ORIGINAL ARTICLE
INSULIN SENSITIVITY TO TRACE METALS (CHROMIUM, MANGANESE) IN TYPE 2 DIABETIC PATIENTS AND NON DIABETIC INDIVIDUALS

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Background: Diabetes mellitus constitutes one of the most important problems in developing and non-developing countries. The purpose of the study to estimate the concentrations of Chromium and Manganese in diabetic and non-diabetic population of Hazara division. The cross sectional comparative study was carried out on one hundred blood samples of Type 2 Diabetic patients collected non-randomly from Ayub Teaching Hospital and one hundred normal healthy controls from Women Medical College Abbottabad from September 2014 to April 2015. **Methods:** The study included two hundred subjects. Among them 100 were diabetic and 100 non diabetic respectively. The blood samples were collected from Ayub Medical College, Abbottabad. The serum Chromium and Manganese levels were determined by Atomic Absorption spectrophotometer. **Results:** Serum Chromium and Manganese levels were decreased in diabetic and increased in non-diabetic patients. **Conclusion:** Low serum level of Chromium and manganese were found in diabetic patients as compare to non-diabetic individuals.
Keywords: Chromium; Manganese Atomic Absorption Spectroscopy

INTRODUCTION

Diabetes mellitus is the commonest endocrine disorder encountered in clinical practice. The disease is characterized by distributed metabolism of carbohydrates, lipids and proteins leading to hyperglycaemia, ketonemia, acidosis and other metabolic abnormalities and lately the occurrence of other complications, involving small blood vessels, eyes, kidneys, nerves and accelerated atherosclerosis.[1]

Diabetes mellitus may be primary or secondary. Primary diabetes is generally classified into insulin dependent diabetes mellitus (IDDM) or type 1 diabetes and Non-insulin dependent diabetes mellitus. (NIDDM) or type 2 diabetes.[2] Whereas secondary diabetes may arise from pancreatic disease, stressful situations, over production of hormones, like growth hormone, glucocorticoids, and thyroxine as well drug therapy.

Unlike type 1 diabetes, the pathogenesis of type 2 diabetes is more complex and less certain. The disease is characterized by a combination of decreased insulin secretion or their actions both of which proceeds and predict the onset of disease.[3] Obesity is a major risk factor for disease. Although environmental factors ,both post and prenatal play an important role in determining the risk of disease, a substantial evidence supports that the disease is influenced by inheritance, On molecular basis several uncommon Mandelian forms of type 2 diabetes have been defined.[4]

Type 2 diabetes, once considered as a rare disease, has been reported to be on rise at an alarming rate[5], and its prevalence according to WHO estimates that the number of diabetics will be increased over 300 million by year 2025[6]. In Pakistan, population the diabetic patients will be over 11.5 million after a decade if appropriate measures are not taken to control the disease.[7]

Insulin, a hypoglycaemia factor, requires Chromium as it activates insulin receptor kinase.[8] It increases insulin sensitivity, glucose utilization and β-cells sensitivity[9,10] because of its role in insulin activity.

Manganese (Mn) is an essential trace metal with insufficient intake in virtually all diets. It has been reported that Mn is involved in normal immune functions, regulation of blood sugar and cellular energy, and the defence mechanisms against free radicals.[11]

The rational of the study was to find out the relationship and role of chromium and manganese in diabetics and non-diabetics.

Objectives are quantitative analysis of Chromium and Manganese in type 2 diabetic and normal subject and comparison of Chromium and Manganese between diabetic and controls.

MATERIAL AND METHODS

The study was conducted in Ayub teaching hospital and Women medical college, Abbottabad, respectively. One hundred patients included in this

study were established as type 2 diabetics, of both sexes. One hundred persons were included as controls having no history of diabetes or any other major illness affecting glucose status.

The cross sectional comparative study was carried out from September 2014 to April 2015. These participants were selected by using Non probability convenient sampling technique. Patients with secondary diabetes were excluded because they affect glucose status. One hundred persons were included as controls, having no history of diabetes or any other major illness affecting glucose status.

Fasting and random blood samples were drawn by Veni puncture and subdivided into two parts, one for estimation of blood glucose, HbA1c and the other was left to clot and serum was immediately separated by centrifugation for estimation of Chromium and Manganese.

Blood was analysed for glucose and HbA1c by using reagents kits supplied by Boehsinger Manhiem and serum was analysed for Cr and Mn by atomic absorption spectrophotometer.
Measurement of weight on a calibrated analogue scale, and height using a digital stadiometer (seca 242, USA). These parameters were used to calculate the BMI using the formula (kg/height (m^2)

For estimation of Chromium and Manganese serum samples were subjected by to wet digestion method. A Digestion mixture was prepared by mixing sulphuric acid, nitric acid and 63% per chloric acid in a ratio of 1:5:2, respectively. Two ml of serum was taken in a conical flask and 20 ml of digestion mixture was added. The solution was placed on hot plate and the temperature was gradually increased. The heating continued till 2–3 ml of transparent solution was left it was cooled and diluted up to 50 ml with deionized water. The solution was filtered using Whatman filter paper. The filtrate obtained was kept for elemental analysis.

Level of Cr and Mn in the serum samples were determined by using atomic absorption spectrophotometer.

RESULT

Overall the cases and the controls were in the age of 22–65 years. There were 69 males and 31 females in type 2 Diabetes mellitus group and 39 males and 61 females in normal. Mean value of BMI in non-diabetic is 22.238±17.475 and in type 2 diabetics the mean value is 26.29±3.833, indicating a significant rise of BMI in diabetics. (≤0.001). Table-1 shows that fasting and random values of glucose were significantly higher in T2D as compare to normal subjects. In table-2 it is observed that there is a significant decrease (≤0.001) of serum Chromium in diabetics in contrast to

non-diabetic, also shows a decline of serum manganese in diabetics as compared to non-diabetic

Table-1: Levels of blood glucose and HbA1c levels in normal and diabetics

	Normal	Type 2 Diabetes	p value
Fasting	77.0700±7.890	170.000±36.58	≤0.05
Random	110.0500±8.90849	286.1700±36.568	≤0.05
HbA1C	5.0270±.60517	8.4330±.9276	≤0.05

Table-2: The serum levels of chromium and manganese in non-diabetics and diabetics

	Normal	Type 2 Diabetes	p Value
Chromium	2.921±1.0581	1.389±.323	≤0.001
Manganese	.310±.330	.288±.267	≥0.05

DISCUSSION

With growing awareness among clinicians and general public about diabetes mellitus as a heterogeneous metabolic disease characterized by hyperglycaemia and by the presence of long term vascular complications arising from effect in insulin secretion or action or both .Certain minerals play key role in the secretion or action or both of insulin.[12]

The role of Chromium and Manganese was called into question by others that these minerals play an important role in action of insulin is confirmed by our present study. Manganese play an important role in activity of insulin and its main function is to activate enzyme hexokinase therapy increasing of glucose into cells and its deficiency may result in hypoglycaemia.

The results of our study were compared with the results of others[13–16] regard to chromium and manganese levels in diabetics and non-diabetic. Our study revealed low levels of Chromium and Manganese in diabetic patients and increased serum Chromium in non-diabetic in population of Hazara division , These findings are in consistency with the findings of.[17,1] Our results correlates with the data reported by.[19]

Our results correlates with finding of other workers[20,21] who found that serum levels of Manganese in the diabetics were significantly reduced when compared with the non-diabetic, This study contradicts with the work of others[22,23] who reported the higher level of manganese in diabetic as compare to non-diabetic.
Our findings are in accordance with the work conducted by[24] where Manganese decreases in serum of type 2 Diabetic patients as compare to non-diabetic. Our study similar with others[25] where lower level of Manganese in diabetic patients and higher in non-diabetics.

CONCLUSION

This study was conducted to evaluate the effect of chromium and Manganese on Type 2 diabetes mellitus. The levels of chromium and Manganese are

compared among the diabetics and non-diabetics and it is observed that diabetics low serum level of chromium and manganese are found as compare to non-diabetic. This study may be helpful to administer Chromium and manganese in diabetic patient.

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AUTHORS' CONTRIBUTION

BH, SA, UF, MH, SR and SW designed recorded and interpreted results of their respective fields. Article writing was done by Bibi Hajra and Shaukat Ali Orakzai.

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