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Efficacy Of Magnesium Supplementations on Metabolic Profiles of Women with PCOS An Observational Study

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Abstract

Background: Polycystic ovary syndrome (PCOS) is affecting women worldwide. This women face difficulties and various outcomes due to consumption of different food and minerals. This study aims to find the impact of magnesium supplements on metabolic profile of women with PCOS. The aim of this study was to observe the effect of magnesium supplementation on metabolic profiles in women with PCOS. **Material & Methods:** In this clinical trial, 120 female patients with PCOS aged 20-46 years were selected. After definition for body mass index (BMI), age, and types of medications, participants were randomly assigned to consume magnesium supplements (containing 250 mg magnesium oxide). To survey biochemical indicators, a venous blood test was taken after an overnight fasting. The mean age of study participants was 26.8 years. **Results:** In this study, magnesium supplementation for 8 weeks among women with PCOS had favorable effects on BMI. In addition, the supplementation lead to preventing the increase in waist circumference in intervention group. No significant effects on glycemic variables and lipid profile were seen following the magnesium supplementation. A significant decrease was found in serum testosterone levels. A significant increase in serum dehydroepiandrogens (DHEA) (136.32 vs. 172.37 intervention, 102.74 vs. 120.15 placebo, P = 0.01) was seen in two groups. Magnesium supplementation had no significant effects on FSH, 17OH-progesteron, and free androgen index (FAI) levels. **Conclusion:** According to the observers, evidences of this study indicate that magnesium supplementation did not influence serum lipid profiles and glycemic indicators among women with PCOS. One the other hand, magnesium supplementation resulted in reduced BMI and testosterone levels as well as increased DHEA concentrations in women with poly cystic ovarian syndrome.

Keywords:- Magnesium, Supplementation, PCOS, Metabolic profiles, Insulin.

INTRODUCTION

Polycystic ovary condition (PCOS) is an endocrine disorder is influencing 6-10% of reproductive-aged women.[1,2] Though the pathogenesis stays vague, prior evidence showed the essential role of insulin resistance, hyperandrogenism, and obesity in its etiology.

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Patients with PCOS are at increased risk of metabolic disorder, infertility, diabetes, and cardiovascular diseases.[3] This condition forces a significant burden on the health care framework. A study shows that, in the USA, the total cost of evaluating and providing care to reproductive-aged PCOS women in 2004 was $4.36 billion which is quite a large amount.[4]

Insulin-lowering medications, anti-androgen therapy, oral contraceptives, and lifestyle changes like weight loss and dietary intervention with energy restriction and/or altered diet composition are typically used to treat PCOS.[2,4] Other than these, dietary intake of minerals, including magnesium, might also assume a vital part in the pathogenesis of PCOS because of its commitment to insulin responsiveness.[5] Improper intake of magnesium has been demonstrated to be connected with insulin resistance through its impact on tyrosine-kinase action, enhancing oxidative stress and inflammation.[6,7,8] Other than observational researches, a few investigations have shown that oral magnesium supplementation further developed insulin responsiveness in gentle straightforward hypertensive patients as well as in normo-magnesemic,[9] overweight, and no diabetic subjects.[10] On the other hand, a few examinations have failed to find any significant relationship between serum Mg levels and insulin resistance.[11,12] A 12-week magnesium and vitamin E co-supplementation valuably affected boundaries of insulin metabolism and serum triglycerides, VLDL, and all out cholesterol in PCOS women.[13] In spite of the job of magnesium in insulin sensitivity and expected job of insulin resistance in the pathogenesis of PCOS, hardly any studies have applied mono-supplement therapy with magnesium supplementation in the management of PCOS. Only one report analyzing the impact of magnesium supplementation in PCOS was found, where supplementation with 400 mg of magnesium oxide for a long time revealed no tremendous impact on serum free unsaturated fat levels and insulin resistance14. The present study, therefore, aimed to investigate the effect of magnesium supplementation on metabolic profiles.

Objective of the study

- General objective: The aim of the study is to review the metabolic profile of the female patients.
- Specific objective: The purpose of the study is to observe the effectiveness of magnesium supplements on metabolic profile of female patients with PCOS.

MATERIAL AND METHODS

This prospective observational study was conducted in the Institute of Child & Mother Health (ICMH) during March 2021 to March 2022. Females with PCOS aged 20–45 years were selected for this study.

Inclusive criteria: Patients with PCOS aged between 20-45 years (within March 2021 to March 2022) who signed the written consent paper were included in this study.

Exclusion criteria: Any individuals who were unable or unwilling to take magnesium supplements for at least 8 weeks were excluded of this study. Patients who were pregnant, smokers, have diabetes, cardiovascular, liver, kidney, and thyroid diseases, using dietary

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supplements, and patients who were unwilling to give informed medical consent were also excluded.

At study baseline and after stratification for BMI, age and types of medications, subjects were randomly assigned to receive either magnesium supplements (n=120) for 8 weeks. Patients took one tablet every day, containing 250 mg magnesium oxide and 47 mg calcium carbonate. Dietary intakes of study participants were examined throughout the study one in every 2 weeks. Study patients were also requested to record their physical activities at the same day they were recording their dietary intakes. The Kolmogrov-Smirnov test was used to examine the normal distribution of variables. Log transformation was conducted for non-normally distributed variables. The analyses were carried out using an intention-to-treat methodology. Missing qualities were treated by the last-observation-carried-forward strategy. The independent samples Student's t test was utilized to identify contrasts in everyday attributes and dietary intakes.

Ethical clearance was taken from the Institute of Child & Mother Health (ICMH) ethics committees as required. Signed informed consent was obtained from patients prior to their enrollment. To determine the effects of magnesium supplementation on metabolic profiles, repeated measures ANOVA was used. To assess if the magnitude of the change in outcome variables was dependent on the baseline value, all analyses were conditioned on baseline values to avoid the potential bias that might have resulted. $P < 0.05$ was considered significant. All statistical analyses were conducted by using the SPSS, version 17 (SPSS Inc.).

RESULTS

Mean age of the participants of this study was 26.8. Three women in the magnesium group were excluded due to not using tablets and lack of willingness to continue the study was identified among 4. Out of 127 patients, a total of 120 participants completed the full study session. On the basis of dietary records obtained throughout the intervention, potassium and energy intake is found to be the major part of plan. Protein and dietary fiber are the least ones [Table 1]. A significant reduction in BMI changes from baseline in intervention group: -0.31 ± 0.07 is seen after magnesium supplementation for 8 weeks. In addition, this supplementation lead to preventing the increase in waist circumference in intervention group. No significant reduction in systolic or diastolic blood pressure was found after supplementation [Table 2]. According to [Table 3], plasma concentrations of fasting blood glucose and insulin have a significant change in 8th week. As well as the QUICKI, HOMA-IR, and HOMA-B were significantly changed and most significant change was found in HOMA-B. [Table 4] shows the effects of magnesium supplementation on lipid. No observed significant effect of the supplementation was seen on levels of serum triglyceride, total cholesterol, LDL, and HDL cholesterol in either the crude or adjusted model. Magnesium supplements resulted in a decrease in serum triglyceride levels 139.13 ± 16.31vs 133.97±18.12. Total and LDL-cholesterol concentrations were found to decrease as well. Increment of serum Total cholesterol/HDL and Serum triglyceride/HDL was noticed after weeks of magnesium supplement intake.

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Table 1: Dietary intake of participants during the study

	Intervention	**P value**
Energy intake (kcal)	1818.10 ± 78.42	0.51
Carbohydrates (% energy)	54.05 ± 2.57	0.60
Protein (% energy)	14.26 ± 0.42	0.73
Fat (% energy)	32.43 ± 1.44	0.69
Saturated fatty acid (g/day)	18.50 ± 1.19	0.98
Cholesterol (mg/day)	201.18 ± 18.73	0.07
Magnesium (mg/day)	246.25 ± 5.16	0.46
Calcium (mg/day)	650.46 ± 39.20	0.99
Sodium (mg/day)	1035 ± 79.58	0.31
Potassium (mg/day)	2123 ± 200.77	0.92
Dietary fiber (g/day)	14.57 ± 0.91	0.61
Folate (µg/day)	241.97 ± 13.16	0.69

Table 2: The effect of magnesium supplementation on anthropometric features of the participants in the study

	Intervention			
	Baseline	**8th week**	**Change**	**P**
Weight (kg)	82.09 ± 2.30	81.54 ± 2.25	- 0.54 ± 0.38	0.16
BMI (kg/m2)	27.90 ± 0.91	27.48 ± 0.82	- 0.31 ± 0.07	< 0.001
Waist circumference (cm)	94.58 ± 2.46	94.85 ± 2.31	0.27 ± 0.51	0.60
Systolic blood pressure (mmHg)	10.16 ± 0.19	9.93 ± 0.14	- 0.22 ± 0.13	0.10
Diastolic blood pressure (mmHg)	7.28 ± 0.15	7.30 ± 0.15	0.02 ± 0.15	0.88

Table 3: The effect of magnesium supplementation on features of glycemic variables in participants

	Intervention			**P value**		
Fasting blood glucose (mg/dL)		Baseline	8th week	Time	Group	Time × group
	Crude	92.32 ± 2.85	89.74±2.9	0.16	0.43	0.79
	Model I	93.12 ± 3.06	90.17±2.9	0.98	0.55	0.77
Insulin (uIU/mL)	Crude	7.82 ± 0.88	13.83±2.15	0.004	0.70	0.07
	Model I	8.15 ± 1.3	14.8±2.23	0.075	0.63	0.08
Quicki	Crude	0.35 ± 0.005	0.33±0.007	0.008	0.74	0.04
	Model I	0.35 ± 0.006	0.33±0.008	0.14	0.75	0.04
HOMA-IR	Crude	1.80 ± 0.22	3.30±0.63	0.01	0.67	0.09
	Model I	1.89 ± 0.32	3.50±0.63	0.13	0.63	0.11
HOMA-B	Crude	106.51 ± 13.57	191.25±20.99	<0.001	0.93	0.019
	Model I	109.57 ± 17.74	203.44±23.49	0.02	0.96	0.02

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Table 4: The effect of magnesium supplementation on features of lipid profile in participants

	Intervention			**P value**		
Serum Triglyceride (mg/dL)		Baseline	8th week	Time	Group	Time × group
	Crude	139.13 ± 16.31	133.97±18.12	0.46	0.84	
	Model I	142.67 ± 15.7	137.38±16.21	0.85	0.33	0.89
Total cholesterol (mg/dL)	Crude	208.55 ± 7.04	201.42±6.33	0.16	0.24	0.93
	Model I	209.08 ± 9.04	201.35±7.44	0.60	0.33	0.89
HDL-C (mg/dL)	Crude	47.03 ± 1.11	44.64±1.32	0.07	0.99	0.31
	Model I	46.56 ± 1.47	43.95±1.32	0.21	0.67	0.35
LDL-C (mg/dL)	Crude	133.61 ± 6.85	129.97±4.84	0.07	0.40	0.35
	Model I	134.02 ± 7.71	129.93±6.4	0.86	0.69	0.34
Total cholesterol/HDL	Crude	4.53 ± 0.20	4.68±0.25	0.76	0.63	0.21
	Model I	4.59 ± 0.27	4.76±0.25	0.31	0.43	0.21
Serum triglyceride/HDL	Crude	3.19 ± 0.46	3.40±0.62	0.98	0.94	0.38
	Model I	3.31 ± 0.45	3.55±0.53	0.99	0.33	0.37

DISCUSSION

The present study has found that magnesium supplementation for 8 weeks among women with PCOS had favorable effects on BMI; however, no significant effect on glycemic variables and lipid profile was seen following the magnesium supplementation. Also, a significant decrease in serum concentrations of testosterone and a significant increase in serum DHEA concentrations by magnesium supplementation, which were statistically significant although might not be clinically significant also found in this study. The beginning and pathophysiology of PCOS is multi-layered, complex, and deficiently comprehended. A combination of hereditary, epigenetic, and natural instruments seems to represent the fluctuated phenotypic indications of this disorder. Magnesium intake might improve metabolic profiles through impacts of its threat to calcium and to take part in protein synthesis and transmembrane particle transport,[18] and furthermore it may diminish the coursing levels of triglycerides and VLDL-cholesterol through expanded discharge of waste fat and expanded lipoprotein lipase action.[19,20] Expanded movement of the acetyl-CoA carboxylase protein and restraining the voltage-subordinate calcium channel by magnesium might further develop insulin responsiveness.[21,22] Intracellular magnesium assumes a crucial part in both insulin and glucose digestion and is as a cofactor in various other metabolic and physiologic cycles including pulse guideline. Subsequently, it would be logical to pursue after dietary examinations and more interventional preliminaries with magnesium supplements.[1]

In the examination on ladies with PCOS, carefully characterized by the Rotterdam measures, no significant impact of magnesium supplementation on glycemic and lipid profile was tracked down in the current study. Though, inverse associations between an individual's magnesium admission and risk of type 2 diabetes have been accounted for, a large portion of prior examinations were completed in Western nations,[23,24,25] and their outcomes

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may not be straightforwardly applied to Iranian and other Asian individuals. Dietary magnesium consumption has been found to have a negative correlation with insulin concentrations or the incidence of type 2 diabetes in some epidemiologic studies,[26,27,28] nonetheless, such affiliations might reflect other advantageous dietary components, for example, fibers in food sources that are high in magnesium. Opposite to current review's discoveries, results from a clinical trial revealed a helpful impact of magnesium supplementation on plasma glucose levels and insulin responsiveness in type 2 diabetics with low complete serum magnesium levels.[29] There is also proof that magnesium supplementation significantly affects insulin awareness in non-diabetics with insulin obstruction and hypomagnesemia.[30] On the other hand, we noticed no tremendous impact of magnesium supplementation on insulin responsiveness in the current review. A portion of these errors might result from contrasts in the span of mediation or plan of the review, type and portion of magnesium, or ethnic foundation of the subjects.[23,27,28,29] A cross-sectional review proposed that surpassing the suggested dietary admission of magnesium probably may not provide extra advantage as for insulin responsiveness.[30,31] A powerful opposite relationship has been displayed between magnesium admission and chance of type 2 diabetes in subjects with low magnesium consumption.[24] Thus, magnesium supplementation may generally be helpful for people with lack of magnesium; the advantages of supplementation on insulin awareness might fluctuate among various ethnic gatherings. The dietary magnesium admission of Taiwanese grown-ups was viewed as generally lower than that of grown-ups in Western nations; in any case, no relationship among diabetes and low dietary magnesium was found.[32]

Hypertension is another obsessive condition coming about because of changed cell magnesium digestion. Investigations of extracellular particle levels have shown that the intracellular free magnesium level is firmly connected with hypertension, proposing a pathophysiological connection between magnesium depletion and hypertension.[33] However, the helpful job of magnesium in hypertension stays vague, despite the fact that it is presently utilized in basic circumstances as harmful hypertension and toxemia.[34] In this way, taking into account the available information, a job for diminished magnesium levels in the pathophysiology of hypertension shows up reasonable, regardless of no affirmation of a consistent, reproducible impact of magnesium supplementation on BP.[35] Moreover, there are not many examinations showing that magnesium supplementation decreases BP in ordinary subjects.[36] Our outcomes are not predictable with those of the past review; notwithstanding, the subjects in that study were hypertensive; They reported that taking magnesium supplements reduced hypertensive subjects' blood pressure, with a greater effect in those with higher initial BP.[37]

In the present study, neither insulin secretion indexes nor Mg supplementation were found to be correlated. This outcome has been upheld by Kaufmann et al.[38] They announced that magnesium levels don't compare with insulin awareness, glycemic levels, and lipid levels in conceptive age ladies with PCOS. While, one more review showed a critical negative

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connection between magnesium and lipid profiles.[39]

Besides, the conceivable role of magnesium in insulin awareness and the possible role of insulin obstruction in the pathogenesis of PCOS, barely any examinations have analyzed the impact of magnesium supplements in patients with PCOS. In the main concentrate in this field, supplementation with 400 mg of magnesium oxide for quite some time in ladies with PCOS affected serum FFA level and isn't a consequence of insulin obstruction.[14] Additionally, a 12-week co-supplementation of magnesium and vitamin E among PCOS women had positive effects on insulin metabolism parameters as well as serum triglycerides, VLDL, and total cholesterol.[13] These examinations showed the positive impacts of consolidated magnesium, zinc, calcium, vitamin-D, vitamin-E on metabolic profiles and proposed new examinations to research the impacts of mono-supplement treatment. The current study demonstrated that taking magnesium supplements may decrease testosterone levels and increase DHEA concentrations in PCOS women. The lessening in serum testosterone and expansion in serum DHEA showed up in intervention group which probably won't be the impact of magnesium.

Limitations of the study

The study has some limitations, including the single centered study and the fact that no attempt was made to measure ionized and urinary magnesium. Applied dose of elemental magnesium in the present study was rather modest, and it may not be high enough to achieve the desired outcomes of our research. Moreover, since our outcomes were acquired in subjects with ordinary serum magnesium levels, the current discoveries can't be summed up to conditions related to magnesium consumption.

CONCLUSIONS

In conclusion, the present study provides the evidence showing that magnesium supplementation did not influence serum lipid profiles and glycemic indicators among women with PCOS. Magnesium supplementation resulted in reduced BMI and increased DHEA concentrations in women with PCOS. Also, magnesium supplementation might increase serum LH levels. For a better knowledge on overall country's scenario, multicenter study is recommended.

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