Full Length Research Paper

Elemental content of some anti-diabetic ethnomedicinal species of genus *Ficus* Linn. using atomic absorption spectrophotometry technique

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Elemental investigation of some selected species of genus *Ficus* (Moraceae) having anti-diabetic property was conducted using atomic absorption spectrophotometry technique. The flame atomic absorption spectroscopy was employed for the estimation of element contents of different plant parts of seven different species including *Ficus bengalensis*, *Ficus religiosa*, *Ficus microcarpa*, *Ficus racemosa*, *Ficus hispida*, *Ficus carica* and *Ficus lacor* content for clinical monitoring. Na, K, Cu, Zn, Cr, Ca, Mn, Fe, Ni, Mg, Cd, Co and Pb were detected and their concentration determined. The results of the present work give the proper reasonable information for the utilization of following plants in the treatment of diabetes through ethnomedicinal as well as AAS studies. These medicinal plants were can be considered as potential sources for providing a reasonable amount of the required elements to the diabetic patients in a particular way, as they contain appreciable amounts of the certain elements which are capable for influence of insulin. It is known that these trace elements may play an important role in the antihyperglycemic properties.

Key words: *Ficus*, diabetes mellitus, elements, atomic absorption spectrometer (AAS), medicines, medicinal plants.

INTRODUCTION

Diabetes mellitus is a growing foretold disease mostly in Asian countries, it is the largest endocrine metabolic disease worldwide, and presently more than 150 million people suffer from diabetes (Yadav et al., 2002). Diabetes is the world’s largest chronic disease associated with morbidity and mortality rate (Sophia and Monoharam, 2007). Diabetes mellitus is also associated with long term complex problems including eye diseases, kidney disorder and cardiac problems etc (Sharma et al., 2010). There is a wide variety of plants used to cure diabetes more efficiently. Presently, herbal remedies are preferred due to less or no side effects for many diseases and due to financial constraints. Therefore, it is carefully forethought to look for options in herbal remedies for the treatment of diabetes. Previous studies showed in many experiments that in alloxan and streptozotocin induced diabetic rats, the blood glucose level was significantly decreased after the administration of extract of different species of *Ficus* with different ranges of doses. Medicinal plants have long been the subject of human curiosity and need. Plants have been used as medicine since man’s existence on the earth (Mazorini, 1987). Despite enormous development in synthetic medicines, several other diseases have grown due to their harmful side effects after prolonged use (Choudhary et al., 2008). Herbal medicines have usually been in the form of fruit and vegetable; drugs are their extracts for the treatment of the disease and maintaining of improved health (Sahito
et al., 2002). Modern clinical research suggests that the body’s balance of mineral trace elements is disrupted by diabetes (Calabrese, 1981). Trace element levels have become of prime importance for both the clinical diagnosis and curing of different diseases (King et al., 1998). Trace elements play a vital role in the production of bioactive chemicals in medicinal plants and are therefore responsible for their medicinal properties (Rajurkar and Damame, 1998).

In the present study, the main objective was to appraise the diversity of ethnomedicinal species of genus Ficus used by Pakistanis. Therefore, documenting indigenous knowledge is important from the view point of conservation of biological resources and their sustainable utilization in the treatment of diabetes and its related complex problems. These seven ethnomedicinal plants on which already clinical tests have been done show that these plant parts have hypoglycemic effect. An elemental assay was done using atomic absorption spectrometry, an analytical tool used for the determination of minor and trace elements in biological samples. Flame atomic absorption methods are referred to as it analyses element without inter-element spectrum interferences.

### MATERIALS AND METHODS

#### Sample collection and preparation

Fresh samples of plants; leaves of F. carica, F. racemosa, F. hispida, F. microcarpa, F. religiosa and F. bengalensis; Fruits of F. racemosa, F. hispida, F. microcarpa, F. religiosa and F. bengalensis; prop roots of F. bengalensis; brk of F. bengalensis, F. religiosa and F. hispida were collected. Plants were grown in gardens, and are about 10 years old; and, collected in their fruiting seasons, mostly in April and June. The different parts of plants including leaves, fruits, bark and prop roots were washed with distilled water to clean surface contamination and dried at 50 to 60°C in an electric oven. The dried plant material was then ground to powder in pestle mortar.

#### Chemical speciation and plant analysis

All solutions were prepared from chemical and analytical grade reagents with double distilled water. The standard working solution of all metals separately prepared. 1 ml of standard solution was diluted in double distilled water to make the standard calibration curve. Absorption for a sample solution uses the calibration curves to determine the quantity of particular element in the sample.

According to Khan et al. (2011), about 0.25 g of each sample were digested in 6.5 ml of acid solution (HNO₃, H₂SO₄, HClO₄ in ratio of 5:1:0.5), and diluted up to 50 ml with double distilled water. Calibration standards of each element were obtained by appropriate dilution of the stock solutions. Two replicates were used of each sample. A Varian AA240FS atomic absorption spectrometer (AAS) was used for the determination of thirteen metals. Cathode lamps were used as radiation source. Air acetylene gas was used for all the experiments.

### RESULTS

#### Elemental analysis

The analysis for various elements in the sampled medicinal plants indicated that K, Ca, Cr, Mn, Fe, Cu and Zn were present in all samples which are responsible for initiating insulin function, but the levels differ with the...
Table 2. Other ethno medicinal uses of studied antidiabetic species of *Ficus*.

<table>
<thead>
<tr>
<th>Species</th>
<th>Part used</th>
<th>Disease</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>F. Bengalensis</em></td>
<td>Bark</td>
<td>Cold</td>
<td>Infusion of bark is used in cold</td>
</tr>
<tr>
<td><em>F. carica</em></td>
<td>Fruit</td>
<td>Constipation and piles</td>
<td>Fruits are eaten for mild constipation</td>
</tr>
<tr>
<td><em>F. lacor</em></td>
<td>Fruit</td>
<td>Stomach diseases</td>
<td>Fruit powder is taken in stomach disorder</td>
</tr>
<tr>
<td><em>F. racemosa</em></td>
<td>Fruits</td>
<td>Cancer</td>
<td>Fruits are taken to treat cancer</td>
</tr>
<tr>
<td><em>F. hispida</em></td>
<td>Leaf</td>
<td>Earache</td>
<td>Leaf juice is taken in earache</td>
</tr>
<tr>
<td><em>F. virens</em></td>
<td>Bark</td>
<td>Menstrual cycle</td>
<td>Decocotion of bark is used to cure irregular menstrual cycle</td>
</tr>
<tr>
<td><em>F. religiosa</em></td>
<td>Leaf</td>
<td>Constipation and nausea</td>
<td>Juice of leaves taken in constipation and nausea</td>
</tr>
<tr>
<td><em>F. microcarpa</em></td>
<td>Bark</td>
<td>Ulcer</td>
<td>Decocotion of bark is used to treat ulcer</td>
</tr>
</tbody>
</table>

Figure 1. Medicinal species on the basis of concentration of essential elements.

**DISCUSSION**

Clinical research suggests that the diabetes causes the disruption of mineral trace elements in body. These trace elements play an important role in the production of secondary metabolites which are responsible for pharmacological actions of medicinal plants. But the exact mechanism of these active metabolites is yet to be established. The elements K, Ca, Mn, Cu, and Zn have been reported to be responsible for the secretion of insulin from the beta cells of pancreas (Chausmer, 1998; Kimura, 1996). By applying statistical analysis on results, it is shown in Figures 1 and 2 that *F. bengalensis* is a more medicinal plant and its prop roots has more antidiabetic activity, while through ethnomedicinal data, it is proven that *F. bengalensis* has more medicinal value.

The recommended daily potassium intake is 4.7 g a day and all the studied species show almost the same concentration which is fulfilling according to requirement. It is reported that optimum potassium and calcium levels are required for secretion of insulin and it plays a vital role in lowering blood glucose (Helderman et al., 1983; Mooradian and Morely, 1987). The recommended daily allowance (RDA) for magnesium is 6 mg/kg/d. This means 400 mg/d to 420 mg/d for adult men and 320 mg/d for adult women. In our present study, *F. hispida* showed maximum concentration of Mg, although in clinical as well
Table 3. Recommended and studied values of antidiabetic essential elements.

<table>
<thead>
<tr>
<th>Antidiabetic essential elements</th>
<th>Recommended daily intake</th>
<th>Amount in Ficus species studied (mg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>2-5.6 g/day</td>
<td>11.07-11.50</td>
</tr>
<tr>
<td>Calcium</td>
<td>1-2 g/day</td>
<td>3.16-16.41</td>
</tr>
<tr>
<td>Zinc</td>
<td>8 to 11 mg/day</td>
<td>11.32-50.76</td>
</tr>
<tr>
<td>Manganese</td>
<td>2.5 to 5 mg/day</td>
<td>13.77-57.22</td>
</tr>
<tr>
<td>Chromium</td>
<td>1,000 mcg daily</td>
<td>10.03-38.26</td>
</tr>
<tr>
<td>Copper</td>
<td>1.2 mg/day</td>
<td>1.09-8.98</td>
</tr>
</tbody>
</table>

ethno medicinally in the form of infusion, given good quantity of it. Zinc, which was present in all the studied plant samples, has an important metabolic role in the production and management of insulin levels (Kumar and Rao, 1974; Scott and Fischer, 1938). Insulin is known to contain Zn and the pancreas of diabetic patient contains only about one half the normal amount of zinc (Brewer and Prasad, 1977).

Chromium is necessary for optimum carbohydrate metabolism. Cr may potentate insulin, and is usually lost in processed foods. Cr concentration was 0.09 mg/g in F. bengalensis prop roots, which has been reported to possess antidiabetic efficacy (Singh et al., 2009). The elements Cu, Fe, and Zn present in all the plant samples are necessary for maintaining proper metabolism (Singh and Garg, 1997). Leaves of F. racemosa contained the least concentration (13.77 mg/g) of manganese while the highest concentration (57.22 mg/g) was exhibited in the bark of F. hispida. The related recommended daily intake and the values found in studied species of antidiabetic essential elements are shown in Table 3 and their ethnomedicinal uses in Table 2. It has been reported that trace amount of Cd and Pb can be detected in all plants and food materials (Piscator, 1985; Sherlock et al., 1983).

The variations in the concentration of these elements within these studied antidiabetic plants are the result of quality factors such as mineral composition of soil in which plant grows and absorbability of corresponding elements, age of plant, season in which sample was collected and climatic conditions including atmosphere and pollution.

Conclusion

Present work could serve as a vital resource for further clinical studies on these medicinal plants and indicated the use of Ficus species to control diabetes. There is a need to study further pharmacological activity, toxicological effects and the exact mechanism of the drug; as they are ideal alternative drugs, especially in underdeveloped countries. In this regard, the species of genus Ficus (Moraceae) are the potential natural source to cure a global problem, diabetes, and can be used as an additive source in nutraceutical and biopharmaceutical industries. The elements present in these antidiabetic medicinal plants have important role in the treatment of diabetes. The results of present work showed...
variation in elemental composition of medicinal plants from region to region, thus there is a need to vouch for more research on medicinal plants to integrate their medicinal values in the advance system of medicine preparation.

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REFERENCES


