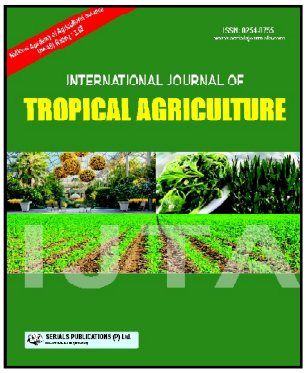

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Assessment of the Heavy Metal Content in Traded Herbal Raw Drug Sida Roots from Kerala Market

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Abstract: Sida famous in ayurveda as "Bala" is one of the most important medicinal plant. Sida root is the major ingredient in many Ayurvedic formulations like Bala taila, Ksheerabala, Baladi kvatha, Baladhyam gritham etc. Sida root is medicinal with its thermogenic, antioxidant, anti inflammatory, anti septic, hypotensive and tonic effects. The drug is useful to treat *vata*, inflammations, wounds, ulcers, jaundice, burns, skin diseases, abdominal disorders, diabetes, fever and general debility. Sida root milk extract is often given to pregnant ladies by grandmas in villages. However the rising demand for this drug has led to its less availability and the commercial cultivation is meagre. Usually from road sides and from unused barren waste lands the collectors take the roots and supply to dealers. If the soil is contaminated ,there is every possibility that these roots absorb unhealthy chemicals. In this background the present study was taken up to assess the heavy metal load of the market samples of sida roots collected from various local markets of Kerala. The analysis was carried out using ICP–AES (Inductively coupled plasma atomic emission spectroscopy) method. The study revealed that sida roots are rich in iron content at the same time free from arsenic and cadmium heavy metals. Other heavy metals like Chromium, Nickel, Cobalt, Copper and Lead were found in a varying quantities. Various types of pollution,the very cause of soil contamination, may be the reason for absorption of heavy metals by the plant roots. This necessitates strict pharmacovigilance.

Key words: Bala, Heavy metal, ICP-AES, Medicinal plant, Sida.

INTRODUCTION

The genus Sida commonly called as Bala, belongs to the family Malvaceae. Sida root is extensively used in the treatment of rheumatism in Ayurveda. It is also effectively utilized for heart diseases, urinary bladder disorders, malaria etc. According to Ayurveda

'Bala' balances tri doshas – *vata, pitta, kapha*. It has more effect on vata dosha. There are about 200 species of sida found all over the world. *Sida cordifolia* Linn. is considered as the source of raw drug bala in North India while in South India especially in Kerala vaidyas prefer *S. rhombifolia Linn Ssp retusa* (Linn.) Borss. (Syn. *Sida rhombifolia* var. *retusa* (Linn.) Mast. Its Malayalam local name is Kurunthotti. The availability of *S. retusa* is decreasing day by day and cultivation is meagre. The road sides and village court yards in Kerala, once up on a time, were rich with medicinal plants, shrubs and annual herbs like "Kurunthotti" (Sida) are now permanently getting lost [1]-[3]. As commercial cultivation is not common in Kerala, usually from road sides and from unused barren waste lands the collectors take the roots and supply to dealers. If the soil is contaminated there is every possibility that these roots also absorb unhealthy chemicals or heavy metals. The heavy metals Cadmium(Cd), Chromium(Cr), Copper(Cu), Iron(Fe), Lead(Pb), Nickel(Ni) and Arsenic (As) were found to be usual major pollutants in herbal raw drugs [4].

In this context we have taken up this study to assess the present scenario of the heavy metal content in the traded raw drug samples of sida roots in markets. The results of the study are discussed.

MATERIALS AND METHODS

Twenty different market samples of *sida* roots were collected from various local markets of Thrissur, Eranakulam, Alapuzha, Kottayam, Malappuram, thiruvananthapuram, Kozhikode and Palakkad districts of Kerala, cleaned shade dried and powdered. O.5 g samples were weighed and digested with 15 ml of 9:4 mixture of Nitric acid and Perchloric acid. The mixture was cooled and filtered through a Whatman no. 1 filter paper into 100 ml volumetric flask and made up to the mark with Milli-Q water. Heavy metal analysis (Arsenic, cadmium,lead, cromium, Iron,nickel copper and cobalt) was performed on ICP-AES (Inductively coupled plasma-atomic emission spectroscope) using standardized protocol and with required elemental standards [5]. The values were expressed as ppm. All the chemicals and reagents used were of analytical grade. Milli-Q water was used throughout the study.

RESULTS AND DISCUSSION

The results of our study (Table 1) revealed that out of twenty market samples many root samples contained toxic heavy metals chromium, nickel, cobalt, copper and lead. All samples were free from the toxic metals Cadmium (Cd) and Arsenic(As).

Lead (Pb)

Lead is a toxic metal which in excess causes poisoining and adverse effect on kidney, liver, immune system [6]. The permissible limit set in edible plants by FAO/ WHO (1984) [7]. was 0.43 ppm. But for medicinal plants the limit of lead set was 10 ppm by China and Malaysia. Lead content of the seven tested market samples ranged from 0.001 ppm to 0.210 ppm. Thirteen samples out of twenty tested were free from lead.

Chromium (Cr)

Exposure to excess of Chromium may cause liver, kidney and lung damage [8]. For medicinal plants the WHO limits havs not yet been established. For edible plants it is set as 0.02 ppm. Permissible limits of chromium in raw medicinal plant set by Canada is 0.002 mg/g (WHO, 2005). In our present study, chromium content was noted in twelve samples that ranged from 0.001 ppm to 0.250 ppm. Eight market samples were free from chromium. The sample from Pattambi showed a high chromium level *i.e.* 0.25 ppm.

Cobalt (Co)

No limit has been so far set for Cobalt in medicinal plants. Studies of Basel and Erdemoglu [9] revealed the presence of Cobalt in herbs in a range 0.14 ppm to 0.48 ppm. Out of twenty sida market samples tested, five samples showed the presence of cobalt ranging from 0.001 to 0.003 ppm. Five samples were free from cobalt.

Table 1
Heavy metal load (ppm) of market samples of sida root from Kerala

Sl. No.	*Source market*	*As*	*Cd*	*Pb*	*Cr*	*Cu*	*Fe*	*Ni*	*Co*
Sida 1	Kodakara	ND	ND	0.052	0.007	0.012	2.54	ND	ND
Sida 2	Chalakudy	ND	ND	ND	0.001	0.006	1.04	ND	ND
Sida 3	Kalady	ND	ND	0.002	ND	0.004	0.51	ND	ND
Sida 4	Palakad	ND	ND	0.001	0.003	0.006	0.68	ND	ND
Sida 5	Wadakaanchery	ND	ND	0.160	0.008	0.027	3.40	0.001	.001
Sida 6	Alathur	ND	ND	0.210	0.020	0.020	1.04	ND	.003
Sida 7	Pattambi	ND	ND	0.013	0.250	0.024	3.30	0.002	ND
Sida 8	Kottayam	ND	ND	ND	ND	0.006	0.14	ND	ND
Sida 9	Valanchery	ND	ND	ND	0.002	0.006	0.32	ND	ND
Sida 10	Kuttippuram	ND	ND	ND	ND	0.002	0.25	ND	ND
Sida 11	Chavakkad	ND	ND	ND	0.001	0.006	0.60	ND	ND
Sida 12	Changaramkulam	ND	ND	0.010	0.010	0.016	5.10	ND	0.001
Sida 13	Alappuzha	ND	ND	ND	0.002	0.001	1.49	ND	0.001
Sida 14	Thrissur-1	ND	ND	ND	ND	0.013	1.05	ND	ND
Sida 15	Thrissur-2	ND	ND	ND	ND	0.020	0.28	ND	ND
Sida 16	Thrissur-3	ND	ND	ND	ND	0.015	0.05	ND	ND
Sida 17	Thiruvananthapuram	ND	ND	ND	ND	0.003	1.00	ND	ND
Sida 18	Perumbavur	ND	ND	ND	ND	0.001	0.17	ND	ND
Sida 19	Kozhikode	ND	ND	ND	0.002	0.007	0.08	ND	0.001
Sida 20	Muvattupuzha	ND	ND	ND	.0010	0.010	1.20	ND	ND

ND-Not detected.

Copper (Cu)

References showed the presence of copper in medicinal plants within a range of 17-57 ppm [10]. The permissible limit of copper in medicinal plant materials set by China is 20 ppm while that by Singapore is 150 ppm (WHO, 2005). WHO has not yet set the limit for medicinal plants. All the samples tested showed the presesenceof copper ranging from 0.001 ppm to 0.027 ppm.

Nickel (Ni)

Ni toxicity is not common as its absorption by our body is very low [11]. In the present investigation only two samples showed nickel content (0.002 ppm and 0.001 ppm) while all other eighteen samples were negative for nickel.

Iron (Fe)

Iron is essential for human body for its haemoglobin and proper oxygen supply. The permissible limit set by FAO/WHO (1984) for iron in edible plant is 20 ppm ; though for medicinal plants the limit was not yet set. Studies have proved that many medicinal plants contain iron ranging from 0.1 ppm to 123 ppm [12-13]. All the twenty sida root market samples revealed the presence of iron content in high quantities which ranged from the lower to higher levels (0.25 ppm to 5.10 ppm).

CONCLUSION

The present study revealed that sida roots available in Kerala market are rich in iron content at the same time free from arsenic and cadmium heavy metals. Many of the samples contain heavy metals like Chromium, Nickel, Cobalt, Copper and Lead in a varying levels. Waste water and industrial pollution leading to soil contamination may be the reason for absorption of heavy metals by the plant roots. Therefore it may be suggested that herbal raw drugs especially roots should be collected from pollution-free natural habitats and should be thoroughly checked for heavy metal load before use either as fresh or for other pharmaceutical purpose. Strict pharmacovigilance must be implemented to improve the quality, safety, and efficacy of herbal drugs during sampling, processing and storage to ensure consumer safety.

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