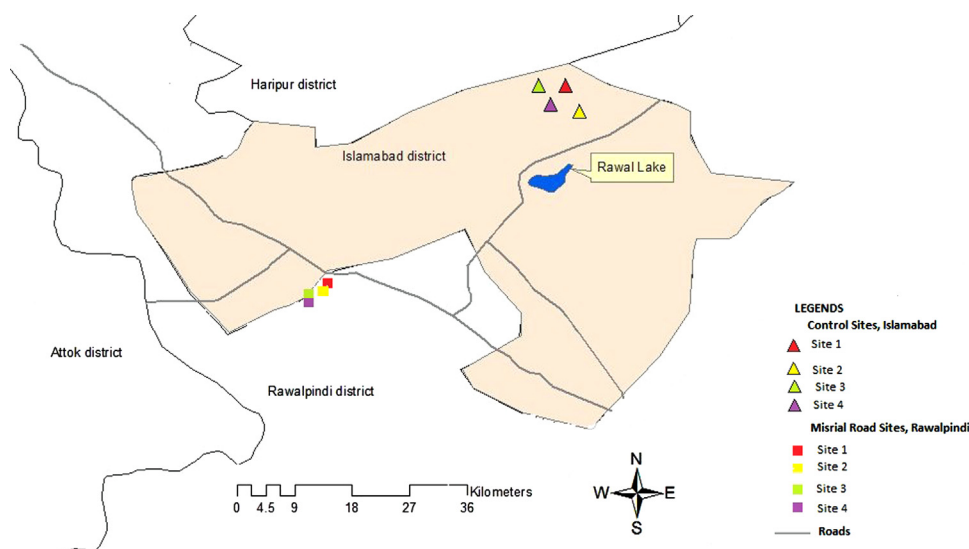


Fig. 1. Map of study area showing the sampling locations.

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