



Trace Metal Analysis in *Withania somnifera*

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ABSTRACT

The stem and seeds of *Withania somnifera* were digested with HNO_3 and HClO_4 (4:1) and the contents of thirteen trace elements such as Zn, Fe, Ni, Mn, K, Ca, Mg, Co, Cr, Cu, Cd, Pb, and As from different parts were determined by atomic absorption spectroscopy. The experimental results confirmed the presence of Fe, Ca, Mg, Zn, Ni, Co and Mn which are beneficial to the human body is within the limit and K is not detected. The heavy trace elements which are harmful to human body i.e., Cd, Pb, Cu within the limit but As is higher and Cr is not detected.

Key words: Atomic absorption spectroscopy, *Withania somnifera*, Trace elements.

INTRODUCTION

Withania somnifera belongs to family *Solanaceae*, also known as ashwagandha, winter cherry and Indian ginseng. It is an important herb in the ayurvedic and indigenous medicinal system of India. Therapeutic importance of the different part of this plant has a long history and mentioned in *Charak sanghita*. Its height is 3-4 feet and grows into a bush. It is used as an antistressor¹ and antioxidant agent². *Withania somnifera* is an ingredient in many formulations prescribed for a variety of musculoskeletal conditions (e.g., rheumatism, arthritis³) and as a general tonic to increase energy, improve overall health, and prevent disease in athlete and during pregnancy⁴. It has anti inflammatory⁵, hyperthyroid activity⁶. In India, at present for medicinal purpose *Withania somnifera* is cultivated.

In recent years people pay important attention to the research of trace element distribution in medicinal plants⁷⁻⁸ because trace elements are the essential parts for human health and prevention of diseases. The atomic absorption spectroscopy⁹⁻¹⁰ is an important method for detection of trace elements. Some other methods are electromagnetic coupling plasmatric emitting spectrometry¹¹⁻¹², atomic fluorescent spectrometry¹³, and electromagnetic coupling plasma¹⁴.

EXPERIMENTAL

Stem and seeds of *Withania somnifera* are picked from Shahjahan garden, Agra. This is identified by head of the Botany Department. For fifteen days, the samples are air dried under shade. Then powdered with the help of warming blender, 2.5gm ground dried plant samples was place in a

250 ml conical flask, 2.5 ml concentrated HNO_3 was added slowly with constant shaking. The mixture was heated on a hot plate until the production of brown fumes ceases. Cool the content of beaker and add 10 ml of 70% HClO_4 . Heated again very gently until the solution turns colorless and allow to evaporating to a small volume. Cool and add double distilled water and filter into a 100 ml flask using Whatmann filter paper and dilute volume with double distilled water. The total concentrations of Zn, Fe, Ni, Mn, K, Ca, Mg, Co, Cr, Cu, Cd, Pb, As etc. were analyzed by atomic absorption spectroscopy (Model: Perkin Elmer A Analyst 100)

RESULTS AND DISCUSSION

The concentration of copper in stem is 0.5842 ppm and in seed is 0.4775 ppm, in edible plants permissible limit set by FAO/WHO in 1984

was 3.00 ppm. Thus in *Withania somnifera* copper is within limit.

The concentration of cadmium in stem is 0.041 ppm and in seed is 0.038 ppm. The permissible limit set by WHO is 0.2 to 0.81 ppm. Thus in *Withania somnifera* concentration of cadmium in stem and seed within limit. Cadmium is a non essential trace element. Cadmium causes high blood pressure. Cd damages kidney and liver¹⁵. The concentration of lead in stem is 0.143 ppm and in seed is 0.120 ppm. The permissible limit set by WHO is 0.1 to 10 ppm. Thus lead in *Withania somnifera* is within limit. Excess of lead checks formation of hemoglobin.

The concentration of arsenic in stem is 11.73 ppm and in seed is 11.72 ppm. In medicinal plants concentration of arsenic recommended is

Table 1: Essential trace elements

<i>Withania somnifera</i> (stem)		<i>Withania somnifera</i> (seed)	
Element	Mean	Element	Mean
Zn	1.534 (ppm)	Zn	1.464 (ppm)
Fe	30.56 (ppm)	Fe	7.01 (ppm)
Ni	1.501 (ppm)	Ni	1.453 (ppm)
Mn	0.757 (ppm)	Mn	0.941 (ppm)
K	ND	K	ND
Ca	225.1 (ppm)	Ca	269.0 (ppm)
Mg	50.77 (ppm)	Mg	109.7 (ppm)
Co	0.112 (ppm)	Co	0.096 (ppm)

ND= Not detectable

Table 2: Harmful heavy metals

<i>Withania somnifera</i> (stem)		<i>Withania somnifera</i> (seed)	
Element	Mean	Element	Mean
Cu	0.5842 ppm	Cu	0.4775 ppm
Cr	ND	Cr	ND
Cd	0.041 ppm	Cd	0.038 ppm
Pb	0.143 ppm	Pb	0.120 ppm
As	11.73 ppm	As	11.72 ppm

ND= Not detectable

less than 1.0 ppm¹⁶. So it is higher in *Withania somnifera*. Excess of arsenic causes metabolic disorder, dermatitis, lung cancer, cardiovascular and neurological effects.

In *Withania somnifera* concentration of Ni in stem is 1.501 ppm and in seed is 1.453 ppm. In 1984 FAO/WHO set permissible limit for Ni is 1.683 ppm. No limit yet been given by WHO in 2005 for Ni in medicinal plants. Ni plays an important role in the production of insulin. Lungs are adversely affected by Ni and it is identified as a suspected carcinogen. Ni in *Withania somnifera* is within limit.

In stem concentration of iron is 30.56 ppm and in seed Fe is 7.01 ppm. For Fe in medicinal plants limits not yet been established by WHO in 2005. For the formation of hemoglobin iron is necessary. For the transfer of oxygen and electron transfer Fe is required in human body¹⁷.

No Cr and K have been determined in stem and seed. *Withania somnifera* has a content of useful trace elements within limit i.e., Mg, Ca, Fe, Mn in stem and seed.

Thus on the basis of above results, it is found that *Withania somnifera* contain useful trace elements Fe, Mg, Ca, Mn, Ni, Zn, Co within limit. Harmful heavy metals Cu, Cd, Pb are also within limit but concentration of As is higher.

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