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# EFFECT OF MINOR MINERALS CONTAINING CHROMIUM ON HUMAN HEALTH
## Part. I. Diabetes Control with Herbs

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It was established scientifically in 1950 that chromium plays a vital role in the metabolism of carbohydrates and that its deficiency leads to diabetes in the human body. In the Islamic system of medicine, several herbs have been used for the control of diabetes for centuries. In the present paper, some of these herbs have been evaluated for their chromium contents by the atomic absorption technique. The results show the presence of chromium in all these herbs perhaps thereby pointing to its therapeutic value. The chromium contents varies from 1.25 to 15.00 μg per gram in dried herb.

## INTRODUCTION

The first recorded evidence of the vital role that chromium plays in animals was obtained when rats on chromium-deficient diet were observed to lose their ability to maintain a healthy blood sugar level [1]. They developed diabetes-like symptoms and also had abnormally high levels of cholesterol in their blood. It has also been experimentally concluded that chromium is necessary [2] for man to deal with sugar in food.

Chromium is now considered [3] part of a compound, called the glucose tolerance factor, a substance known to be present in brewer's yeast, liver and kidney, which improve glucose tolerance in animals suffering from insulin disorders. The analysis of the hair of a diabetic patient showed that the level of chromium was less than normal in the body [5]. It was suggested that the deficiency of chromium resulted in hyperglycemia, growth failure, neuropathy, cataract and atherosclerorsis [6]. Chromium supplementation [7, 8] has been reported to improve glucose tolerance in malnourished children and elderly diabetic subjects. Administration [9] of organic chromium compound was found to be of benefit and appeared to be advisable during pregnancy.

It has also been reported that the absorption of chromium depends on the chemical form in which it is bound. It occurs in the brewer's yeast [10], ranging between a reported 0.1 to 1.2% of trivalent chromium salt to about 25% as the organic complex. In the Missouri studies [11], both diabetic and normal subjects experienced significant decline in serum cholestrol after consuming the brewer's yeast.

Mertz [12] suggested that chromium protects the sugarcane eaters for the side-variations in blood sugar which adversely affect health. It has therefore been suggested that chromium makes insulin more readily mobilised and available to the system. The mechanism of this, however, is not yet established. It has been suggested [13] that relatively isolated chromium deficiency in man (hitherto poorly documented) causes glucose intolerance and inability to utilise glucose for energy neuropathy as with normal insulin levels, thus causing high free fatty acid levels and low respiratory quotient and abnormalities of nitrogen metabolism. In the above experiment [13, 14] chromium chloride ($CrCl_3$), chromium oxide ($CrO_3$) and chromium acetate were used intravenously.

Nature has provided chromium with different compositions. Cane juice [15, 19], honey, and brown sugar are known to contain sufficient amounts of chromium to meet the requirement of the body for the metabolism of carbohydrates, but refined sugar contains negligible amounts of chromium.

In the Islamic system of medicine, several herbs are used for the control of diabetes. Their water or alcoholic extracts when administrated to diabetic patients showed no responce while in a powder form, they diminished the quantity of sugar [15] in urine and allayed the unquenchable thirst of diabetics. It is suggested that the herbs act indirectly through stimulation on insulin secrection of the pancreas and reduce glycosuria. Due to the effectiveness of these herbs, study of their chromium contents merits examination as it can throw light on the importance of chromium in diabetes. In this connection, it is relevant to add that Mertz *et al* [13] have suggested that chromium defici-

ency results in glucose intolerance and that the conversion of this impaired state to normal glucose-tolerance is brought about by the administration of chromium. Lue and Abernathy [19] reported that relative supplemented chromium response was signficantly higher in low insulin than in high insulin subjects and the ratio of total insulin to the total glucose was signficant in low insulin than in high insulin subjects.

## EXPERIMENTAL

1. *Eugenia jambolana (Jamoon):* The seeds were collected from the bazaar. These were washed with distilled water, dried and ashed at 800°. It took 8 hr to get carbon free ash.

2. *Symnema sylvestre (gurmar buti):* The leaves of *Symnema sylvestre* were collected from herb-sellers, washed with distilled water dried and ashed at 800° which took 4-5 hr.

3. *Momordica charantia (Karela):* The fresh unripe bitter *Karela* was taken, washed with distilled water and ashed at 800° for 4-5 hr.

4. *Terminalia belerica (Bahera):* The fruits of *Terminalia belerica* were procured from the market. They were washed with distilled water and dried and ashed at 800°. The procedure took 6-7 hr.

5. *Terminalia chebula (Harad):* The fruit of *Terminalia chebula* was also procured from the market, washed with distilled water and ashed at 800°. It took 6-7 hr to get carbon-free ash.

6. *Morua nigara (Shahtoot):* The fresh leaves were washed with distilled water dried and ashed at 800° for 4-5 hr for further studies.

## PREPARATION OF SOLUTIONS FOR ATOMIC ABSORPTION STUDIES

A definite amount of each herb was taken for each experiment. The ash of the herbs was prepared by burning the material at 850° – 900° in an electrically heated oven. Higher temperature gave more insoluble materials. The ash was first treated with 10% HCl, then with 20% HCl and finally with concentrated HCl. All the coloured material went into solution leaving a minute quantity of a white insoluble material. The solution was made upto 250 ml, by adding distilled water, for atomic absorption studies.

Measurements of absorption were carried out in a ketone phase by using Perkin-Elmer 280-B atomic absorption spectrophotometer with lamps having different wave lengths for the estimation of chromium, zinc and copper.

## RESULTS

Chromium, zinc* and copper in different herbs

| Source | Average micrograms per gram | | |
|---|---|---|---|
| | Cr. | Zn | Cu |
| (i) *Eugenia jambolana* (Jamoon) | 2.50 | 6.32 | 18.23 |
| (ii) *Symnema sylvestre* (Gurmar buti) | 15.00 | 73.00 | 197.00 |
| (iii) *Momordica charantia* (Karela) | 1.26 | 3.07 | 2.12 |
| (iv) *Terminalia belerica* (Bahera) | 3.12 | 25.08 | 80.24 |
| (v) *Terminalia chebula* (Harad) | 1.87 | 10.0 | 36.47 |
| (vi) *Morus nigra* (leaves of Shahtoot) | 3.75 | 8.00 | 8.20 |

* The results for Zn and Cu and their importance for human body would be dealt with in one of the next publications.

## DISCUSSION

Scientific literature fully supports [2, 5, 7, 11, 12] the view that chromium deficiency in the human body first disturbs its carbohydrate metabolism and then leads to the diabetic condition. In order to keep the carbohydrate metabolism in order, nature has provided chromium specially with all sweet things and the quantity is sufficient for normal body function. (Raw sugar contains 0.24 ppm and honey, 0.29 ppm). White sugar contains a negligible amount of chromium which is the real cause of chromium deficiency inside the human body.

The chromium requirement of the body can be fulfilled by giving inorganic salts ($CrCl_3$, $CrO_3$, CrOAc). The chromium absorption by the body depends on the nature of the salts. Organic chromium salts are preferred [10] as they are more acceptable to the body.

The analysis of the herbs, which have been utilised for the control of diabetes in the Islamic system of medicine showed the presence of large amounts of chromium (1.25 ppm to 15.00 ppm) as compared with the carbohydrates. So the amount of chromium in herbs is of therapeutic value in its natural form. The chromium present in herbs may be one of the major factors which controls diabetes in human beings. The chromium salts present in herbs are largely of organic origin. There are more acceptable and hence get readily assimilated by the body compared with the inorganic salts of chromium [9]. Even the absorption

of organic salts by the body depends on the nature of the organic group attached to the chromium atom. So a mixture of these herbs will probably provide different types of organo-chromium salts and the possibility of the maximum absorption of chromium salt by the body will increase and will also effect mobility and the production of insulin in the body [13, 9]. From these results, it can be concluded that use of herbs for diabetes clearly provides a scientific ground of its effectiveness.

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