

RELATIONSHIP BETWEEN LATE PREGNANCY AND SERUM CHROMIUM CONCENTRATION IN PATIENTS WITH DIABETES MELLITUS

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Abstract

Chromium is essential element in human nutrition. Serum concentration of chromium are not well characterized during pregnancy or in gestational diabetes mellitus.

Fifty females were involved in this study, all of them were in the third trimester, twenty without diabetes mellitus and thirty with diabetes mellitus.

The aims of our study were to detect the alteration in the serum chromium levels in late pregnancy in women suffering from diabetes mellitus type 1 and those with gestational diabetes mellitus, and the association of altered serum chromium concentration with lipid concentration.

The results of this study show that low serum concentrations of chromium are associated with hyperglycemia and hypotriglycerdemia. There were no significant differences in serum chromium in patients with type 1 D.M. and those with gestational D.M.

Introduction

A number of studies have reported an association between diabetes mellitus (D.M.) and alteration in the metabolism of several trace minerals⁽¹⁾. Impaired insulin release, insulin resistance and glucose intolerance in experimental animals and humans with D.M. have been linked to a compromised status of chromium, magnesium, selenium, vanadium and zinc⁽²⁾. Some of these minerals (e.g. zinc, chromium, magnesium) are excreted at higher than normal rates in patients with D.M., often leading to excessive urinary mineral wasting⁽³⁾. The characteristics polyuria of D.M. that result from the glucose-mediated hyperosmotic glomerular filtrate may be largely responsible for enhanced urinary mineral loss⁽⁴⁾.

So many experimental evidence in animals and humans support a significant role for minerals in D.M.⁽⁵⁾. Chromium is one of the basic building blocks of all things, living and non-living. Therefore, it plays a vital role in our life⁽¹⁾. Chromium picolinate which is the biological active form of chromium helps insulin to do its job⁽⁶⁾. Insulin's ability to regulate glucose levels and lipid metabolism depends on its binding to specific receptors found in many peripheral tissues, in addition Chromium increase the number of insulin receptors present in a target tissue, chromium also has

been demonstrated to increase the binding of insulin to its receptors⁽⁷⁾. Chromium was initially suspected to be an essential dietary mineral in the late 1950s after studies in patients receiving total paranteral nutrition (TPN) demonstrated a sever deficiency of chromium resulting in impaired glucose tolerance and subsequent hyperglycemia and glucosuria⁽⁸⁾.

Other signs of chromium deficiency include hyperinsulinemia (common in type 2 D.M.), decreased insulin binding and D.M. associated neuropathies and vascular pathologies⁽⁹⁾.

Subjects and Methods

The study was carried out in Hilla Maternal and Child Hospital for 4 months (from May to August 2005). The experimental protocol consists of:

Patients

Thirty adult women with diabetes mellitus, their mean age is (31±2) years were involved in this study. The patients had no other disease which might influence the results.

Fifteen women were with gestational diabetes in which it develops during pregnancy. The other fifteen women were suffering from type 1 diabetes mellitus.

Twenty healthy women with mean age equal to (32±2) years were involved in this study as control group.

Methods

Venous blood was collected in the morning after an overnight fasting from patient and control groups for measurement of whole blood glucose, serum chromium, triglyceride and total cholesterol.

Chromium concentration was measured by graphite urnace atomic absorption spectrometer using Varian Spectra AA 800 Zeeman effect instrument from Varian Australia P/L Melbourne.

Blood glucose was measured in (10 c.c) sample of fresh whole blood by glucose oxidase method using Randox, Kit ⁽¹⁰⁾, serum total cholesterol concentration was measured by enzyme colorimetric testing Biomerieux, Kit ⁽¹¹⁾ and serum triglyceride was measured by enzyme colorimetric testing Kit, frm Biomerieux ⁽¹²⁾

Statistical Analysis

The results are given as the mean and standard deviation. (mean±SD) Comparisons between groups are assessed using student (t -test). The data were also analyzed for correlation between the serum or plasma chromium and blood glucose. The results were considered significant when (p < 0.05)

Results

The mean concentration of serum chromium level was significantly higher in control group than in patients with D.M. (p < 0.05),while there were no significant differences between type 1 and gestational D.M.

The mean concentration of serum triglyceride was significantly higher in patients with D.M. than control group (p < 0.05), while there were no significant differences between type 1 and gestational D.M.

The mean concentration of serum total cholesterol was significantly higher in patients with D.M. than control group (p<0.05), while there were no significant difference between type 1 and gestational D.M.

The mean concentration of blood glucose level was significantly higher in D.M. patients than control group (p < 0.05),

while there were no significant difference between type 1 and gestational D.M.

Table (1)
Show (mean ± SD) of chromium , triglyceride (TGL), total cholesterol , and fasting glucose in three group,* P<0.05

Group	Serum chromium (nmol/L)	Serum TGL (mg/dl)	Serum total cholesterol (mg/dl)	Fasting blood glucose (mg/dl)
Type 1 DM	1.12 ± 0.170 *	192.3 ± 8.17 *	211.4 ± 6.79 *	140.8 ± 14.34 *
Gestational D.m	1.87 ± 0.33	196.3 ± 6.58	208.8 ± 8.92	145.7 ± 12.93
Control group	3.31± 0.49	118.7 ± 24.8	143.6 ± 7.77	85.9 ± 5.59

Table (2)
Show the age , length, and week gestational in three groups.

Group	Age	Length	Week gestation
Type 1 DM	31 ± 1	153.5± 16.15	31± 1.5
Gestational D.m	32 ± 2	141.9 ± 5.6	32 ± 1.6
Control group	32 ± 2	141.9 ± 4.77	32 ± 1.6

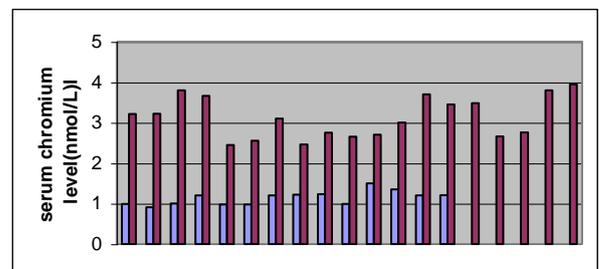


Fig.(1) Show the level of serum chromium in patients with gestational diabetes (n=15) compared with control(n=20).

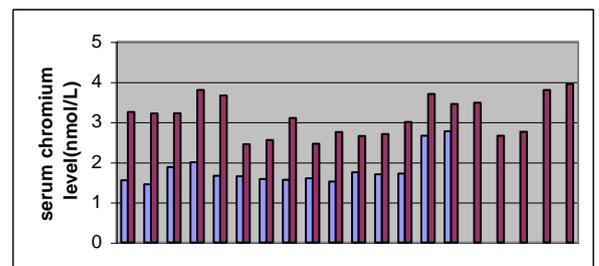


Fig.(2) Show the level of serum chromium in patients with type I diabetes mellitus (n=15) compared with control(n=20).

Discussion

Chromium is a mineral the body needs in very small amounts, but it plays a significant role in human nutrition. The most important function of chromium in the body is to help regulate the amount of glucose⁽¹³⁾. Our study shows that a significant decrease in the level of chromium in type 1 diabetes ($p < 0.05$). Epidemiological studies indicate that low chromium levels may be indirectly related to glucose intolerance⁽¹⁴⁾, and indirectly to diabetes and cardiovascular disease⁽¹⁵⁾.

This is due to insulin which plays a starring role in metabolism of blood glucose by regulating the movement of glucose out of blood and into cells⁽¹⁶⁾. Scientists believe that insulin uses chromium as an assistant (technically, a co-factor) to the cell membrane, thus allowing glucose to enter the cell⁽¹⁷⁾.

In the past, it was believed that to accomplish this, the body first converted chromium into a large chemical called glucose tolerance factor (GTF)⁽¹⁸⁾. However, subsequent investigation indicated that scientists now believe that there is no such thing as GTF, rather, chromium appears to act in concert with a very small protein called low molecular weight chromium-binding substance to assist insulin's action⁽¹⁹⁾.

So chromium facilitates the binding of insulin to its receptors and chromium deficiency during pregnancy has the potential to impair glucose tolerance and insulin resistance thus increasing risk of gestational diabetes, whether or not this actually occurs is uncertain⁽²⁰⁾.

Supplementation during pregnancy with chromium has not been recommended⁽²¹⁾. One study suggests that chromium may also improve lipid levels particularly triacylglycerols⁽²³⁾, while other studies suggest no relation between them⁽²⁴⁾, in our study there was a significantly higher concentration of lipid in patients with D.M. ($p < 0.05$) than control group.

Numerous case reports and small limited studies on the effectiveness of chromium as an adjunct in the treatment of patients with DM have appeared in the

literature. Many have documented the ability of this mineral to lower fasting glucose serum lipid (total cholesterol triglyceride) and HbA^{1c} levels, While some also demonstrate increase in HDL cholesterol⁽²⁵⁾.

Our results show significant decreased level of chromium with increased levels of total cholesterol and triglyceride in Type I diabetes mellitus.

This result agrees with results of numerous experiments have shown that chromium can prevent atherosclerosis. In rats, for example, chromium deficiency has been associated with increased serum cholesterol levels and formation of aortic plaques, adding chromium to the diet prevented both the formation of aortic plaques and the rise of serum cholesterol^(26,27). Therefore concluded, a strong association exists between chromium deficiency and elevated blood cholesterol levels.

Conclusion

The increase in blood sugar in type 1 D.M. and gestational diabetes was associated with decrease in serum chromium level, whether this decrease contributes to the pathogenesis of D.M. or is merely a consequence of disease is unclear.

There is an alteration in serum total cholesterol and triacylglycerol in patients with D.M. associated with low serum chromium level and the increment in blood sugar.

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الخلاصة:

الكروم عنصر أساسي في تغذية الإنسان , ولم يتم تشخيص او تقدير تركيز هذا العنصر أثناء فترة الحمل أو في حالة داء السكري المصاحب للحمل, وقد تضمنت هذه الدراسة (50) امرأة و جميعهن في الأشهر الأخيرة من الحمل (20) منهن مصابات بداء السكري بينما (30) الأخريات مصابات بداء السكري (15) مصابات بداء السكري من النوع الأول بينما الـ(15) الأخريات ممن لديهن داء السكري أثناء الحمل .

الهدف من هذه الدراسة تقدير مدى التغيير في مستويات عنصر الكروم في مصول النساء ممن ليدهن مرض داء السكري النوع الأول وكذلك دراسة العلاقة بين التغييرات في تركيز الكروم مع مستويات الدهون .

أظهرت النتائج انخفاض تراكيز الكروم في مصول النساء المصابات بداء السكري من النوع الأول بالاقتران مع ارتفاع مستويات كل من الكلوكوز والدهون دون وجود أي أهمية معنوية في مستويات الكروم عند المقارنة مجموعة النساء المصابات بمرض السكري من النوع الأول وممن لديهن داء السكري أثناء الحمل