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Chemical Elements in Datura Innoxia Seeds and Leaves

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Abstract

Datura innoxia seeds and leaves have been studied to determine the essential and trace elements content and their correlation with the toxicity of the plant. The energy-dispersive X-ray fluorescence (EDXRF) spectroscopy has been used for the determination of the elements. The analytical method allows the determination of 17 elements (K, Ca, S, Si, Cl, Fe, Al, P, Mg, Ti, Mn, Zn, Sr, Cu, V, Br and Zr). Among the considered elements, K content was the highest in seeds (5.469 ± 0.021% w/w), Ca the highest in leaves (2.461 ± 0.019 % w/w) and S has the highest content in leaves (1.254 ± 0.022 % w/w). The elements Ti, Mn, Sr, V, Br and Zr were not detected in the plant seeds but detected in the plant leaves with range concentration between 0.062-0.002 % w/w. The range of elemental concentration of the elements Si, Cl, Fe, Al, P, Mg and Zn in seeds varied from 0.002 to 0.942 % w/w in leaves varied from 0.014 to 0.346 w/w%. The concentrations of these elements did not exceed the standard dangerous toxic levels. Some of these elements are of vital importance for human metabolism and some are well known for curing diseases.

Keywords : *Datura Innoxia;* Seeds and Leaves; Essential Eleme; Energy Dispersive X-ray Fluorescence; Medicinal Plants; Medicinal Herbs

Introduction

Plants have formed the basis of traditional medicinal systems that have been in existence for thousands of years, and they continue to provide humanity with new remedies. There is up to 80 percent of people still rely on herbal remedies for their health care [1,2]. The effectiveness of medicinal plants is mainly associated with their constituents; it was found that prolonged intake may cause health problems duo to the presence of toxic elements [3]. It is estimated that Sudan encompasses more than 3156 species belonging to 1137 genera and 170 families [4,5]. Therefore, there are large numbers of medicinal plants in Sudan used traditionally against different diseases. Sudanese traditional medicine is characterized by a unique combination of knowledge and practices of Arabic, Islamic, and African culture. In fact, the collection of medicinal plants has become form of rural self-employments in Africa which is generating a lot of income for the rural poor people. South Africa has the richest plants biodiversity in the world, many of which are medicinally useful. It is estimated that over half million people are directly involved in medicinal plants in the country [6]. Old civilization in Egypt, China and India had a rich experience of the health benefits of medicinal herbs. The use of medicine plant declined during the last century because of the development of synthetic drugs. Due to the high cost and toxic effects associated with synthetic drugs the use of medicinal herbs continued co-existing with modern medicine and widely used throughout developing and developed countries as nutritional supplements, herbal remedies and as raw materials for the drugs synthesis [7]. Dietary supplements which increase the total dietary intake of minerals are very common. The possible adverse effects of long-term ingestion of high dose mineral supplements are unknown [8]. The World Health Organization (WHO) cites maxim um permissible levels only for arsenic (1mg/kg), cadmium (0.3mg/kg) and lead (10mg/kg) in raw plant materials [9].

There are at least fifty elements are extremely important for the health of humans. There is growing interest in the trace elements in the area of medical science. It is believed that the great majority of them act as key components of essential enzymes systems or protein, which performs vital biochemical functions [10,11].

Heavy metal toxicity in plants depends on the bioavailability of these elements in soil solution. Nonessential metals/metalloids such as Hg, As, Sb, Cd, Cr and Pb are toxic for the human bio-system even at very low levels of intake and they are usually present in plants by taken up from the soil, pesticide treatment,

industrial process, anthropogenic operation and fertilizer. The bioaccumulation of heavy metals in excessive concentrations may replace the essential metals in pigments or enzymes disrupting their function and causing oxidative stress [12,13]. *Datura* species are herbaceous, leafy annuals and short-lived perennials which can reach up to 2 m in height. Most parts of the plants are toxic, and *Datura* has a long history of use for causing delirious states and death. It was well known as an essential ingredient of potions and witches' brews [14]. All parts of the plant are anodyne, antispasmodic, hallucinogenic, hypnotic and narcotic. It has been used in the past as a painkiller and also in the treatment of insanity, fevers with catarrh, diarrhea and skin diseases. The plant contains several alkaloids, the most active of which is scopolamine. The leaves contain 0.52% scopolamine, the stems 0.3%, the roots 0.39%, the fruits 0.77%, the capsules 0.33%, and the seeds 0.44%. This is a potent cholinergic-blocking hallucinogen, which has been used to calm schizoid patients [15].

Materials

Plant Material (Seeds and Leaves)

Table 1: Contents of elements in Datura innoxia leaves and seeds analyzed by EDXRF technique.

	Seeds	Leaves
Elements	**% (W/W)±SD**	**% (W/W)±SD**
K	5.469±0.021	0.570±0.003
Ca	0.037±0.001	2.461±0.019
S	0.037±0.002	1.254±0.022
Si	0.942±0.015	0.051±0.001
Cl	0.647±0.011	0.078±0.002
Fe	0.008±0.000	0.346±0.003
Al	0.012±0.005	0.226±0.008
P	0.08±0.001	0.080±0.007
Mg	0.012±0.007	0.068±0.015
Ti	0.000±0.000	0.062±0.003
Mn	0.000±0.000	0.035±0.001
Zn	0.002±0.000	0.014±0.000
Sr	0.000±0.000	0.011±0.001
Cu	0.001±0.000	0.008±0.001
V	0.000±0.000	0.005±0.002
Br	0.000±0.000	0.005±0.000
Zr	0.000±0.000	0.002±0.001

Datura innoxia seeds and leaves were collected from El-Obeid city (North Kordofan State- Sudan) and identified by a botanist at Department of Botany, Faculty of Science, University of Kordofan. The plant leaves and seeds were cleaned, washed in distilled water in order to remove superficial dust, shade dried. Three grams of each of the dried samples were ground into fine powder by a mechanical grinder. The powder sample of each plant part was then prepared and pressed into thick pellet. The content of the elements K, Ca, S, Si, Cl, Fe, Al, P, Mg, Mn, Ti, Zn, Sr, Cu, V, Br and Zr was determined in *Datura innoxia* seeds and leaves as shown in table 1. Eleven elements namely K, Ca, S, Si, Cl, Fe, Al, P, Mg, Zn and Cu were detected in varied concentration in *Datura innoxia* seeds and leaves while Ti, Mn, Sr, V, Br and Zr were not detected in seeds but detected in leaves. Table 1 showed that the *Datura innoxia* seeds contain high percent of K compared to other elements detected in the seeds meanwhile the leaves contain high percent of Ca and S compared to other elements detected in leaves. The elements Ti, Mn, Sr, V and Br were found in low percentage in leaves (0.062, 0.035, 0.011, 0.005, 0.005 and 0.002% respectively). The elements Ti, Mn, Sr, V, Br and Zr were not detected in seeds. Cu and Zn were found in low percentage in both seeds and leaves.

Analysis

The samples analyzed by an energy-dispersive X-ray fluorescence (EDXRF) spectrometer7000\8000 Shimadzu. This equipment runs under PCEDX pro software. The elements were analyzed according to the Shimadzu set condition.

Result and Discussion

The heavy metals concentrations found were under the internationally permitted limits, some of them are natural constituents of the environment and found in varying levels in the soil, ground and surface water. Some minerals are essential, required for normal metabolism of organisms and various physiological according to Martin and Coughtrey [16].

Conclusion

The analysis of *Datura innoxia* seeds and leaves showed the presence of K, Ca, S, Si, Cl, Fe, Al, P, Mg, Mn, Ti, Zn, Sr, Cu, V, Br and Zr. The range of the elemental concentrations vary from 0.001 to 5.469 % w/w. The results showed that the plant leaves and seeds contain elements of vital important in human metabolism. No toxic heavy metals were detected such as As, Sb, Hg, Cr, Pb and Cd.

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