



# The effects of footbath on sleep among the older adults in nursing home: A quasi-experimental study



Hyun-Joo Kim<sup>a,1</sup>, Yaelim Lee<sup>b</sup>, Kyeong-Yae Sohng<sup>c,\*</sup>

<sup>a</sup> Shineville Seniors Longterm Care Facilities, Gyeong-gi Province, Republic of Korea

<sup>b</sup> Yeouido St. Mary's Hospital, The Catholic University of Korea, Republic of Korea

<sup>c</sup> College of Nursing, The Catholic University of Korea, 222 Banpo-daero, Socho-gu, Seoul 137-701, Republic of Korea

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## ABSTRACT

**Objectives:** To examine the long-term effects of foot-bathing therapy, using different water temperatures, on the sleep quality of older adults living in nursing homes.

**Design:** A quasi-experimental study design with non-equivalent control group.

**Settings:** Thirty participants were recruited from a nursing home in Gyeong-gi Province, South Korea.

**Interventions:** The participants were randomly assigned to experimental, placebo, and control groups. The foot-bathing therapy was performed for 30 min daily for four weeks. Water at 40 °C was used for the experimental group, while water at 36.5 °C was used for the placebo group. The control group did not receive any intervention.

**Main outcome measures:** The participants' sleep patterns (total sleep amount, sleep efficiency, and sleep latency) and sleep-disturbed behaviors were compared based on group, using actigraphy and a sleep disorder inventory.

**Results:** The total amount of sleep and sleep efficiency were significantly different for the experimental group, especially those with poor sleep quality. There were no differences in sleep latency or sleep-disturbed behaviors among the groups. The long-term effect of the therapy decreased in the third week of the therapy.

**Conclusions:** Daily, 30-min foot-bathing therapy sessions with water at 40 °C were effective in improving sleep quality for older adults. The therapy was more effective for participants with poor sleep quality at baseline assessment than those with relatively good sleep quality. The long-term effects of foot-bathing therapy decreased three weeks after initiation; therefore, it might be desirable to deliver the therapy for two weeks, pause it for a week, and then resume it.

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## 1. Introduction

Sleep is a life-sustaining activity that affects every individual's well-being and quality of life.<sup>1</sup> Sleep deprivation increases levels of fatigue, anxiety, and depression, inducing cognitive impairment, sleep-disturbed behaviors, and higher mortality.<sup>2,3</sup> Although sleep disturbance can occur in all age groups, quality of sleep tends to decrease in older adults.<sup>4,5</sup> As individual ages, non-rapid eye movement (NREM) sleep decreases and sleep stage 1 increases, which results in spontaneous awakening, increased sensitivity to auditory stimuli, frequent waking, and insufficient sleep.<sup>6</sup> In particular, older adults who reside in nursing homes reported higher levels of

stress due to collective living conditions and poor sleep quality due to unfamiliar environments and living habits differing from those in their homes.<sup>7</sup>

Because long-term use of sleeping pills can cause various side effects, such as physical dependence and cognitive impairment, many of studies have examined the effectiveness of nonpharmacological treatments for sleep disturbance, including herbal inhalation, massage, and footbaths.<sup>2,5</sup> Footbath therapy has been reported to effectively enhance the quality of sleep by decreasing core body temperature through peripheral vasodilation.<sup>8</sup> It has been reported to improve sleep by reducing sleep-onset latency, increasing NREM sleep, and reducing REM sleep.<sup>9</sup> Moreover, it is easy to administer and cost-effective, and it involves minimal risk.<sup>9,10</sup> The effects of footbath therapy vary depending on water temperature, length of the therapy, and subject; however, there are no detailed criteria suggested for older adults.<sup>8</sup> The purposes of this study were to address this gap in the literature by (1) evaluating the long-term effects of footbath therapy on sleep quality and

\* Corresponding author. Fax: +82 2 2258 7772.

E-mail address: [sky@catholic.ac.kr](mailto:sky@catholic.ac.kr) (K.-Y. Sohng).

<sup>1</sup> Shineville Seniors Longterm Care Facilities, 511-1, Daedae-ri, Yangji-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, Republic of Korea.

**Table 1**  
General characteristics of the participants.

Characteristic	Mean (SD) or N (%)			p
	Exp.	Pl.	Cont.	
Age(years)	81.6 (4.5)	77.0 (9.0)	77.0 (11.8)	.425
Gender				
Male	1 (10.0)	2 (20.0)	3 (30.0)	.535
Female	9 (90.0)	8 (80.0)	7 (70.0)	
Duration of disease(months)	69.8 (40.6)	54.2 (26.1)	53.5 (24.8)	.562
Residence period(months)	26.5 (19.9)	25.3 (18.0)	23.6 (20.8)	.946
Pain				
Yes	6 (60.0)	2 (20.0)	6 (60.0)	.117
No	4 (40.0)	8 (80.0)	4 (40.0)	
Mobility				
Bed ridden	3 (30.0)	3 (30.0)	4 (40.0)	.570
Walking available	4 (40.0)	4 (40.0)	1 (10.0)	
Wheelchair bound	3 (30.0)	3 (30.0)	5 (50.0)	
Hypnotics use				
Yes	0 (0.0)	2 (20.0)	4 (40.0)	.082
No	10 (10.0)	8 (80.0)	6 (60.0)	
Sedatives use				
Yes	1 (10.0)	2 (20.0)	2 (20.0)	.787
No	9 (90.0)	8 (80.0)	8 (80.0)	
Body temperature (°C)	36.8 (.3)	36.6 (.3)	36.8 (.3)	.352
K-MMSE	10.5 (9.4)	12.3 (8.4)	9.6 (8.7)	.741
Sleep pattern				
Total sleep amount (min)	303.9 (142.4)	296.3 (163.0)	392.9 (167.7)	.330
Sleep efficiency (%)	52.3 (23.4)	60.2 (29.0)	63.9 (24.9)	.600
Sleep latency (min)	16.4 (16.3)	6.9 (3.5)	7.6 (5.8)	.084
SDI				
Frequency	1.3 (.3)	1.5 (.3)	1.2 (.3)	.073

Note. Exp.—experimental group (n = 10); Pl.—placebo group (n = 10); Cont.—control group (n = 10); K-MMSE = Korea-Mini Mental State Examination.

sleep-disturbed behaviors and (2) exploring the therapy's effectiveness relative to the baseline sleep quality of the participants.

## 2. Method

### 2.1. Study design

A quasi-experimental study design was used to examine the effects of footbath therapy on sleep patterns among older adults living in a nursing home. To tease out the effect of footbath therapy at a specific water temperature, as distinguished from simply soaking the feet in water, three groups were used: the experimental group, which received footbath therapy at a water temperature of 40 °C; the placebo group, which received the therapy at a water temperature of 36.5 °C, and the control group, which did not receive the therapy.

### 2.2. Sample and setting

The study participants were ambulatory adults over the age of 65 living in S nursing home in Yong-in City in Gyeong-gi Province, South Korea. The potential participants with the following conditions were excluded from the study: having a foot injury or sensory disorder, acute disease, peripheral vascular disease, schizophrenia, having difficulties in communicating, having pain or infection (e.g., ear pain or infection).<sup>11,12</sup>

Among 66 residents in the facility, 51 who met the study criteria were approached, consented to participate in the study, and were asked to wear an actigraphy (ATG) while sleeping. Based on the average sleeping time of the 51 participants (320.1 min) and average sleep efficiency (58.9%), we assigned the participants to a good-sleep category and a poor-sleep category by convenience.

Then, we randomly selected 15 participants from each category, for a total of 30. The 15 participants from each category were then assigned to the experimental group, the placebo group, or the control group (five in each group).

A sample size of the study was calculated using G\*Power software (version 3.1.2). An alpha level of .05, an F-test effect size of .25 from the five repeated measures of variance analyses of the three groups, and an effect power of .95 were selected for the calculation. A sample size of nine in each group was calculated to be sufficient for the study; however, considering the number of dropouts, we assigned 10 participants to each group.

### 2.3. Data collection

The data collection was conducted between June 2011 and September 2011 (Fig. 1). The study was reviewed and approved by C University's Institutional Review Board (Approval number: CUMC11U044). Four research assistants and two facility staff were trained to observe and document cognitive ability and sleep-disturbed behaviors, deliver footbath therapy, and apply ATG. After being informed about the objectives and procedure of the study, the participant or a legal caregiver signed the informed consent form.

### 2.4. Study intervention

The footbath therapy was administered at a water temperature at 40 °C at one and a half hours before bedtime for 30 min over a period of four weeks. The water temperature and therapy length were chosen based on findings from previous studies that showed water temperature higher than 40 °C tends to increase core temperature<sup>8,13</sup> and a study that demonstrated the effectiveness of footbaths performed for 30 min.<sup>14</sup> Researchers have hypothesized

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