ATOMIC ABSORPTION SPECTROPHOTOMETER ANALYSIS OF IVY (*HEDERA HELIX* L.) LEAVES FOR HYPOGLYCEMIC TRACE ELEMENTS

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Abstract

Chromium, Zinc, and Manganese, which are hypoglycemic trace elements, were determined with the help of atomic absorption spectrophotometer in the leaves of *Hedera helix*, which is reputed as a folk hypoglycemic medicinal plant. All the three elements were present in very high amounts as compared to some other hypoglycemic medicinal plants.

Key Words

Hedera helix, hypoglycemic, chromium, zinc, manganese, atomic absorption spectrophotometer.

Introduction

Diabetes is one of the most prevalent diseases affecting mankind all over the world. In addition to the various oral hypoglycemics and insulins, a large number of indigenous herbal drugs are used for the treatment of diabetes. Zafar (1991) found that there are about 75 plants, indigenous to the sub-continent, which possess hypoglycemic activity. *Hedera helix* is an important medicinal plant, growing wild in the temperate forests of Pakistan.

It possess antibacterial (Cioaca *et al.*, 1978), antifungal (Favel *et al.*, 1994) and cytotoxic (Danloy *et al.*, 1994, Ibrar, 1998) properties. In folk medicine it is used for the treatment of diabetes. A recent study (Ibrar, 1998) showed that aqueous extract of this plant has significantly lowered the blood glucose level of alloxan-induced diabetic rabbits.

Some trace elements play very important role in body metabolism. There are eleven trace elements, which are of vital importance, mostly acting as catalysts (co-enzymes to co-factors); by combining with enzymes making metallo-enzymes. Various clinical and pathological disorders arise as a consequence of trace elements deficiencies or excesses (Schoeder, 1976). There is a growing evidence that chromium, zinc and

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manganese play important role in glucose metabolism and their deficiencies may accompany diabetes (Uusitupa *et al.*, 1983, Robenson *et al.*, 1985).

The present study was carried out to analyse *Hedera helix* leaves for these hypoglycemic trace elements by atomic absorption spectrophotometer.

Materials and Methods

Hedera helix leaves were collected from Baragali-Abbottabad in mid October during blooming period of the plant. These leaves were cleared of surface contaminations, garbled, dried and powdered.

Both Dry Ashing and Wet Digestion methods (Issac *et al.*, 1975) were adopted, using SP 191 PYE UNICAM ATOMIC ABSORPTION SPECTROPHOTOMETER.

Preparation of Stock/Standard and Working Standard Solutions

Accurately weighed 3.725 gm of K_2CrO_4 was dissolved in deionized water and diluted to 1000 ml with double distilled water to prepare 1000ppm stock/standard solution of chromium. One gram zinc metal was dissolved in about 20 ml of 1:1 HCl and was diluted to 1000 ml with double distilled water to obtained 1000ppm stock/standard solution of zinc. One gram of manganese was dissolved in concentrated HCl and was made to the volume of 1000 ml with double distilled water to obtain 1000ppm stock/standard solution of manganese. 10 ml of 1000ppm standard stock solution of each element was taken in 100 ml flask and was made to volume with double distilled water to make 100ppm standard stock solutions.

Preparation of Working Standard Solutions

Working standard solutions of 0.5, 1, 2, 4 and 8ppm were prepared by taking 0.5, I, 2, 4 and 8 ml of each of the 100ppm stock solution in a series of 100 ml volumetric flasks and volume was made to the mark with double distilled water. The atomic absorption spectrophotometer was set for each of the element according to the following conditions.

Element	Mode	Wave Length nm.	Slit width nm.	Acetylene L/min.	Air flow L/min.	Cathode lamp current mA.
Cr	Setting	357.9	4	4.5	4.8	9.0
Zn	Absorption	213.9	4	1.2	4.3	10.0
Mn	Absorption	279.5	4	1.2	4.2	12.0

For each of the element, the cathode lamp was turned on for about ten minutes and then the air acetylene flow was ignited. The instrument was calibrated and standardized with their respective working standards. All the working standards were then run as unknown to verify the standardisation. Stock solutions of certified standards were run through the instrument and the results were then compared with the certified values. After making sure that the results were within the confidence limits, the sample stock solutions were then aspired into the flame and the concentration of the respective trace elements were noted and calculated in parts per million (ppm).

Results and discussion

The results of the analysis (Table 1) show that *Hedera helix* leaves contain all the three hypoglycemic trace elements and the yields from dry ashing and wet digestion are not appreciably different. The average content of chromium, zinc and manganese are 15.50, 49.75 and 53.25 ppm respectively.

In a recent work Khan *et al.* (1998) have carried out a similar analysis of trace element of some important indigenous hypoglycemic plants. A comparison of *Hedera helix* with these plants in respect of these hypoglycemic elements (Table 2), show that all the three elements are present in very high amounts. All these trace elements have very significant role in glucose metabolism of body. Chromium is an essential part of dietary factor. Schroeder (1968), Mertz (1969), and Masironi (1973) have demonstrated that a severe chromium deficiency led to fasting-hyperglycemia, glucosuria and impaired growth. Janjua (1991) found that in diabetic patients, chromium and zinc concentrations are much lower as compared to normal persons. An Organo-chromium complex, **Glucose Tolerance Factor** (GTF), consisting of glycin, glutamic acid, cystein and niacin is synthesised in the body tissue from the absorbed chromium. This complex potentiate the action of insulin through facilitating its attachment to cell membrane, that ultimately enhance glucose uptake by the cells (Uusitupa *et al.*, 1983, Robenson *et al.*, 1985). The chromium content of *Hedera helix* might have acted in a similar way. The role of zinc is also very important in glucose metabolism. Hurber & Gershoff (1973), Kirchgessner *et al.*, (1976) and Wolman (1979) have shown that zinc depletion from the body is associated with abnormalities in glucose utilisation and impaired release of insulin from pancreas. Lee *et al.*, (1989) has reported that oral zinc uptake increases intestinal absorption of glucose. Similarly manganese is also an important trace element which activates about 67 enzymes in the body. In an *in vivo* study on rats, Donbach (1982), found that manganese deficient diet for two months led to diabetic or pre-diabetic glucose curve, but when put back on Mn-adequate diet, the curve returned to normal.

Table 1. Data of the Hypoglycemic Trace Elements present in the powdered Ivy (*Hedera helix*) leaves.

Trace element	Dry method Con. (ppm)	Wet method Con. (ppm)	Average Con. (ppm)
Chromium	15.10	15.90	15.50
Zinc	50.00	49.50	49.75
Manganese	52.55	53.95	53.25

Table 2. Comparison of hypoglycemic trace element contents (ppm) of *Hedera helix* with some other hypoglycemic plants

S.No	Hypoglycemic Plant	Cr	Zn	Mn
1	*Hedera helix*	15.50	49.75	53.25
2	*Gymnema sylvestre*	0.19	0.26	3.12
3	*Momordica charantia*	0.10	0.25	0.38
4	*Caralluma edulis*	0.19	0.25	1.02
5	*Berberis lycium*	0.16	0.44	0.64

Hedera helix leaves contain all the three trace elements in sufficient amounts. The availability of these hypoglycemic trace elements in proper form might have helped synergistically the release of insulin from pancreas, as well as, might have enhanced its function.

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