

Original Research Article

Association between serum magnesium and obesity in postmenopausal women

Alka Yadav, Madhuri Gupta*, R. C. Gupta

Department of Biochemistry, National Institute of Medical Sciences and Research, Jaipur, Rajasthan, India

Received: 13 July 2018

Accepted: 07 August 2018

***Correspondence:**

Dr. Madhuri Gupta,

E-mail: madhurigupta01@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Obesity is a complex, multifactorial condition in which excess body weight may put a female at risk of serious health problems such as hypertension, dyslipidemia, diabetes mellitus and cardiovascular diseases. Magnesium deficiency is reported to be associated with obesity in children and adolescents. An inverse relationship has been reported between serum magnesium and estrogen levels in women. It is not known whether magnesium deficiency may have a role in genesis of obesity in women after menopause. Therefore, the present study was planned to compare serum magnesium levels in obese and non-obese postmenopausal women and to find out the relationship, if any, between serum magnesium levels and obesity.

Methods: This cross-sectional study was conducted in the department of Biochemistry at National Institute of Medical Sciences and Research, Jaipur, Rajasthan on fifty subjects over a period of six months. Twenty-five obese postmenopausal women (BMI ≥ 30) having their final menstrual period at least one year prior to the study were taken as the study group and twenty-five non-obese (BMI ≤ 22.9) post-menopausal women were taken as control group. All subjects were asked to give detailed dietary history using Food Frequency Questionnaire (FFQ). Venous blood samples were collected after an overnight fast for estimation of serum total magnesium in all subjects.

Results: Obese postmenopausal women had significantly higher weight (78.36 ± 0.064 kg) and BMI (32.68 ± 1.7 kg/m²) compared to non-obese postmenopausal women (wt. 54.72 ± 4.80 kg and BMI 21.75 ± 1.68 kg/m²). The mean \pm SD serum magnesium concentration found in the obese postmenopausal women was 1.40 ± 0.45 mg/dl as compared to 2.03 ± 0.49 mg/dl in the non-obese group. Pearson's correlation analysis showed a significant ($r = -0.9$) negative correlation between BMI and serum magnesium in postmenopausal women.

Conclusions: Serum magnesium was lower in obese postmenopausal women as compared to that in non-obese postmenopausal women. Serum magnesium was negatively correlated with BMI. Magnesium supplementation may be useful in prevention of obesity after menopause.

Keywords: Body mass index, Obesity, Postmenopausal women, Serum magnesium

INTRODUCTION

Menopause, also known as "climacteric, is described as the lasting cessation of menses that occurs naturally or is induced by surgery, chemotherapy or radiation". The menopausal transition occurs with wide variations in

hormone levels marked by physiologic and psychological changes in response to gonadotropins and their secretion.¹ Many symptoms are related to menopause and seem to be directly associated with a decrease in estrogen levels and are perceived by a large number of women including palpitations, headache, debility, fatigue, bone and joint pain, lower back pain, flatulence, the decrease in physical

strength, polyuria, skin changes and hirsutism, depression, loss of memory (amnesia), irritability, poor concentration and weakness.²⁻⁴

Amongst all essential minerals, magnesium is the fourth most abundant essential mineral, and as intracellular divalent cation, it is the second most abundant. It participates as a cofactor in more than 300 reactions in the body. In plasma, approximately 70% of the magnesium is in the ionized (free) form, which is required for multiple physiological functions.⁵ An inverse relationship has been reported between serum magnesium and estrogen concentration.⁶

Obesity is a complex, multifactorial condition in which excess body weight may put a female at risk of serious health problems such as dyslipidemia, hypertension, diabetes mellitus and cardiovascular diseases.⁷ Due to obesity and androidal fat redistribution, postmenopausal women are usually distressed by increasing weight and waist circumference.⁸ Patients with coronary risk factors like hyperlipidemia, hypertension, diabetes, and obesity have been frequently found to be associated with hypomagnesaemia. Some studies have linked obesity with low serum magnesium levels in children and adolescents and it has been speculated that magnesium deficiency is one of the causes of obesity but relationship between magnesium and obesity is not well documented in postmenopausal women and is still not clear.⁹ Therefore, the present study was planned to compare serum magnesium level in obese and non-obese postmenopausal women and to find out the relationship, if any, between serum magnesium levels and obesity.

METHODS

The study was conducted on fifty postmenopausal women who had their last menstrual period at least one year prior to the study. The subjects were divided into a test group of obese women (n= 25) having a BMI of ≥ 30

and a control group of non-obese women (n = 25) who had a BMI of ≤ 23 .

Other than being in a post-menopausal state, the women were completely healthy and were not taking any medication.

All the subjects were asked to give detailed dietary history using Food Frequency Questionnaire (FFQ). Family history of obesity was enquired into. A detailed clinical examination was performed including anthropometric measurements and blood pressure. BMI was calculated for each subject as weight (in kilograms) divided by height (in meters) squared (kg/m^2). Venous blood samples were collected from all the subjects after an overnight fast. Serum magnesium was measured using a commercial kit (Xylidyl blue method) on fully autoanalyzer Humastar 200.¹⁰

Statistical analysis

The quantitative data were expressed as mean \pm SD. Qualitative data were expressed as percentage of total sample size. Quantitative data of test and control group were compared by unpaired student's t-test. Chi-square test was used to examine the relationship between the qualitative variables. Pearson's correlation coefficient was used to find correlation between variables. A p value < 0.05 was considered as statistically significant.

RESULTS

Table 1 shows the demographic, clinical and biochemical (serum magnesium) comparison of obese and non-obese postmenopausal women.

The height was found to be significantly higher in non-obese postmenopausal women than that of obese postmenopausal women (1.58 ± 0.04 and 1.55 ± 0.06 mt respectively; $p = 0.04$).

Table 1: Qualitative (%) and quantitative (mean \pm SD) comparison between obese and non- obese postmenopausal women.

	Obese Postmenopausal women (n = 25)	Non-obese Postmenopausal women (n=25)	P value
Age (years)	56.56 \pm 9.31	57.12 \pm 9.12	>0.05*
Family history of obesity	06 (24%)	03 (12%)	0.2743 ^v
Height (mt)	1.55 \pm 0.06	1.58 \pm 0.04	<0.05*
Weight (kg)	78.36 \pm 0.064	54.72 \pm 4.80	<0.001**
BMI (kg/m^2)	32.68 \pm 1.7	21.75 \pm 1.68	<0.001**
Waist circumference (cm)	128.12 \pm 10.68	64.28 \pm 4.75	< 0.001**
Systolic BP (mm Hg)	126 \pm 12	118 \pm 10	< 0.05*
Diastolic BP (mm Hg)	81 \pm 14	72 \pm 11	<0.01
Serum magnesium(mg/dl)	1.40 \pm 0.45	2.50 \pm 0.49	< 0.001**

*Significant, ** Highly Significant

The test and control groups were comparable in terms of age. Family history of obesity was higher but not statistically significant in obese postmenopausal women (24%) compared to non-obese postmenopausal women (12%), where $p = 0.2743$.

Obese postmenopausal women had significantly higher weight and BMI compared to non-obese postmenopausal women. They also had higher systolic and diastolic blood pressure compared to the non-obese controls.

Serum magnesium (mg/dl) of obese postmenopausal women was found significantly lower as compared to non-obese postmenopausal women (1.40 ± 0.45 Vs 2.50 ± 0.49).

Pearson's correlation analysis showed a significant ($r = -0.93$) inverse correlation of BMI with serum magnesium in all postmenopausal women with a p-value of 0.001 (Figure 1).

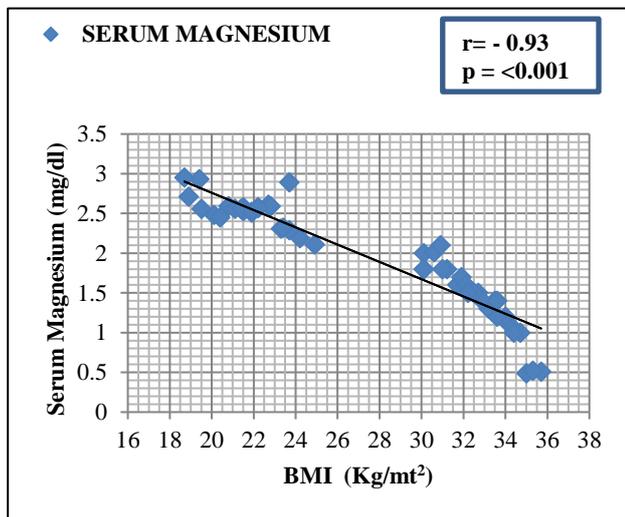


Figure 1: Correlation of BMI with serum magnesium in all postmenopausal women.

DISCUSSION

Obesity is a common problem in women, especially after menopause. One study has suggested an inverse relationship between serum estrogen concentration and serum Mg.¹¹ Another study has reported that serum magnesium and copper were inversely related with body weight and BMI.¹² Zaakouk et al, have reported an association between low serum magnesium levels and obesity in children and adolescents.⁹

In the present study, the serum magnesium level in obese postmenopausal group was found to be statistically significantly lower in comparison to that in non-obese postmenopausal group. Whether magnesium deficit caused obesity or obesity caused a decrease in serum magnesium is not clear at present.

Grochans et al, have also reported that serum magnesium and zinc concentrations in postmenopausal women, not using menstrual hormonal therapy, were low.¹³ Thurston et al, have reported a decrease in serum magnesium level in postmenopausal women.¹⁴ This indicates that magnesium deficit may be the primary event in postmenopausal women and not obesity. Present results, specially the inverse relationship between serum magnesium and BMI, show that magnesium deficit may cause or contribute to obesity in postmenopausal women.

Low serum magnesium levels are reported to be associated with low dietary magnesium intake.¹⁵ Mishra et al, have suggested that pre and postmenopausal women should take magnesium rich foods daily to prevent osteoporosis.¹ Present study results show that correction of magnesium deficiency may be useful in preventing obesity also.

CONCLUSION

The present study shows lower levels of serum magnesium in obese postmenopausal women compared to the non-obese postmenopausal women. Moreover, there is an inverse relationship between serum magnesium and BMI irrespective of the presence or absence of obesity.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Mishra S, Manju M, Toora BD, Mohan S, Venkatesh BP. Comparison of bone mineral density and serum minerals in pre and post-menopausal women. *Int J Clin Trials*. 2015;2(4):85-90.
- Singh A, Pradhan SK. Menopausal symptoms of postmenopausal women in a rural community of Delhi, India: a cross sectional study. *J Mid-life Health*. 2014;5(2):62-7.
- Barbara H, Schorge J, Schaffer J, Halvorson L, Bradshaw K, Cunningham F. *Williams Gynecology*. Edition 5th New York: McGraw-Hill Medical. 2012:555-6.
- Llaneza P, García-Portilla MP, Llaneza-Suárez D, Armott B, Pérez-López FR. Depressive disorders and the menopause transition. *Maturitas*. 2012 Feb 1;71(2):120-30.
- Assadi F. Hypomagnesaemia: an evidence based approach to clinical cases. *Iran J Kidney Dis*. 2010;4(1):13-29.
- Muneyyirci- Delale O, Nacharaju VL, Dalloul M, Altura BM, Altura BT. Serum ionized magnesium and calcium in women after menopause: inverse relation of estrogen with ionized magnesium. *Fertil Steril*. 1999;71(5):869-72.

7. Gungor NK. Overweight and obesity in children and adolescents. *J Clin Res Pediatr Endocrinol.* 2014;6(3):129-43.
8. Stachowiak G, Pertyński T, Pertyńska-Marczewska M. Metabolic disorders in menopause. *Menopause Rev.* 2015 Mar;14(1):59-64.
9. Zaakouk AM, Hassan MA, Tolba OA. Serum Magnesium status among obese children and adolescents. *Egyptian Ped Ass Gazette* 2016; 64(1):32-7.
10. Mann CK, Yoe JH. Spectrophotometric determination of magnesium with 1-azo-2-hydroxy-3-(2,4-dimethylcarboxanilido)-naphthalene-1-(2-hydroxybenzene). *Analytica Chimica Acta.* 1957 Jan 1;16:155-60.
11. Muneyyirci- Delale O, Nacharaju VL, Dalloul M, Altura BM, Altura BT. Serum ionized magnesium and calcium in women after menopause: inverse relation of estrogen with ionized magnesium. *Fertil Steril.* 1999;71(5):869-72.
12. Demerdash HM. Obesity and trace elements. *Obes Res Open J.* 2015;2(3):98-100.
13. Grochans E, Karakiewicz B, Kozielc T, Brdowska A, Brodowski J, Starczewski A, et al. Serum Mg and Zn levels in postmenopausal women. *Magnesium Res* 2011;24(4):209-14.
14. Thurston RC, El Khoudary SR, Sutton-Tyrrell K, Crandall CJ, Sternfeld B, Joffe H, et al. Vasomotor symptoms and insulin resistance in the study of women's health across the nation. *J Clin Endocrinol Metab.* 2012;97(10):3487-94.
15. Geiger H, Wanner C. Magnesium in disease. *Clin Kidney J.* 2012;5(1):25-38.

Cite this article as: Yadav A, Gupta M, Gupta RC. Association between serum magnesium and obesity in postmenopausal women. *Int J Res Med Sci* 2018;6:3156-9.