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Original Article

Therapeutic Effect of Magnesium Supplementation in Improving Quality of Life among Elderly Insomniac Participants

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ABSTRACT

Insomnia is increasing day by day, according to global prevalence it ranges from10%to40%with trouble falling asleep, remaining asleep, or having non-restorative sleep that is accompanied by daytime impairment or distress. Magnesium seems to play a key role in there gelation of sleep. **Objective:** To compare the therapeutic effect of magnesium supplementation in improving quality of life among elderly insomniac participants with control and treatment group. **Methods:** The study design was double blind randomized clinical trial. Purposive sampling technique was used to allocate gender elderly people. Data were collected from Al-Saida Shuhda old age home, Lahore and the participants were divided into two groups, 40 participants in each group. Group 0 (control group) were given regular diet without magnesium supplement for 8 weeks. Group 1 (treatment group were given Magnesium supplements (500mg) for 8 weeks. Data were tabulated and analyzed with the help of SPSS 25.0. **Results:** The results shown that the magnesium supplementation had highly significant results in improving LSEQ, serum magnesium, serum melatonin, serum cortisol and serum renin level without showing any side effects. Group 0 has shown 0.152 (GTS), 0.088(QOS), 0.168(AFS), 0.195(BFW), 0.292(serum Mg), 0.567(serum melatonin), 0.276(serum cortisol), 0.101(serum renin) whereas group 1 has shown 0.01(GTS), 0.01(QOS), 0.003(AFS) and 0.03(BFW), 0.02(serum Mg), 0.01(serum melatonin), 0.02(serum cortisol), 0.02(serum renin), respectively. **Conclusions:** It was concluded from the results that magnesium supplementation in elderly people has highly significant effects in improving insomnia and quality of sleep.

INTRODUCTION

Insomnia is trouble sleeping, characterized by non-restorative sleep, daytime impairment, and distress, occurring three or more times per week for at least one month, requiring sleep disturbance [1]. Insomnia is a sleep issue causing difficulty falling or staying asleep, waking too early, and difficulty falling back. It can cause exhaustion, anger, and daytime sleepiness, impacting comfort and quality of life. Factors include anxiety, depression, stress, caffeine, alcohol consumption, and underlying medical conditions. Treatment involves addressing the underlying cause, lifestyle changes, and medication [2]. Health-related Quality of Life (HRQoL) is crucial in healthcare and medications, assessing disease load and therapies' impact. Insomnia has limited evidence, but both medications can improve social, physical, and emotional health [3]. Sleep quality is influenced by beverage consumption, medical conditions, and smartphone use. 54% of participant's drink coffee or tea to calm, while 32% report interrupted sleep. Smartphone use is a common contraindication for sleep disturbances [4]. Dietary

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nutrition is considered to have a major effect on sleep health. Several vitamins and minerals are being tried in an attempt to improve sleep health. On the other hand, the association among nutrients and sleep is difficult [5]. Magnesium (Mg) is a mineral found mostly in whole grains leafy green vegetables, legumes and nuts. Magnesium has recently been shown to be effective in maintaining normal sleep cycles and sleep patterns [6]. The 2nd most abundant and 4th most prevalent cation in the body is Mg. It participates in about 300 metabolic events in our body. Mg is required for many enzyme actions, including those involved in energy metabolism and neurotransmitter production [7]. The 8th most prevalent element in the earth's crust is magnesium. Magnesium is essential in both plants and animals. Mg is the key component of chlorophyll in plants [8]. Animals have 0.4 g magnesium/kg, while the human body has 20 mmol/kg fat-free tissue, containing 24 g total [9]. Cereals and grain products were the main sources of magnesium for the whole population, with adolescents providing more than elderly people. Milk and dairy products contributed 15.7%, while meat and meat products accounted for 12.5% and 11.1%, respectively. Fruits, fish, and pulses contributed 5.4%, with older individuals consuming more [10]. Surveys in European countries show magnesium consumption falls under guidelines, with higher deficiency in women in some age categories but not in everyone. ENIDE trial found average daily intake of 350 mg/day [11]. Mg is a relaxing NMDA and GABA agonist, promoting sleep and improving insomnia severity, sleep efficiency, cortisol, melatonin, and renin levels [12]. The impact of magnesium on brain activity and sleep cycles remains unclear. Research suggests that magnesium controls sleep by acting as an NMDA antagonist and GABA agonist, affecting slow-wave sleep and ion channel conductivity. It also has a relaxing and anti-depressant effect, potentially increasing melatonin and renin levels while decreasing cortisol levels [6]. Magnesium can impact sleep by altering ligand-gated ion channels, specifically the NMDA and GABA receptor systems. Deficiency-induced blocking increases NMDA receptor stimulation, boosting calcium ions and neuronal activity. Insufficient sleep increases NMDA receptor activity, while magnesium can enhance GABAergic activity, improving slow-wave sleep in humans [13].

METHODS

After taking informed consent in written form, the data were collected with the help of questionnaire. The study was Randomized Control Trial (RCT) and the participants were selected from Al-Saida Shuhda old age home Lahore. Those who meet the study inclusion criteria were enrolled in the study. They include both male and female participant's aged from40-60 years old. Participants were screened using LSEQ (Leeds Sleep Evaluation Questionnaire) and lab test values of serum magnesium, serum melatonin and serum cortisol. Participants with serum magnesium levels below 0.95 mmol/L, frequent nocturnal awakenings, trouble falling asleep, dietary magnesium intake below 75% of the recommended daily allowance, body mass index (BMI) range of 25–34.9, serum magnesium level below 0.95 mmol/L, not receiving loop diuretics, cyclosporine, digoxin, amphotericin, and any hormonal treatment, not having renal diseases, acute heart failure, and not having sleep-related MO. Exclusion criteria for this study include participants taking prescription medication affecting sleep, pregnant and lactating women, night shift workers and late night awakens, patients suffering from systematic disease, serum magnesium level above 0.95 mmol/L, dietary intake of magnesium above 75% RDA, psychiatric disorder history, recent stressful life events (e.g., divorce or death or acute illness of a family member), substance or alcohol abuse, and a trans-meridian flight during last 6 weeks. After the allocation of sample size, participants were divided into two groups (control group G0 or treatment group G1. G0 will continue normal diet and G1 will be given magnesium 500mg supplement 2 times a day for 8 weeks. The follow up for patients was conducted after 8 weeks. The LSEQ score, serum magnesium level, serum melatonin and serum cortisol level of both control and treatment group were collected in last follow up. Study Duration: 8 weeks. Sampling Techniques: Purposive sampling technique was used. Sample Size: This sample size was calculated by this formula [19].

$$n = \frac{(z_1 - \frac{\alpha}{2} + z_{1-\beta})^2 \sigma^2}{\blacktriangle^2}$$

Mean in group1(μ1)= 20.46
Mean in group2(μ2)= 6.24
SD. In group1(σ1)= 22. 25
SD. In group2(σ2)= 6.07
Ratio(r)= 1alpha(α)= 0.05
Beta(β)= 0.2
Sample size: Group 1 = 40 Group 2 = 40

We calculated the sample size, which is 40 participants per group. So the total no. of participants was 80. Group 1 (Normal diet without magnesium supplements). Group 2 (Magnesium supplements). Data were tabulated and analyzed with the help of SPSS version 25.0. The quantitative variables like age, BMI etc. were reported by using mean and standard deviation. To find out the mean difference of the impact of Magnesium supplementation on quality of life in patients of insomnia paired sample T - test was used. $p \leq 0.05$ was considered significant.

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RESULTS

Table 1 showed sociodemographic characteristics of participants which include 23.1% male, 43.0% females, 59.5% married, 6.6% unmarried, 40.5% 40-50 years old, 8.3% 51-60 years old, 17.4% 61-70 years old, 31.4% illiterate, 3.3% middle, 6.6% matric, 9.9% intermediate and14.9% graduate.

Table 1: Sociodemographic Characteristics of Patients

Demographic Profile	Frequency (%)	Mean ± SD
Gender		
Male	28 (23.1)	1.65±0.48
Female	52 (43.0)	
Marital status		
Married	72 (59.5)	1.10±0.30
Unmarried	8 (6.6)	
Age		
40-50	49 (40.5)	1.65±0.87
51-60	10 (8.3)	
61-70	21 (17.4)	
Education		
Illiterate	38 (31.4)	2.6±1.69
Middle	4 (3.3)	
Matric	8 (6.6)	
Intermediate	12 (9.9)	
Graduation or above	18 (14.9)	

Table 2 showed that leeds sleep evaluation questionnaire of control group (G0) regarding getting to sleep at day 0 was 1.87±1.42 and after 8 weeks was 2.12±0.93. Treatment group (G1) regarding getting to sleep at day 0 was 2.00±1.47 and after 8 weeks was 2.75±1.09. The comparison between both the groups showed that in G0 the results are in significant as p-value
0.152 and the results of G1 were highly significant with p-value 0.01.

Table 2: LSEQ Comparison between G0 and G1 regarding Getting to Sleep

LSEQ (Q1-3)	Groups	Parameters	N	Mean ± S.D	p-value
Getting to sleep (Q1-3)	G0 Control group	Pre	80	1.87±1.42	0.152
		Post	80	2.12±0.93	
	G1 Treatment group	Pre	80	2.00±1.47	0.01
		Post	80	2.75±1.09	

Table 3 showed that Leeds sleep evaluation questionnaire of control group (G0) regarding quality of sleep at day 0 was 1.67±0.85 and after 8 weeks was 1.77±0.71. Treatment group (G1) regarding quality of sleep at day 0 was 1.67±0.85 and after 8 weeks was 2.27±1.19. The comparison between both groups showed that the results in G0 are insignificant as p-value 0.088 and the G1 results were more significant with p-value 0.01.

Table 3: LSEQ Comparison between G0 and G1 regarding Quality of Sleep

LSEQ (Q4-5)	Groups	Parameters	N	Mean ± S.D	p-value
Quality of sleep (Q4-5)	G0 Control group	Pre	80	1.67±0.85	0.088
		Post	80	1.77±0.71	
	G1 Treatment group	Pre	80	1.67±0.85	0.01
		Post	80	2.27±1.19	

Table 4 showed that leeds sleep evaluation questionnaire of control group (G0) regarding awakening following sleep at day 0 was2.00±1.2 and after 8 weeks was 1.80±0.73. Treatment group (G1) awakening following sleep at day 0 was 2.00±1.21 and after 8 weeks was 2.48±0.99. The comparison between both groups showed that the G0 results are insignificant as p-value 0.168 and G1 had significant improvement with p-value 0.003.

Table 4: LSEQ Comparison between G0 and G1 regarding Awakening Following Sleep

LSEQ (Q6-7)	Groups	Parameters	N	Mean ± S.D	p-value
Awakening following sleep (Q6-7)	G0 Control group	Pre	80	2.00±1.2	0.168
		Post	80	1.80±0.73	
	G1 Treatment group	Pre	80	2.00±1.21	0.003
		Post	80	2.48±0.99	

Table 5 showed that leeds sleep evaluation questionnaire of control group (G0) regarding behavior following wakening at day 0 was 1.22±0.42 and after 8 weeks was 1.31±0.46. Treatment group (G1) regarding behavior following wakening at day 0 was 1.22±0.42 and after 8 weeks was 1.37±0.48. The comparison between both groups showed that the results of G0 are insignificant with p-value 0.195 and G1 results were highly significant with p-value 0.03.

Table 5: LSEQ Comparison between G0 and G1 regarding Behavior Following Wakening

LSEQ (Q8-10)	Groups	Parameters	N	Mean ± S.D	p-value
Behavior Following Wakening (Q8-10)	G0 Control group	Pre	80	1.22±0.42	0.195
		Post	80	1.31±0.46	
	G1 Treatment group	Pre	80	1.22±0.42	0.03
		Post	80	1.37±0.48	

Table 6 showed that lab test of control group (G0) regarding serum magnesium at day 0 was 1.31±0.46 and after 8 weeks was 1.23±0.42. Treatment group (G1) regarding serum magnesium at day 0 was 1.38±0.49 and after 8 weeks was 1.55±0.50. The comparison between both groups showed that G0 results were insignificant with p-value 0.292 and G1 results were highly significant with p-value 0.02.

Table 6: Serum Magnesium levels in both groups

Lab test	Groups	Parameters	N	Mean ± S.D	p-value
Serum Magnesium	G0 Control group	Pre	80	1.31±0.46	0.292
		Post	80	1.23±0.42	
	G1 Treatment group	Pre	80	1.38±0.49	0.02
		Post	80	1.55±0.50	

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DISCUSSION

According to the current study results, across-sectional survey was conducted with 80 participants whose age ranges from 40-60 above. Kim *et al.*, 2014 conducted a study with 960 participants age 45 and above [14]. Similar study was conducted by Cricco *et al.*, 2001, with 6444 participants age 65 and older [15]. In the current study, across-sectional survey was conducted with 23.1% male and 43.0% female. A similar study conducted by Dangol *et al.*, 2020 in which 48.2% male and 51.8% females participated. According to present study there were 59.5% married and 6.6% unmarried participants. A similar study conducted by Dangol *et al.*, 2020 in which 76.3% individuals were married. According to the present research, the educational status 31.4% Illiterate, 3.3% Middle, 6.6% Matric, 9.9% Intermediate, and 14.9% Graduation or above. A research conducted by Dangol *et al.*, 2020 in which 43.9% were illiterate, 12.3% Primary level, 7.89% Secondary level and 0.9% University level and above [16]. The results of present study regarding LSEQ questionnaire which include getting to sleep (GTS), Quality of sleep (QOS), awakening following sleep (AFS) and behavior following wakening (BFW) of control group at day 0 were 1.87±1.42 (GTS), 1.67±0.85 (QOS), 2.00±1.2 (AFS), 1.22±0.42 (BFW) and after 8 weeks were 2.12±0.93 (GTS), 1.77±0.71 (QOS), 1.80±0.73 (AFS) and 1.31±0.46 (BFW). Treatment group and at day 0 were 2.00±1.47 (GTS), 1.67±0.85 (QOS), 2.00±1.21 (AFS), 1.22±0.42 (BFW) and after 8 weeks were 2.75±1.09 (GTS), 2.27±1.19 (QOS), 2.48±0.99 (AFS) and 1.37±0.48 (BFW). The comparison between both groups showed that in G0 the results were insignificant as p-value 0.152 (GTS), 0.088(QOS), 0.168 (AFS), 0.195 (BFW) and G1 results were highly significant with p-value 0.01 (GTS), 0.01 (QOS), 0.003 (AFS) and 0.03 (BFW) respectively, as shown in table 2,3,4 and 5. Kim *et al.*, 2014 conducted a comparable investigation in which he evaluated if the LSEQ questionnaire was an accurate and trustworthy tool to evaluate sleeping disorders and screen for insomnia. The findings of several tests for determining the LSEQ's internal consistency all suggested that it is an effective instrument for measuring subjective sleep. This means that the LSEQ measures sleep latency (GTS), sleep quality (QOS), ease of awakening (AFS), and daytime coordination and behaviour after sleep (BFW) in a reliable and independent manner [14]. Another similar study, conducted by Choi *et al.*, 2014, found that the LSEQ is more suitable for evaluating the impacts of therapies over epidemiological investigations since it compares recent sleeping condition to normal sleep status. In regards to accuracy, the LSEQ had the best values. One possible explanation is that this questionnaire compels respondents to reflect over their sleep state for a brief length of time. Because the LSEQ inquired regarding current sleep status versus usual sleep status, respondents may report last night's sleep status, but the actigraphy examined sleep status throughout the previous 5 days [17]. Stevens *et al.*, 2017 conducted another similar study. This research presents an intriguing glimpse into the supplement's possible therapeutic benefits on sleep quality. The LSEQ was initially intended for evaluating subjective changes in sleep variables in individuals after one night of therapy; despite this, it has been widely employed to evaluate medication efficacy in experiments that span from one day to 24 weeks. [18]. According to the researcher, the LSEQ is a trustworthy and reliable tool for psychopharmacological analyses. Furthermore, it offers relevant reliable metrics for measuring the efficacy of sleep modulators. In the present study, LSEQ indicators were used to investigate subjective variances in sleep measures between a stimulant herbal supplement and a neutral placebo in healthy volunteers. Table 6 showed that lab test of control group (G0) regarding serum magnesium at day 0 was 1.31±0.46 and after 8 weeks was 1.23±0.42. Treatment group (G1) regarding serum magnesium at day 0 was 1.38±0.49 and after 8 weeks was 1.55±0.50. The comparison between both groups showed that G0 results were insignificant with p-value 0.292 and G1 results were highly significant with p-value 0.02. Abbasi *et al.*, 2012 conducted a similar study in which he discovered that the serum magnesium level in the treatment group seemed to augment (P = 0.06); nonetheless, the difference between the two groups was only slightly different at the end of the trial. The calculation of serum magnesium concentration was employed in the research to evaluate magnesium status [19].Similarly, Barragán-Rodríguez *et al.*, 2008 showed an important distinction in serum magnesium levels in the treatment group compared to the control group in their investigation on the use of magnesium supplements in the management for anxiety in diabetic senior adults[20].In their investigation, Haddad *et al.*, 2005 similarly showed a substantial rise in serum magnesium of the group that administered intravenously magnesium relative to the control group[21].

CONCLUSIONS

It was concluded from the research that the magnesium supplementation has highly significant results in the treatment of insomnia in elderly people as the p-value was <0.05. There was a significant improvement in LSEQ variables. Magnesium supplements improve quality of sleep in insomniac elderly people and shown highly significant results in improving serum magnesium.

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Authors Contribution

Conceptualization: AL
Methodology: AL
Formal analysis: ZR, AA
Writing-review and editing: AL, BR, ZR

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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