

# **Integrative Literature Review of Non-Pharmacological Interventions for Elderly Patients with Sleep Disorders**

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## **Abstract**

The purpose of this study is to provide evidence for developing non-pharmacological intervention programs for elderly patients with sleep disorders by integrative literature review and analysis. The integrative literature review was performed for articles published from January 2009 to December 2019. The key words, “insomnia,” “sleep disorder,” “elderly,” and “intervention” were used to search peer-reviewed evidence on five electronic databases. We reviewed 14 appropriate papers among them for the final analysis. Analysis of the articles of non-pharmacological interventions surveyed in the elderly with sleep disorders in Korea was conducted in five steps of the integrated literature review presented by Whittemore & Knafl. The 14 articles revealed six kinds of interventions for non-pharmacological intervention in elderly patients with sleep disorders: aromatherapy, laughter therapy, sleep program, auriculotherapy, footbath, and relaxation program. As a result of the integrative literature review, it was found that non-pharmacological interventions improved sleep quantitatively and qualitatively and was also effective in physiological and psychological ways. First, it was confirmed that the quantity and quality of sleep improved, and satisfaction with sleep increased. In particular, sleep quality was greatly improved with foot bath therapy and complex intervention. Second, a decrease in systolic blood pressure, changes in EEG and increase in B lymphocytes among the immune responses were confirmed as physiological effects. Third, among the psychological effects, depression, anxiety, and life satisfaction were improved. This study provides evidence for intervention programs for sleep improvement for elderly patients with sleep disorders. This study suggests to measure the effects of objective sleep assessment, complex intervention, and immunity-related variables in a non-pharmacological intervention study for the elderly with sleep disorders in the future.

**Keywords:** Sleep disorder; Aged; Intervention; literature, review

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## **Introduction**

Sleep is a basic human need and is an important factor that determines the health and quality of life of individuals and affects the recovery of physical functions and cognitive functions. The sleep characteristics of the elderly include reduced total sleep time due to physical changes resulting from aging and chronic diseases, and deteriorated sleep quality due to increased arousal index during sleep and sleep latency(Rodriguez J C *et al.*,2015). The prevalence of sleep disorders among the elderly in South Korea is 32.8%, which means that 1/3 of the elderly experience sleep disorders (Kim K W *et al.*,2017). In particular, sleep disorders in the elderly lead to increases in the risk of falling and the risk of outbreak of physical illness, declines in cognitive function, and increases in the number of hospitalizations, and the number of visits to emergency rooms(Rodriguez J C *et al.*,2015). In a study that investigated the causes of mortality of 4,064 elderly persons aged at least 65 years residing in the community for nine years, it was reported that the mortality rate increased as the number of times sleeping pills were taken increased(Chen H C *et al.*, 2013). In addition, in a meta-analysis that examined the relationship between sleep time and mortality, it was found that sleep time exceeding 10 hours increased the risk of cardiovascular mortality by 43%,while sleep time shorter than 7 hours was statistically significantly associated with all causes of increases in mortality rates(da SilvaA A *et al.*, 2016). Thus, it can be seen that sleep disorders in the elderly not only cause the problem of not being able to sleep, but also damage physical and mental health and increase mortality. Therefore, attention should be paid to the sleep disorders of the elderly. Treatments for the elderly with sleep disorders can be divided into drug treatments and non-pharmacological treatments. Although drug treatments are known to be effective for elderly patients with sleep disorders, long-term use of sleeping pills makes it difficult to stop drug use due to dependency and abuse, and leads to side effects such as increased risk of falls, memory loss, hallucinations, and dizziness (Vermeeren A., 2004). In addition, symptoms of delirium in the elderly were 4.4 times higher among the elderly who were taking sleep inducers (Kim Y *Met al.*, 2013). Therefore, non-pharmacological interventions are necessary to effectively control the symptoms of sleep disorders in the elderly and are very important because reduction of the dose of sleeping pills and improvement in health functions can also be expected from non-pharmacological treatments. Intervention studies on elderly patients with sleep disorders conducted in South Korea

include aromatherapy(Park *Set al.*, 2011), laughter therapy(Park E., 2013), and sleep enhancement programs (Chun *Net al.*, 2017; Hong S *Het al.*, 2009). However, such studies are insufficient to grasp the effectiveness of intervention programs suitable for elderly subjects because no study was conducted through a comprehensive review of intervention studies. Given the negative effects of sleep disorders on the physical health, mental health, and daily life functions of the elderly along with the increase in the elderly population and the rapidly aging society(Li *Jet al.*, 2013), the development of non-pharmacological interventions related to sleep disorders for the elderly is very urgent. Therefore, this study is intended to provide evidentiary materials to present a direction for future non-pharmacological intervention studies on the elderly with sleep disorders through a comprehensive review of the relevant literature in South Korea. The concrete purposes of this study are first to understand the characteristics of studies on non-pharmacological interventions for the elderly with sleep disorders in South Korea conducted over the last 10 years, and second, to analyze the contents and effects of non-pharmacological interventions.

## **Materials and Methods**

### **Study design**

This study is a literature review study that analyzed non-pharmacological intervention studies conducted with the elderly with sleep disorders in South Korea using an integrative review method.

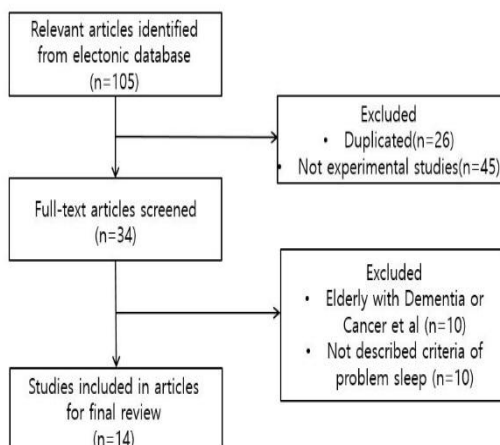
### **Study procedure**

To analyze the papers related to non-pharmacological interventions performed in the elderly with sleep disorders in South Korea, this study was conducted in five stages of the integrative literature review suggested by Whitemore & Knafl(Whitemore R *et al.*, 2005). The first stage is problem identification to determine the concrete purpose of the study, and it was defined as the research problem “What are the characteristics of non-pharmacological intervention studies on the elderly with sleep disorders in South Korea and the effects of the interventions?” In the second stage, suitable selection criteria for the research problem were prepared through a literature search, and the literature was surveyed. Stage 3 is a process of evaluating the data extracted through the literature search, and the data were analyzed based on the hierarchy of levels of evidence for evidence-based practice developed by Arbesman, Scheer and Lieberman(Arbesman, Scheer *et al.*, 2008) to assess the qualitative level of the literature. In stage 4, in order to analyze the data to fit the purpose of the study, the data were divided into two forms:

study design and study intervention, and analyzed thereafter. The study design consisted of the author (year), the purposes of the study, the number of subjects (experimental group, control group), measurement tools, and the effects that appeared in the results of the study. The study intervention consisted of the author (year), content of intervention, intervention performer, intervention period, number of intervention times, mediation time, and location of intervention to analyze the literature. In stage 5, the last stage, the final results of the analysis were summarized and presented in the form of a table.

### **Data collection**

Non-pharmacological intervention studies published in South Korea from January 2009 to December 2019 were searched in domestic search data bases comprising the Korean-studies Information Service System (KISS), Research Information Sharing Service (Riss4U), and academic database service (DBpia), Google Scholar, and KoreaMed. The major keywords “elderly,” “insomnia,” “sleep disorder,” “intervention,” “program,” and “effect” were combined to search papers and as a result, a total of 14 papers were finally selected. In order to improve the reliability of the study, two researchers went through the literature search process and prepared the following final criteria for literature selection: 1) studies published in domestic academic journals, 2) studies related to the elderly aged at least 65 years, 3) studies related to sleep intervention programs for the elderly with sleep disorders, and 4) those who complained of sleep disorder among the subjects of sleep disorder studies in cases where they satisfied the score corresponding to sleep disorder when a sleep evaluation tool was applied were defined as subjects with sleep disorders. The criteria for exclusion were 1) studies that implemented sleep interventions in adults and 2) studies designed as a survey study or a literature review study. A total of 105 papers were retrieved in this study, and 71 papers were excluded because they were retrieved in duplicate or were non-experimental studies. Thereafter, the full texts of the remaining 34 papers were secured and read to review paper titles and abstracts and 20 papers in which the subjects did not correspond to the purpose of this study or the criteria for sleep disorder were not described were excluded. In this study, 14 papers comprising two dissertations and 12 articles published in domestic academic journals were finally selected for analysis [Figure 1].



**Figure 1: Flow chart of literature search**

## Results and Discussion

### General characteristics of the studies on elderly with sleep disorders

The 14 papers on non-pharmacological interventions for the elderly with sleep disorders finally selected in this study were analyzed and according to the results, the evidence levels of the papers consisted of evidence level I, two papers (14.3%); evidence level II, 10 papers (71.4%); and evidence level III two papers (14.3%). Table 1 shows the general characteristics of the study results.

**Table 1: Characteristics of domestic studies on elderly with sleep disorders (n=14)**

Item	Categories	n (%)
Year	After 2010	11(78.5)
	Before 2010	3(21.5)
Type of article	Thesis	2(14.3)
	Journal	12(85.7)
Field of study	Nursing	9(64.3)
	Psychiatry	3(21.5)
	Sports science	1 (7.1)
	Social welfare	1 (7.1)
Type of intervention	Single intervention	12(85.7)
	Complex intervention	2(14.3)
Intervention content	Aromatherapy	4(28.5)
	Laughter Therapy	3(21.5)
	Sleep program	3(21.5)
	Auriculotherapy	2(14.3)
	Footbath	1 (7.1)
	Relaxation Program	1(7.1)

### Effects of quantitative and qualitative sleep on the elderly with sleep disorders

The variables for measuring the quantitative and qualitative effects on sleep were shown to be sleep disorder, sleep quality, sleep hygiene score, sleep time, sleep satisfaction, insomnia severity, and sleep. In this study, the outcome indicators that were applied the most frequently as the effects

of sleep were shown to be the quality of sleep in six papers and sleep in four papers. In a study conducted by Choi et al. in 2019, sleep disorder scores were significantly improved after applying a 6-week relaxation program, and in a study conducted by Lee in 2019, after applying auricular acupressure therapy, sleep latency significantly decreased in the experimental group from 72.72 minutes before intervention to 47.77 minutes after intervention. In a study conducted by Oh et al. in 2018, after applying a short-term insomnia intervention program, sleep quality improved and the sleep hygiene score improved from 16.8 points to 11.1 points after treatment. In a study conducted by Chun et al. in 2017, after applying a sleep program in combination with an aroma necklace, sleep quality, sleep time, and sleep satisfaction were improved, and in a study conducted by Lee in 2016, the quality of sleep was improved after applying aroma foot massage. In a study conducted by Park in 2013, the severity of insomnia was relieved after applying visiting laughter therapy, and in study conducted by Choi in 2013, the quality of sleep was improved after applying aromatherapy. In a study conducted by Lee et al. in 2011, the sleep score was improved significantly from 30.10 points to 44.60 points after applying an emotional freedom technique for insomnia (EFI-I), and in a study conducted by Park et al. in 2011, after applying aromatherapy hand massage, the sleep scale score increased significantly from 25.45 points to 48.00 points in the experimental group compared to the control group. In a study conducted by Seo & Sohng in 2011 where a footbath was used as an intervention, the total amount of sleep, measured using actigraphy, increased from 426.4 minutes before intervention to 470.7 minutes after intervention, and sleep latency increased from 76.6 minutes before intervention to 69.7 minutes after intervention in the experimental group. In a study conducted by Seo & Chang in 2011, after applying laughter therapy, the sleep scale score significantly increased in the experimental group from 39.65 points before intervention to 42.44 points after intervention. In in a study conducted by Lee & Sook in 2009, after applying an ear stimulation intervention, the sleep score was quite significantly improved from 35.22 points to 75.65 points. In in a study conducted by Jung et al. in 2009, insomnia severity and sleep quality scores were improved after applying laughter therapy, and in in a study conducted by Hong & Kim in 2009, after applying a sleep enhancement program, the sleep scale score significantly increased from 26.31 points to 32.13 points [Table 2].

### **Effects of physiological sleep on the elderly with sleep disorders**

Outcome indicators of physiological effects were evaluated using various methods such as TNF- $\alpha$ , melatonin, T3, T4, B lymphocytes, systolic and diastolic blood pressures, pulse, brainwaves, core temperature, pain, fatigue, and urine frequency. To review the studies in which physiological

effects were revealed, in a study conducted by Choi et al. in 2019, it was identified that the TNF- $\alpha$  level decreased from 1.41pg/ml to 0.74pg/ml after applying six weeks of relaxation therapy. In a study conducted by Lee in 2019, after applying auricular acupressure therapy, the pain score in the experimental group significantly decreased from 6.91 points to 3.14 points, and the number of urination times also significantly decreased from 4.45 to 2.55. However, there was no difference in melatonin levels. In a study conducted by Seo & Sohng in 2011, after applying footbath therapy, fatigue was significantly lowered from 57.5 points before the experiment to 51.9 after the experiment. In a study conducted by Hong & Kim in 2009, after applying a sleep enhancement program, the proportion of T3 decreased significantly from 60.70% to 52.66% thanks to effect of immune responses in the experimental group. On the other hand, to review studies in which no physiological effect appeared, in a study conducted by Chun et al. in 2017 in which a sleep enhancement program in combination with an aroma necklace was used as an intervention, systolic blood pressure and diastolic blood pressure were not different after intervention. In a study conducted by Seo & Sohng in 2011 in which footbath therapy was used as an intervention, there was no significant difference in core body temperatures measured immediately before the footbath, immediately after footbath, and 1 hour after footbath [Table 2].

### Effects of psychological sleep on the elderly with sleep disorders

As for the outcome indicators of psychological effects, depression was examined the most frequently, in eight papers, and anxiety, stress, self-esteem, and life satisfaction were evaluated as other outcome indicators. Among the eight studies where the effects of depression were examined, seven studies showed that the depression score significantly decreased after the intervention

**Table 2: Analysis of research design and results on elderly with sleep disorders (n=14)**

Author( year)	Research design	Intervention name & Interventionist	Duration of Program	Subjects		Result/Instrument (*:significant)
				Exp	Con	
Choi et al. (2019)	Non-equivalent control group pre and post-test design	Relaxation Program & Investigator (lecture)	1/wk for 1hour, 18times for 6wks	16	12	Sleep disorder* Stress, TNF- $\alpha$ * C-reactive protein (CRP)
Lee J. H. (2019)	Completely randomized design	Auricular Acupressure & Investigator (nurse)	1/wk for 15min, 6times for 6wks	26	25	Subjective-sleep quality Objective-sleep quantity* Melatonin levels
Oh et al. (2018)	One group pre and post-test design	Brief Intervention for Insomnia & Psychiatric nurse with medical experience	1.wk for 1hour, 5 times for 5wks	41	0	Sleep quality (PSQI)*, Sleep hygiene index* Depression(S-GDS) Beck anxiety inventory

Chun et al. (2017)	Non-equivalent control group pre and post-test design	Sleep Improvement Program Combined with Aroma-Necklace & Investigator (professor)	1/wk for 1hour, 4times for 1month	35	35	Sleep quality*, Sleep duration*, Sleep satisfaction*, Depression(CES-D)*, Anxiety (STAI-Y)*, Systolic BP&Diastolic BP
Lee H.K. (2016)	Non-equivalent control group pre and post-test design	Aromatherapy Foot Massage & Investigator (professor)	1/wk for 10min, 6times for 2wks	22	21	Chronic pain Sleep quality (KMLSEQ)* Number of urination during sleep
Park, E.O (2013)	Non-equivalent control group pre and post-test design	Visiting Laughter Therapy & Trained nurse	1/wk for 10-15min, 8times for 2month	42	47	Depression(S-GDS)* Insomnia(ISI)*
Choi S.W. (2013)	Completely randomized design	Aromatherapy & Investigator	1/wk for 20min, 1time for 1wk	29	29	Sleep quality* Depression (GDS)* Blood pressure* & EEG*
Lee et al (2011)	One group pre and post-test design	Emotional Freedom Techniques Program for Insomnia(EFT-I) & Investigator(doctor)	1/wk for 60min 8times for 1month	10	0	Sleep* Depression(S-GDS)* Anxiety(STAI)* Life Satisfaction*
Park et al (2011)	Non-equivalent control group pre and post- test design	Aroma Hand Massage & Investigator (professor)	1/wk for 10min 6times for 2month	20	20	Sleep* Depression(S-GDS)*
Seo & Sohng. (2011)	Non-equivalent control group pre and post- test design	Laughter Therapy & Investigator (nurse, laughter therapist)	1/wk for 30min 3times for 1wk	27	23	Sleep amount* Sleep efficiency Sleep latency* Sleep satisfaction* Fatigue* & Temperature
Seo & Chang (2011)	Non-equivalent control group pre and post- test design	Laughter Therapy & Investigator (nurse, laughter therapist)	1/wk for 60min, 4times for 1month	28	30	Sleep* Depression(S-GDS)* Self-esteem
Lee & Sook (2009)	Non-equivalent control group pre and post-test design	Auriculotherapy & Investigator (nurse)	1/wk for 10min, 5times for 5wks	23	20	Sleep* Sleep satisfaction*
Jung et al (2009)	Non-equivalent control group pre and post-test design	Laughter therapy & Investigator (doctor)	1/wk for 60min, 4times for 1month	48	61	Insomnia(ISI)* Sleep quality(PSQI)* Depression(GDS)*
Hong & Kim (2009)	Non-equivalent control group pre and post-test design	Sleep Promoting Program & Investigator (professor)	1/wk for 60min, 4times for 1month	16	16	Sleep score* Sleep satisfaction* Immune response*

compared to before the intervention. However, there was no significant difference in the mean value of depression in only one study conducted by Oh et al. in 2018 on a short-term insomnia treatment program. In a study by Seo & Chang in 2011 where laughter therapy was applied four times in total for 60 minutes each time, depression significantly decreased after intervention, but there was no significant difference in self-esteem [Table 2].



## Discussion

This study attempted to develop effective sleep intervention programs through an integrative review of previous studies on non-pharmacological interventions for the elderly with sleep disorders in South Korea, and to suggest the future direction of non-pharmacological interventions. This study will discuss the characteristics of studies on non-pharmacological interventions in the elderly with sleep disorders, the qualitative and quantitative effects, physiological effects, and psychological effects on sleep identified through the integrative literature review. Studies on non-pharmacological interventions in the elderly with sleep disorders have been conducted in various fields such as nursing, psychiatry, sports, and social welfare studies over the last 10 years, most actively in the field of nursing. With regard to study design methods, most studies applied the nonequivalent control group pretest-posttest design and have a limitation that they did not randomly assign the subjects. Therefore, in order to improve the internal and external validity of non-pharmacological intervention studies on the elderly with sleep disorders hereafter, it is thought that a purely experimental study design method with random assignment should be implemented (da Silva A A *et al.*, 2016). The intervention time was at least 20 minutes and programs with at least four sessions were the most frequent, as they were used in 10 papers. Given these effects, the studies are thought to have considered the duration and time of the non-pharmacological interventions suitable for the characteristics of the elderly with sleep disorders. The contents of the intervention programs were aromatherapy, laughter therapy, footbath therapy, auricular acupuncture therapy, sleep enhancement program, short-term insomnia program, and relaxation therapy, which were provided by trained experts. Although these intervention programs may show effects immediately after the experiment, no study that investigated long-term effects after the experiment could be found. In future studies of non-pharmacological interventions for the elderly with sleep disorders, it is considered necessary to investigate long-term effects and develop intervention programs that can be easily applied to the elderly. As for the quantitative and qualitative effects of non-pharmacological interventions on sleep, there were studies that measured sleep objectively using actigraphy or a Fitbit tracker, those that measured subjective sleep with questionnaires, and those that combined objective and subjective measurements. Subjective sleep quality, sleep satisfaction, and sleep scale scores improved, and the objective sleep measurement also showed increases in total sleep time and decreases in sleep latency. However, since 12 studies evaluated sleep subjectively with the questionnaire survey method and only two studies evaluated sleep objectively, in future studies, sleep should be evaluated using more objective, reliable, and valid methods instead of the current evaluation that relies only on

subjective measurement to verify the effects of studies(Chen H C *et al.*, 2013).The most effective intervention for sleep scores was footbath therapy(Seo H S *et al.*, 2011). The total sleep time quite significantly increased after taking a footbath for 30 minutes in water temperature automatically controlled at 42 degrees, one hour before bedtime. This is consistent with the results of a study of conducted by Seyyedrasooli *et al.*(Seyyedrasooli, *Aet al.*, 2013), indicating that after applying footbath therapy, sleep efficiency and the use of sleeping pills did not change, but sleep time was significantly affected. This is considered attributable to the fact that footbath therapy not only increased blood circulation, but also the activity of parasympathetic nerves, thereby relaxing the mind and body, leading to increases in slow-wave sleep in NREM stages 3 and 4(Seo H S *et al.*, 2011). In addition, in an intervention study using a sleep enhancement program in combination with an aroma necklace, large effects on sleep quality scores appeared after the intervention(Chun N *et al.*, 2017), suggesting that the effects of multimodal intervention for the elderly with sleep disorders should be studied in the future.

The variables for the physiological effects of non-pharmacological interventions for the elderly with sleep disorders were diverse and included TNF- $\alpha$ , melatonin, T3, T4, B lymphocytes, systolic blood pressure, diastolic blood pressure, pulse, brainwaves, and core temperature, and some studies examined the effects on pain, fatigue, and the number of urination times. The trend of the immune responses should be analyzed after applying the program over a long period of time, rather than the effect in a short period of time, and the control of exogenous variables such as stress and nutrition that can affect sleep and immune response should be considered(Hong S H *et al.*, 2009). Since only two domestic studies applied immune responses, for which many things must be considered, as an outcome variable for non-pharmacological intervention, it is thought that studies on sleep and immune responses as the effects of intervention programs should be expanded hereafter(Irwin M R *et al.*, 2015). In most studies conducted with the elderly with sleep disorders, there were significant decreases in the Elderly Depression Scale test, anxiety decreased, and life satisfaction increased. In particular, aromatherapy(Park S *et al.*, 2011) and laughter therapy(Park E., 2013) were found to be effective on depression in the elderly with sleep disorders. Although it was revealed that aromatherapy improves depression because the fragrance of lavender is delivered to the limbic system, which controls emotions through the cerebral cortex (Hong S H *et al.*, 2009), many studies did not find any reasonable and clear evidence for the improvement of depression. Whether depression was improved thanks to the improvement in sleep or the effect of the program should be investigated in the future. Aromatherapy intervention was applied to the elderly with sleep disorders the most frequently, and it is considered to be an

intervention that can be used as an effective alternative because it is safe to apply to the elderly, and in particular, its inhalation method can be conveniently used by the elderly. On the other hand, in a study of intervention with a short-term insomnia treatment program that was reconstructed to facilitate the implementation of insomnia cognitive behavioral therapy, no change appeared in depression scores. This is because the proportion of subjects with moderate depressive symptoms was high so that changes in depression scores were insignificant, although depression scores decreased compared to before treatment in some subjects with high depression scores. When conducting a homogeneity test between an experimental group and control group, it is necessary to consider the severity ratio as well as the average score in the case of psychological variables such as depression. Although cognitive-behavioral therapy is known as a representative treatment method for patients with sleep disorders, when applied to the elderly, it should be helpful to decrease depression when it is combined with aromatherapy or laughter therapy (Hong S Het *al.*, 2009).

## **Conclusion**

Based on the above results, matters that must be considered when developing a successful non-pharmacological intervention program for the elderly with sleep disorders are suggested as follows. First, until now, many studies have relied on subjective questionnaires to be filled in by the subjects for the evaluation of sleep. Hereafter, objective sleep evaluation and measurement is necessary along with subjective sleep evaluation. Second, all studies on non-pharmacological interventions grasped effects immediately after the intervention, and long-term effects on sleep could not be found. Therefore, long-term follow-up studies are necessary. Third, rather than single interventions, it is necessary to develop multimodal interventions that consider various aspects of the elderly such as physiological, physical, emotional, and psychological aspects, and in particular, studies that measure the effects of variables related to immunity, a physiological index, should be expanded.

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