Effects of a Brief Behavioral Training Program on Sleep Quality in Older Adults With Moderate Sleep Disturbances

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Abstract

Background: Sleep disturbances are very common among elderly population and mostly remain incurable. Practical, brief, and effective interventions are needed to promote sleep quality in older adults with moderate sleep disturbances. This study aimed to investigate the effectiveness of a brief behavioral training program in ameliorating sleep quality in older adults suffering from moderate sleep disturbances.

Materials and Methods: This study was conducted on 64 older adults with moderate sleep disturbances, as defined by Pittsburgh Sleep Quality Index (PSQI) score ≥ 5 . Participants were randomly allocated to either intervention ($n=32$) or control ($n=32$) group. Older adults in the intervention group received a brief behavioral-based sleep training program which was delivered in a single in-person session followed by four telephone sessions during 4 weeks. While their peers in the control group did not receive any intervention. The main outcome of the study was scores on the PSQI which was compared at pre- and post-intervention between both groups. Data were analyzed using the SPSS software version 19.0.

Results: At 4 weeks, PSQI scores decreased in older adults receiving intervention, as compared with the scores of participants to the control group ($P<0.001$). Subjects in the intervention group also showed significant improvements in sleep latency, subjective sleep quality, sleep duration, and sleep efficiency ($P<0.05$).

Conclusion: Brief behavioral interventions may be promising and useful for older adult population with moderate problems, and can be considered an efficacious and non-invasive intervention approach to improve elderly's sleep quality.

Keywords: Behavior therapy, Elderly, Sleep disturbances.

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Introduction

In 2040, the population of older adults aged 65 years and above is projected to double (1), most of whom will be living in the developing countries (2). Based on the latest census in 2016, the number of older adults in Iran has reached nearly 7 million, accounting for 9.2% of the nation's total population (3). Sleep disturbances are common complaints facing older adults that affect 36%-69% of this population (4, 5). This prevalence is more than other sleep disorders such as persistent insomnia (6) and also is higher in older population than in the younger age groups (7). In older adults, moderate

sleep disturbances enhance the possibility of harmful health consequences including earlier morbidity and mortality, cardiovascular disease, caregiver load, deficits in cognitive functioning and daily performance, and poor quality of life, and lead to the beginning of clinical insomnia (8, 9). Therefore, prophylactic intervention approaches that target moderate sleep problems have the ability to delay the onset of chronic health conditions and insomnia disorder in at-risk elderly population. Despite the health outcomes of sleep problems, they often go not cured in older population, notably among adults afflicted by moderate severity of sleep difficulties. More than

two-thirds of adults with sleep disturbances but without insomnia disorder are unwilling to ask professional treatments. However, when insomnia is existent, various therapeutic choices are accessible (7, 8). Insomnia is basically managed with medicines. However, despite the provisional improvement from such drugs, they pose risks, side effects, and dependency syndrome. Specific adverse effects of pharmacological treatments including sleepiness, risk of falls and fractures, agitation, and detrimental interactions with other medications in older adults should not be ignored (9-11). Furthermore, a main concern in populations with non-clinical sleep problems is scarce and inconclusive evidence regarding the use of over-the-counter sleep remedies. Therefore, targeting the effectiveness of medication-free alternative interventions in poor sleep quality populations but without a sleep disorder is increasingly becoming more important (6, 12). Guidelines for evidence-based practice considerably support the behavioral therapies compared to medications for diminution of insomnia and sleep disturbances (13). Cognitive behavioral therapy (CBT) is one of the prevalent psycho-behavioral and non-pharmacologic approaches in alleviating sleep problems and is endorsed as a first-line treatment for elderly population due to their powerful practical evidence, high safety, and both short-term and long-term advantages (14-16). CBT is usually presented individualized, in in-person meeting, and over a relatively long period, and is generally administered by expert clinical psychologists. These resources may not be readily available or low cost-efficient especially among older adults with moderate sleep disturbances but without diagnosed insomnia (5, 16, 17). Research on the effects of behavioral therapies that focus on moderate sleep problems in the elderly is limited. Inadequacy of usual therapeutic options for sleep complaints reveals the necessity for alternative interventions that might enhance sleep quality in older adults with subsyndromal insomnia. Brief behavioral-based interventions likely meet these needs. Behavioral factors raise the risk of sleep disturbances and when addressed can help purposeful interventions in older adults (18). A shorter form of therapy known as brief behavioral therapy that involves core techniques from CBT, is directed at improving circadian regulation of sleep (11). Behavioral approaches that are less intensive and focus on either sleep directly or sleep hygiene behaviors, may propose more confident alternatives for aging population (17, 19). In order for a behavioral treatment to meet the demands of the majority of the elderly, it should be concise, desirable, with fairly quick efficiency, and applicable by nurses or other caregivers (20). Such interventions have been successfully delivered in little sessions, in group formats, and over virtual communication lines (web or telephone interventions) (12, 21). Results of a former study showed brief behavioral therapy can be successfully trained through brief phone intervention (16, 22). In most

published literature, patients with insomnia have been studied and many of the elderly population with moderate sleep disturbances largely ignored. Furthermore, older adults are more interested in the use of preventive and health-promoting interventions than treatment of the disease (9) and recent studies have emphasized shorter interventions (17).

To our knowledge, there are no reports focused on improving sleep quality of older adults with moderate sleep disturbances in Iran. Hence, we conducted this study to assess the efficacy of training a low-cost brief program of behavioral therapy on measures of self-reported sleep quality in the older adults with moderate sleep disturbances.

Materials and Methods

Study Design and Randomization

This controlled randomized trial was conducted to investigate the effects of a brief training behavioral therapy on improving the sleep quality of older adults with moderate sleep disturbances. The study was conducted in two states: a brief behavioral-based sleep training program and non-treated control $\times$ 2 times: pre-intervention, and post-intervention after 4 weeks.

Each sample enrolled in the study was randomly allocated either to intervention or to control group using random allocation based on the permuted block method with a size of 4 and a randomization ratio of 1:1. Based on the results of a similar study conducted in Shiraz, Iran, which reported two means of 11.26 ± 2.5 and 12.78 ± 2.29 (23) and a power of 80%, a confidence level of 95%, and a potential rate of attrition 15%, the sample size was calculated to be 64 ($n = 32$ per group). Flowchart of participants is illustrated in Figure 1.

Participants

This study was conducted in Centers related to Gonabad University of Medical Sciences, Eastern Iran. Ninety-eight potential participants were examined for inclusion to the study via a semi structured interview.

Eligibility criteria were: (1) PSQI score ≥ 5 ; (2) informed consent to participate in the study; (3) aged 60 years or older; (4) non participation in any other sleep related study; and (5) full alertness, free from communication problems (speech and hearing problems), and literacy for responding to questions. Exclusion criteria used in this study included: (1) an end stage disease; (2) a recorded background or present symptoms of primary sleep disorders such as obstructive sleep apnea and restless legs syndrome; (3) Alzheimer; (4) severe anxiety or depression; (5) current utilization of sleeping pills, herbal sleep remedies; and (6) travel or death.

Interventions

The intervention sessions comprised a single in-person 45- to 60-minute session along with four 15-minute

Figure 1. Flow Diagram of Participants Throughout the Study

telephone sessions. The four telephone sessions were scheduled at 1-week intervals for 4 weeks administered to the intervention group.

The brief program of behavioral therapy used in this study included training the behavioral components (included stimulus control and relaxation) and sleep hygiene educations.

Behavioral training program contained following recommendations: (1) use the bed only for sleep; (2) go to bed unless you are asleep; (3) get up at the same time every day; (4) get up and leave the bedroom whenever unable to fall asleep; (5) avoid or limit daily naps; (6) engage in regular daily exercises (including breathing exercises and muscle relaxation); and (7) avoid the exercise just before sleeping time. Sleep hygiene consisted of the following educations: (1) keep bedroom environment calm and dark with moderate temperature; (2) avoid heavy meals and plenty of fluid intake before bedtime; (3) eliminate substances containing caffeine at least 4 hours before sleeping time; and (4) quit smoking in the evening (24, 25).

In-person and telephone sessions were managed by a female nurse (corresponding author) who had previously received some training for interventions. The researcher developed session's contents according to the elderly needs acquired from the baseline assessment and the study goals.

The in-person session included face-to-face group-based comprehensive education in small groups (4 to 6 elderly in each group) respecting relationship between sleep problems and aging, processes that modify sleep, agents that affect sleep, and behavioral functions that

boost or worsen sleep quality. The nurse presented this information verbally during the session through the simple language to suit the level of understanding of the elderly. Media were used including posters and pictures. In addition, each subject under training was provided with an illustrated pamphlet reiterating this educational material and treatment instructions for use at home. One, 2, 3 and 4 weeks after in-person session, the intervention group received 4 telephone call sessions from the nurse and received the behavioral interventions administered in the first and second telephone sessions and sleep hygiene education in the third telephone session. The fourth, and indeed the final telephone session contained an outline of all the instructed content in the previous sessions and answer to probable questions. Participants were instructed to follow the instructions for the following 4 weeks. All subjects in the intervention group received the same educational content using the same teaching methods, media, and the same pamphlet.

Control Group

Participants in the control group were observed as the intervention group through to the 4 weeks but without any training of the brief program of behavioral therapy.

Measures

Data of recruited participants was collected by an independent assessor who was blind to the participants' assignments via the face to face interviews at two stages: baseline (i.e., before the intervention), and at 4 weeks (i.e., after completion of the intervention).

The survey instruments comprised a demographic

questionnaire and the Pittsburgh Sleep Quality Index (PSQI).

Instrument 1: Demographic Questionnaire

It was developed by the first author to gather the essential data about socio-demographic features of study samples such as; age, gender, educational level, marital status, underlying diseases, and addiction history.

Instrument 2: Pittsburgh Sleep Quality Index

The main purpose of this study was to indicate differences between two study groups in moderate sleep problem which was measured by the PSQI at post-intervention. The PSQI is a 19-item self-rated clinical questionnaire that measures sleep quality and sleep disturbances in 7 domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, use of sleeping pills, sleep disturbances, and daytime dysfunction for a preceding month. Each domain score has a range of 0 (not difficulty) to 3 (severe difficulty). The sum of these seven domain scores yields a global score (range, 0-21). Higher scores indicate worse sleep quality. A global score <5 indicates good sleep, whereas a score ≥ 5 indicates poor sleep (2). The Persian version of The PSQI had good internal consistency (Cronbach $\alpha = 0.83$) and test-retest reliability ($r = 0.85$) (26).

Statistical Analysis

Data analysis was carried out via the IBM SPSS statistical software version 19.0 (SPSS, Inc, Chicago, IL). In order to examine the normal distribution of quantitative data, Kolmogorov-Smirnov statistical test was employed. Qualitative variables description was done through the frequencies and percentages and quantitative variables via the mean and standard deviation. To assess within- and between-group comparisons on sleep quality, the independent *t* test and Mann-Whitney U test were computed. We considered a *P* level <0.05 to be statistically significant in all the tests.

Results

Characteristics of the Study Participants at Baseline

Out of the 64 elderly participants in this study, 3 from the intervention group discontinued the intervention due to traveling ($n = 2$) and death ($n = 1$) and 2 from the control group withdrew due to loss to follow-up. Accordingly, statistical analysis was done on 59 samples (29 in the intervention group and 30 in the control group). The mean age (SD) of the elderly was 70.17(8.2) in the intervention group and 68.07(8.0) in the control group. The educational level of 68.9% and 53.3% of participants in the intervention and control groups was primary, respectively. Two study groups did not differ significantly regarding socio-demographic variables ($P > 0.05$; Table 1). No adverse events related to intervention were reported by study participants.

Table 1. Demographic and Clinical Characteristics of Participants

Characteristics		Intervention Group (n=29)	Control Group (n=30)	P Value
Underlying disease	Yes	21 (72.4)	21 (70)	0.84 ^a
	No	8 (27.6)	9 (30)	
Marital status	Married	18 (62.1)	18 (60)	0.89 ^a
	Single	11 (37.9)	12 (40)	
Gender	Male	16 (55.2)	13 (43.3)	0.36 ^a
	Female	13 (44.8)	17 (65.7)	
Addiction history	Yes	1 (3.4)	1 (3.3)	0.37 ^b
	No	28 (96.6)	29 (96.7)	

Data are presented as number (%).

^a The results of the chi-square test.

^b The results of the Fisher exact test.

Sleep Quality Data

At baseline, global PSQI score was 8.5 ± 3.3 in the intervention group and 8.1 ± 2.6 in the control group. These findings indicate that subjects included in the study had poor sleep quality. However, analyses revealed that there was no significant difference between groups on the PSQI score and its indices prior to the intervention ($P > 0.05$).

According to the independent *t*-test results, PSQI score was 4.6 ± 2.4 in the group under brief behavioral sleep training program and 8.2 ± 2.5 in the control group at 4 weeks, immediately after completion of the intervention, with a significant difference between the two groups. The intervention group was more probably to have good sleep quality (PSQI score <5) than the control group at post- intervention ($P = 0.000$). Visual comparison showed a mean between-group difference of 3.9 points. Mann-Whitney U test results also demonstrated between-group significant differences after the intervention as regards sleep efficiency, sleep latency, sleep disturbance, sleep duration, and subjective sleep quality ($P < 0.05$; Table 2).

Discussion

The elderly population and consequently their problems, specially sleep problems, are increasing rapidly which highlight the necessity to address the problems of this stratum (2). Therefore, educating about the good sleep habits, non-pharmacological, and behavioral interventions that may enhance sleep quality can be helpful (27).

Notwithstanding the considerable outbreak of sleep disturbances in aging population, limited therapeutic options are available to increase the quality of sleep in adults with moderate complaints, who are at risk for clinical insomnia. Such preventative methods may anticipate the onset and development of insomnia complaints to clinical severity, which might accelerate the risk of impaired mood and the onset of functional disability in older adults (9).

Table 2. Comparisons of PQSI Scores at Two Time Points in Two Study Groups

Outcome Measures	Intervention Group (n = 29)		Control Group (n = 30)		Test Results
	Baseline	Post-intervention	Baseline	Post-intervention	
Global PSQI	8.51 ± 3.36	4.68 ± 2.42	8.10 ± 2.60	8.20 ± 2.59	t = -37.5 P < 0.001 ^a
Subjective Sleep Quality	1.62 ± 0.67	0.79 ± 0.55	1.03 ± 0.61	1.23 ± 0.77	Z = 2.27 P = 0.023 ^b
Sleep Latency	1.65 ± 0.97	1.06 ± 1.03	1.76 ± 1.11	1.76 ± 0.85	Z = 2.54 P = 0.011 ^b
Habitual Sleep Efficacy	1.44 ± 1.27	0.82 ± 0.55	1.30 ± 1.05	1.00 ± 0.94	Z = 2.069 P = 0.039 ^b
Sleep Duration	1.93 ± 1.22	0.97 ± 0.79	1.60 ± 0.96	1.66 ± 0.92	Z = 3.28 P = 0.001 ^b
Sleep Disturbance	1.27 ± 0.45	1.03 ± 0.32	1.26 ± 0.52	1.26 ± 0.52	Z = 2.05 P = 0.040 ^b
Use of Sleeping Pills	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	---
Daytime Dysfunction	0.51 ± 0.50	0.50 ± 0.37	1.06 ± 0.58	1.03 ± 0.61	P = 0.206 ^b Z = 1.265

Abbreviation: PSQI, Pittsburgh Sleep Quality Index.

Data are presented as mean ± SD.

^a The result of the Student T test.

^b The results of the Mann-Whitney U test.

(---) Test result not valid

It was hypothesized that after implementation of brief behavioral-based intervention program, sleep quality of older adults with moderate severity of sleep disturbances in the intervention group will be improved. This hypothesis was supported by the current study findings which revealed that brief behavioral-based training program had an effect on PSQI component scores and PSQI global score, based on significant pre- to post-intervention and between group changes that can be attributed to the training intervention results.

The results of several previous studies have shown positive effects of behavioral interventions on sleep quality. A former RCT aimed to investigate the efficacy of a brief behavioral therapy in older adults with comorbid insomnia. This intervention was administered in a single, 45-minute intervention session with a 30-minute supportive session delivered 2 weeks after first session by a trained psychologist and a primary care nurse. The findings of this study demonstrated that after carrying out the intervention, there was statistically significant amelioration in sleep quality as evaluated via the PSQI (17). In older adults with moderate sleep disturbances composing our study samples, we found a similar improvement on PSQIs at post-intervention.

A brief 60-minute 4-week group-based treatment program of CBT reported a significant improvement in quality of sleep, insomnia severity, and fatigue of older adults suffering maintenance insomnia disorder. On the contrary, the control group worsened over the course of the study (28). In another study, intervention involved one 45-60 minute session and a 30-minute session two

weeks later, and phone calls 1 and 3 weeks after the intervention. In brief behavioral therapy intervention (BBTI) group, intervention involved sleep training and discussion about sleep regulation mechanisms, and in IC (information control) group, intervention involved review of published articles and sleep hygiene in them. Results showed better therapy outcomes in BBTI group compared to IC group, and the difference in PSQI mean global sleep quality score was -3.55 (20). In an earlier study, 179 older adults underwent 6 consecutive weeks of stimulus control and sleep restriction interventions separately and in combination, and the results showed single and combined therapies had similar effects, and both therapies led to improved sleep quality compared to the control group (29). Nevertheless, in contrast with the current study, these prior studies focused on older adults with insomnia diagnosis. The results of abovementioned studies despite the differences with present study support our findings regarding the positive effects of training behavioral-based intervention on sleep quality.

In a systematic review and meta-analysis, information about the psycho-behavioral interventions to promote sleep health in adults without diagnosed sleep disorders was presented. They reported intervention components including stress management, relaxation practice, stimulus control, sleep hygiene, and exercise improves sleep in adults without clinical sleep disorder (6).

In our study, significant ameliorations were detected in 5 out of the 7 domains of the PSQI including subjective sleep quality, sleep efficiency, sleep duration, sleep latency, and sleep disturbance. Insignificant difference was found

for daytime dysfunction and use of sleeping pills during the study; at the beginning of the study, participants reported at least daytime dysfunction and no use of sleeping pills. A prior study on the effects of the CBT on primary insomnia indicated notable improvements in measures of sleep onset latency, numbers of awakenings during night, sleep efficiency, and quality of sleep (30). Similarly in another Egyptian study, all PSQI component scores except for sleeping pills improved at the post-intervention phase (2).

Conducting the study based on the Consort flow diagram, use of control group, and blindness were strengths of this study. Even so, there are several limitations, including self-report and non-use of objective assessments of sleep, and limited generalizability to older adults nursed at home. Further studies respecting the efficacy of behavioral-based training program on hospitalized older adults, along with the effects of other alternative interventions on late-life sleep complaints are needed.

Conclusion

Brief behavioral sleep training program can be considered an effective non-pharmacologic intervention to remediate sleep quality in older adults with moderate sleep disturbances, possibly before clinical insomnia develops. By applying above results, community health nurses can take a useful step toward increasing sleep quality among the elderly population with sleep difficulties.

Conflict of Interest Disclosures

None to disclose.

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Ethical Statement

This study protocol was approved by the Ethics Committee of Gonabad University of Medical Sciences, Gonabad, Iran (No: 123.98.F.T.S.4886). Participants were notified that they could quit participating in this study at any time and were assured that any information taken from them will be remained confidential and be used for the research purpose only. In consideration of ethical matters, immediately after completing the 1-month post-intervention, all subjects in the control group received the brief program of behavioral therapy to help them with their sleep problems.

Author Contributions

Study conception and design was done by Eshghizadeh and Esmaeili. Statistical analysis and interpretation of data were carried out by Eshghizadeh. Data gathering was done by Esmaeili. Planning for training sessions and drafting the manuscript were done by Eshghizadeh, Esmaeili, and Ahrari. Confirmation of final manuscript for publication was performed by all authors.

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Informed Consent

All eligible participants provided full informed consent after receiving explanations on the study objectives.

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