

ROLE OF MAGNESIUM AS HYPOGLYCEMIC AGENT IN TYPE 2 DIABETES MELLITUSRekha Kumari¹¹Associate Professor, Department of Biochemistry, Katihar Medical College.**ABSTRACT****INTRODUCTION**

Magnesium deficiency has been associated with Insulin Resistance (IR) and increased risk for type 2 diabetes in adults. We evaluated the relationship between magnesium and insulin resistance in obese diabetic woman visiting to medical outpatient clinics (OPD).

METHODS

In this cross-sectional study, a total of fifty diabetic female subjects with age group of 30-60 years, whose body mass index was above 30kg/m² were studied for 16 months between July 2013 to November 2014 who were attending general medicine OPD were studied. Subjects with endocrine disorders other than diabetes or who were taking multivitamin supplements or corticosteroids were excluded. Blood samples were assessed for Serum magnesium, Fasting blood sugar, Fasting Insulin and HOMA IR was calculated.

RESULTS

A total of fifty subjects participated in the study. The mean age of the patients was 31.4±7.32 years. We found that 43/50(86%) of these subjects are having insulin resistance as estimated by HOMA IR and 37/50(74%) are having hypomagnesaemia. Serum magnesium was inversely correlated with HOMA-IR (spearman $r = -0.44$, $P < 0.05$).

CONCLUSION

In our study, we observed that hypomagnesaemia coexists with insulin resistance in obese diabetics with insulin resistance. Caution has to be executed in interpretation of results as our sample is small. Serum magnesium deficiency in obese children may be secondary to decreased dietary magnesium intake.

KEYWORDS

Hypomagnesemia, Insulin Resistance, Obese Woman, HOMA-IR.

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INTRODUCTION: Magnesium is an essential cofactor for enzymes involved in carbohydrate metabolism.⁽¹⁾ A considerable relationship between magnesium and insulin action has been reported.⁽²⁾ Low serum and intracellular magnesium concentrations are associated with IR, impaired glucose tolerance and decreased insulin secretion in adults.⁽³⁻⁵⁾ In addition, few epidemiologic studies in adults point toward poor dietary magnesium and lower serum magnesium are associated with increased risk for type 2 diabetes.⁽⁶⁻⁷⁾ Magnesium deficiency is linked with increased intracellular calcium levels, can lead to IR.⁽⁸⁾ However, the role of magnesium deficiency in the development of IR has not been clearly defined. The present study was designed to determine whether a relationship exists between magnesium homeostasis and IR in obese women and to evaluate potential mechanisms leading to magnesium deficiency in diabetic obese women.

METHODS: In this cross-sectional study, a total of fifty female diabetic subjects with age group of 30-60 years, whose body mass index was above 30kg/m² were studied for 16 months between July 2013 to November 2014 who were attending general medicine OPD were studied. The Ethical Committee has approved the study protocol and obtained the patient informed consent. Subjects with endocrine disorders other than diabetes or who were taking multivitamin supplements or corticosteroids were excluded. Participants underwent clinical and routine laboratory examination. From each patient 5ml of blood sample was collected after an overnight fast of >8h. Blood samples were assessed for serum magnesium, fasting blood sugar, fasting insulin and HOMA-IR was calculated. Plasma glucose levels were measured using a hexokinase enzymatic reference method.⁽⁹⁾ Fasting insulin levels were measured using a Radioimmunoassay (RIA) method. HOMA-IR was used to evaluate insulin resistance (fasting serum insulin (μ U/ml) $\times$ fasting plasma glucose (mmol/L))/(22.5).⁽¹⁰⁾ A HOMA-IR value of 2.5 is taken as an indicator of IR in adults.⁽¹¹⁾ Magnesium was measured using calorimetric method.⁽¹²⁾ Normal values are 1.5-2.4mEq/L. Critical value: <1.0mEq/L and >4.7mEq/L. (0.75-1.2mmol/L, Critical value: <0.5mmol/L and >2.35mmol/L).

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STATISTICAL ANALYSIS: Data was entered into excel spread sheet in 2007. Statistical analysis was performed using graph pad prism version-5. Data was described as mean $\pm$ SD or actual numbers and percentages. Spearman correlation was used to evaluate strength of association between IR and Hypomagnesaemia.

RESULTS: A total of fifty subjects participated in the study. The mean age of the patients was 31.4 $\pm$ 7.32 years. We found that 43/50(86%) of these subjects are having insulin resistance as estimated by HOMA IR and 37/50(74%) are having hypomagnesaemia. Low serum magnesium statistically correlated with HOMA-IR (spearman $r=0.44$, $P < 0.05$).

Clinical Parameters	Statistics
N	50
Age (yrs)	44.40 $\pm$ 9.12
Insulin Resistance (IR)	43/50 (86%)
Hypomagnesaemia	37/50 (74%)
Correlation between IR and Hypomagnesaemia	$r=0.44$, $P < 0.05$

Table 1

DISCUSSION: Milagros G. Huerta et al. in children found that magnesium deficiency is associated with IR.⁽¹³⁾ Serum magnesium and dietary magnesium were inversely associated with IR, providing the first evidence that the association between magnesium deficiency and IR is present. Guerrero-Romero F in their study found low serum magnesium concentrations were associated with hyperinsulinemia, decreased insulin-mediated glucose disposal and the metabolic syndrome.⁽¹⁴⁾

CONCLUSION: The association between magnesium deficiency and IR is present in obese diabetic woman. Serum magnesium deficiency may be secondary to decreased dietary magnesium intake. Magnesium supplementation or increased intake of magnesium-rich foods may be an important tool in the management of type 2 diabetes in obese woman.

REFERENCES:

1. Paolisso G, Scheen A, D'Onofrio F, et al. Magnesium and glucose homeostasis. *Diabetologia* 1990;33(9):511–514.
2. Nadler JL, Buchanan T, Natarajan R, et al. Magnesium deficiency produces insulin resistance and increased thromboxane synthesis. *Hypertension* 1993;21:1024–1029.

3. Ma J, Folsom AR, Melnick SL, et al. Associations of serum and dietary magnesium with cardiovascular disease, hypertension, diabetes, insulin, and carotid wall thickness: the ARIC study. *J Clin Epidemiol* 1985;48:927–940.
4. Rosolova H, Mayer O Jr, Reaven GM. Insulin-mediated glucose disposal is decreased in normal subjects with relatively low plasma magnesium concentrations. *Metabolism* 2000;49:418–420.
5. Resnick LM, Gupta RK, Gruenspan H, et al. Hypertension and peripheral insulin resistance: possible mediating role of intracellular free magnesium. *Am J Hypertens* 1990;3:373–379.
6. Lopez-Ridaura R, Willett WC, Rimm EB, et al. Magnesium intake and risk of type 2 diabetes in men and women. *Diabetes Care* 2004;27:134–140.
7. Kao WH, Folsom AR, Nieto FJ, et al. Serum and dietary magnesium and the risk for type 2 diabetes mellitus: the atherosclerosis risk in communities study. *Arch Intern Med* 1999;159(18):2151–9.
8. Draznin B, Sussman KE, Eckel RH, et al. Possible role of cytosolic free Calcium concentrations in mediating insulin resistance of obesity and hyperinsulinemia. *J Clin Invest* 1988;82(6):1848–1852.
9. Trinder P. Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. *Ann.Clin. Biochem* 1969;6(1):24–27.
10. Antuna-Puente B, Disse E, Rabasa-Lhoret R, et al. How can we measure insulin sensitivity/resistance? *Diabetes Metab* 2011;37(3):179–188.
11. Muniyappa R, Lee S, Chen H, et al. Current approaches for assessing insulin sensitivity and resistance in vivo: advantages, limitations, and appropriate usage. *Am J Physiol Endocrinol Metab*. 2008;294:15–26.
12. Smith AJ. A colorimetric method for the estimation of serum magnesium. *Biochem J* Jul 1955;60(3):522–527.
13. Milagros G Huerta, James N Roemmich, Marit L Kington, et al. Magnesium deficiency is associated with insulin resistance in obese children. *Diabetes care* May 2005;28(5):1175–1181.
14. Guerrero-Romero F, Rodriguez-Moran M. Low serum magnesium levels and metabolic syndrome. *Acta Diabetol* 2002;39:209–213.