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AN IMPACT OF CHROMIUM ON LIPID PROFILE AND GLYCEMIC LEVELS IN THE PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

INTRODUCTION: Chromium is a vital trace mineral that appears to play a significant role in the modulation of insulin function and its impact on the metabolism of carbohydrates, proteins, and lipids. It is a crucial element for enhancing the efficacy of insulin. Research indicates that individuals with type 2 diabetes tend to have lower serum chromium levels compared to those without the condition. Insulin resistance serves as a common factor among various cardiovascular disease risk elements. Evidence suggests that chromium can diminish insulin resistance and potentially lower the risk of developing cardiovascular disease and type 2 diabetes.

AIM AND OBJECTIVES: To study the impact of chromium supplementation of blood sugar levels, insulin levels and lipid profile in type 2 diabetes mellitus patients.

METHODS: This study is a randomized controlled trial involving 60 participants diagnosed with Type 2 Diabetes Mellitus, who were divided into two groups: one receiving chromium supplementation and the other receiving a placebo. Fasting blood glucose levels, postprandial blood glucose levels, and lipid profiles were assessed at both the commencement and conclusion of the study. Participants were advised to maintain their usual dietary habits, lifestyle, and medication regimen. No significant alterations were noted in weight, body mass index, fasting blood glucose, or postprandial blood glucose levels in either group.

RESULTS: The findings of this study indicate that chromium supplementation did not produce significant changes in blood glucose levels. Nevertheless, there were modest positive effects observed regarding insulin resistance and lipid profiles associated with chromium supplementation.

CONCLUSION: Supplementation with chromium may assist patients with Type 2 Diabetes Mellitus in ameliorating the lipid profile disturbances and insulin resistance linked to the disease.

Keywords: Chromium, Cancer, Diabetes Mellitus, Hyperlipidaemia, Trace Elements

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1. INTRODUCTION:

Diabetes is classified by the World Health Organization (WHO) as a "metabolic disorder of various origins, characterized by persistent hyperglycemia and disturbances in the metabolism of carbohydrates, fats, and proteins, which arise from defects in insulin secretion, insulin action, or both." Research indicates that in the year 2000, approximately 171 million adults globally were diagnosed with diabetes, a figure projected to increase to around 366 million by 2030. he prevalence of diabetes mellitus is nearing epidemic levels. While the underlying mechanisms of diabetes are intricate, advancements in scientific research have identified various risk factors contributing to the disease, including genetic predispositions, lifestyle modifications, alcohol consumption, smoking, and elevated body mass index (BMI). These factors lead to alterations in insulin production or action, ultimately resulting in hyperglycemia. Diabetes is classified into type1 –insulin dependent diabetes mellitus which occurs due to lack of insulin secretion. It is an autoimmune destruction of beta cells of pancreas (1). Destruction of beta cells can also occur in viral infections and heredity. The onset of disease in early childhood or adolescence is known juvenile diabetes. Type 2 diabetes mellitus is a non-insulin dependent type which occurs due to decreased sensitivity of tissues to insulin. The insulin secretion may be normal or sometimes increased, but the receptor on the target tissue is resistant to insulin. This condition starts later in life, usually 3rd or 4th decade (2). Chromium is an essential mineral that appears to have a beneficial role in the regulation of insulin action and its effects on carbohydrate, protein and lipid metabolism. Chromium is an important factor for enhancing insulin activity. Studies show that people with type 2 diabetes have lower blood levels of chromium than those without the disease. Insulin resistance is the common denominator in a cluster of cardiovascular disease risk factors. Chromium has been shown to reduce insulin resistance and to help reduce the risk of cardiovascular disease and type 2 diabetes (3).

AIM AND OBJECTIVES:

To study the impact of chromium supplementation of blood sugar levels, insulin levels and lipid profile in type 2 diabetes mellitus patients.

2. MATERIALS AND METHODS:

It was a randomized control study done on 60 patients with Diabetes Mellitus in a tertiary care hospital for a duration of 8 weeks. The study population was divided into 2 Groups-Group 1: receiving chromium supplementation and group 2: receiving placebo. Patients over 40 years old with a documented history of T2DM for more than six months without any other chronic diseases, without the background of thyroid, liver, and any chronic diseases or under medical therapy for hyperlipidaemia, not being pregnant or lactating, not consumption of any other supplements (antioxidants, minerals or vitamins, omega 3, and carnitine) or herbal medicines were included in the study.

3. RESULTS:

TABLE 1: COMPARISON OF BASELINE CHARACTERISTICS OF STUDY POPULATION

VARIABLES	CHROMIUM GROUP	PLACEBO GROUP

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AGE	50.62±4.5 YEARS	51.9±5.5 YEARS
WEIGHT	76.8±8.5KGS	75.9±9 KGS
HEIGHT	160.2±9.5CMS	161.4±9.2CMS
BMI	27.9±5.0KG/M²	27.8±4.7KG/M²

TABLE 2: COMPARISON OF BLOOD SUGAR LEVELS AND LIPID PROFILE IN BETWEEN THE GROUPS

PARAMETER	CHROMIUM GROUP	PLACEBO GROUP	P-VALUE
FBS BASELINE	188.64±70.3MG/DL	204.7±66.5MG/DL	>0.05
FBS END POINT	158.2±64.25MG/DL	178.4±50.4MG/DL	>0.05
PPBS BASE LINE	220±75.4MG/DL	218.6±64.8MG/DL	>0.05
PPBS END POINT	200.66±66.5 MG/DL	210.6±58.2MG/DL	>0.05
INSULIN BASELINE	9.8±7.1µIU/ML	7.5±3.6µIU/ML	>0.05
INSULIN END POINT	7.4±3.1µIU/ML	7.0±4.2µIU/ML	<0.05
TOTAL CHOLESTEROL BASE LINE	211.4±47.2mg/dl	206.1±48.1mg/dl	>0.05
TOTAL CHOLESTEROL ENDPOINT	180.4±36.1mg/dl	191.2±30.2mg/dl	0.035
TRIGLYCERIDE BASELINE	153.3±51.6mg/dl	179.4±100mg/dl	0.040
TRIGLYCERIDE ENDPOINT	138.1±64mg/dl	150.2±51.6mg/dl	0.026
LDL CHOLESTEROL BASELINE	139.5±47.1mg/dl	149.6±34.7mg/dl	0.045
LDL CHOLESTEROL ENDPOINT	110.1±42.2mg/dl	192.1±30.2mg/dl	0.030
HDL CHOLESTEROL BASELINE	39.6±8.5mg/dl	45.5±8mg/dl	>0.05

4. DISCUSSION:

The mean age of the chromium group was 50.62±4.5 years and the mean age of placebo group was 51.9±5.5 years. The mean weight of the chromium group was 76.8±8.5kgs and the mean weight in the placebo group was 75. 9±9kgs.The mean height of the chromium group was 160.2±9.5 cms and the mean height of the placebo group was 161.4±9.2 cms. The mean BMI of the chromium group was 27.9±5.0kg/m²and the mean BMI of the placebo group was 27.8±4.7kg/m².

The mean baseline fasting blood sugar levels in the chromium group was 188.64±70.3mg/dl and the mean baseline FBS in the placebo group was 204.7±66.5mg/dl.P-value for comparison

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of fasting blood sugar levels in between the groups was>0.05 which was statistically insignificant in between the groups. The mean endpoint fasting blood sugar levels in the chromium group was 158.2±64.25mg/dl and the mean baseline FBS in the placebo group was 178.4. ±50.4mg/dl.P-value for comparison of fasting blood sugar levels in between the groups was>0.05 which was statistically insignificant in between the groups. The mean baseline post prandial blood sugar levels in the chromium group was 220±75.4mg/dl and the mean baseline FBS in the placebo group was 218.6±64.8mg/dl.P-value for comparison of basal post prandial blood sugar levels baseline in between the groups was>0.05 which was statistically insignificant in between the groups. The mean endpoint post prandial blood sugar levels in the chromium group was 200.66±66.5mg/dl and the mean baseline PPBS levels in the placebo group was 210.6 ±58.6mg/dl.P-value for comparison of post prandial end point blood sugar levels in between the groups was>0.05 which was statistically insignificant in between the groups.

The mean insulin levels baseline in chromium group was 9.8±7.1µIU/ml and the insulin baseline levels in placebo group was 7.5±3.6µIU/ml.P-value for comparison of mean baseline levels in the study population was>0.05 which was statistically insignificant in between the groups. The mean insulin levels end point in chromium group was 7.4±3.1µIU/ml and the insulin endpoint levels in placebo group was 7.0±4.2µIU/ml.P-value for comparison of mean baseline levels in the study population was <0.05 which was statistically significant in between the groups.

In our study the mean baseline total cholesterol levels were 211.4±47.2mg/dl in the chromium group and in the control group the mean baseline total cholesterol levels were 206.1±48.1mg/dl.P-value for baseline total cholesterol levels was >0.05 which was statistically insignificant in between the groups. The mean endpoint total cholesterol levels were 180.4±36.1mg/dl in the chromium group and in the control group the mean baseline total cholesterol levels were 191.2±30.2mg/dl.P-value for endpoint total cholesterol levels was 0.035 which was statistically significant in between the groups. The mean baseline triglyceride levels were 153.3±51.6 mg/dl in the chromium group and in the control group the mean baseline triglyceride levels were 179.4±100mg/dl.P-value for baseline triglyceride levels was 0.04 which was statistically significant in between the groups. The mean endpoint triglyceride levels were 138.1±64 mg/dl in the chromium group and in the control group the mean endpoint triglyceride levels were 150.2±51.6 mg/dl.P-value for baseline end point triglyceride levels was 0.026 which was statistically significant in between the groups.

In our study the mean baseline LDL cholesterol levels were 139.5±47.1mg/dl in the chromium group and in the control group the mean baseline LDL cholesterol levels were 149.6±34.7mg/dl.P-value for baseline LDL cholesterol levels was 0.045 which was statistically significant in between the groups. The mean endpoint LDL cholesterol levels were 110.1±42.2mg/dl in the chromium group and in the control group the mean baseline LDL cholesterol levels were 192.1±30.2mg/dl.P-value for endpoint LDL cholesterol levels was 0.030 which was statistically significant in between the groups. In a study done by Robert Amadu Ngala et al on the effects of plasma chromium on lipid profile, glucose metabolism and cardiovascular risk in type 2 diabetes mellitus observed that patients with diabetes had significantly ($p<0.0001$) increased LDL, TC, TG, VLDL, insulin, CRP and HOMAIR and a significantly reduced plasma chromium ($p<0.0001$) (0.53± 0.02µg/l and 0.11±0.01µg/l control and case respectively). Low Cr ($p \leq 0.001$) was associated with high blood pressure, obesity and lipid dysregulation. Plasma Cr significantly correlated negatively with blood pressure and LDL. Therefore, increased apoB secretion, upregulation of VLDL and LDL, and an increased risk of cardiovascular disease can result from insulin shortage or hepatic insulin resistance.

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Although plasma lipids were enhanced in this study, the atherogenic or cardiovascular risk (total cholesterol / HDL) was low, and the lipid levels were still within physiological norms (8).

5. CONCLUSION:

Supplementation with chromium may assist patients with Type 2 Diabetes Mellitus in ameliorating the lipid profile disturbances and insulin resistance linked to the disease. The disruption of lipid metabolism is consistent with the markedly reduced plasma chromium levels observed in type 2 diabetic patients. The subjects' lifestyle choices may have contributed to their low cardiovascular risk. It has been demonstrated that increasing energy expenditure or exercise can enhance lipid profile.

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