



# Using of Hot Red Bean Bag on the Symptoms of Depression, Sleep, and Fatigue in Stroke Patients

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## Abstract

**Background:** Symptoms of depression, sleep, and fatigue in stroke patients are associated with each other, and intervention development for improving of these symptoms is needed. This study aimed to examine the effects of hot red bean bag on depression, sleep state, sleep satisfaction, and fatigue among Korean stroke patients.

**Methods:** A quasi-experimental pretest-posttest control group design was employed. The study participants included 57 stroke patients (Intervention: n=28, Control: n=29) in a hospital in Seoul, South Korea from Aug 2017 to Mar 2018. Hot red bean bag, as an intervention, was heated in a 2,450 MHz microwave oven for 3 min, and applied for 30 min at  $41 \pm 6$  °C in the lower limbs of the intervention group for 5 days.

**Results:** There were statistically significant differences on depression ( $P < 0.001$ ), sleep state ( $P < 0.001$ ), sleep satisfaction ( $P < 0.001$ ), and total fatigue ( $P < 0.001$ ) between the two groups.

**Conclusion:** Hot red bean bag was an effective intervention for decreasing depression and total/subcategories fatigue, and for improving sleep state and sleep satisfaction of Korean stroke patients. Research on complementary and alternative therapies for stroke patients needs be studied continuously.

**Keywords:** Stroke; Red bean; Depression; Sleep; Fatigue

## Introduction

Stroke afflicts one in six people around the world. Moreover, it occurs in one person every 2 seconds worldwide, and is a major cause of chronic disorders among adults (1). Once stroke occurs, only 9% of patients recover to their pre-disease function, and 73% of the remaining patients suffer from disorders in sensory, cognitive, and speech functions, or hemiplegia, depending on the degree of brain damage (1).

Stroke patients have decreased peripheral blood volume, resulting in cold and pale skin, and severe muscle weakness. For this reason, stroke patients experience cold sensation or paralysis. These symptoms act as major stress factors in stroke patients (2). As they live with the disease, they realize its therapeutic limitations. Stroke patients fall into powerlessness and sense of loss, as well as depression, if severe. Depression interferes with the daily activities of stroke patients,



negatively affecting their life patterns and becoming a major cause of sleep disorders (3-5).

On the other hand, sleep disorder is a common symptom that occurs in 20% to 50% of stroke patients. Oversleeping, excessive daytime drowsiness, and changes in sleeping habits significantly trigger fatigue in the daily life of stroke patients (6). About 24% of stroke patients complain of severe fatigue, which negatively affects their rehabilitation treatment, and delays their recovery (5,7). Stroke patients who suffer from fatigue also become anxious about their own body, while experiencing sudden changes in their external environment. Fear of stroke treatment causes serious side effects. It is also related to mortality rate in severe cases (4,6).

Recently, thermotherapy by using red beans was found to be a complementary and alternative nursing care that can be applied with the help of a microwave (8). Thermotherapy increases the metabolism of the peripheral region of a stroke patient, and relieves their pain by alleviating joint stiffness. It may also lead to the relaxation of the peripheral blood vessels of stroke patients who are experiencing symptoms of hypothermia and blood circulation disorders in the peripheral region, thereby increasing skin temperature, and, eventually, helping muscle stabilization and sleep (8-10).

However, most of the recent nursing studies on thermotherapy by using red beans have been applied to alleviate menstrual pain related to female diseases (11-13). Furthermore, there is insufficient research into effective nursing intervention among stroke patients who are constantly struggling with the disease. Research on nursing intervention is deemed necessary to increase the effect of the rehabilitation treatment, since it can be applied more easily on stroke patients with permanent disabilities, and it can improve their physical and emotional being.

Since the number of stroke patients have been increasing worldwide (2,8), this study may raise the global understanding of the effects of complementary and alternative therapy among stroke patients. Moreover, this study may be a valuable

source of information to help improve depression, sleep, and fatigue affecting stroke patients.

We aimed to examine the effects of using a hot red bean bag on depression, sleep patterns, and fatigue among stroke patients.

## Materials and Methods

### Participants

A quasi-experimental pretest-posttest control group design was employed. The study participants included 57 stroke patients (Intervention: n=28, Control: n=29) admitted to a hospital in Seoul, South Korea, that is equipped with more than 1,000 beds. Participants were selected through convenience sampling, and they were randomly assigned to each group. Participants diagnosed with stroke (e.g., cerebral infarction and cerebral hemorrhage) through CT or MRI were currently receiving rehabilitation treatment, had normal vital signs, and agreed to participate by understanding the purpose and content of this study. One withdrawal participant in the intervention group was excluded from this study. Sample size adequacy (n=26 in each group) by using the three-groups F-test, G power 3 analysis software was estimated based on an alpha level=0.05, effect size=0.30, and power=0.80 (14). Therefore, the sample size in the study was adequate.

### Intervention

The researcher, along with one research assistant, ordered a hot red bean bag according to the previous study for the overall process (15). The hot red bean bag was made of  $1600 \pm 5$  g of 100% Korean red bean in a bag made of 130 cm×90 cm double cotton. The hot red bean bag was heated in a 2,450 MHz microwave oven for 3 min, and applied for 30 min at  $41 \pm 6$  °C in the lower limbs of the intervention group for 5 d. At this time, if the participant was perceived to be feeling hot, a towel was used for 5-10 min in order to prevent skin burns (15).

The intervention group used the hot red bean bag for 30 min each time for 5 d in the same time

and method by the researcher. On the other hand, the control group received the usual treatment for 5 d, and only the rehabilitation treatment effects and vital signs were measured. In this study, the hot red bean bag was implemented at 7:00 pm, 1.5 h before sleep, considering the lights off time of the hospital room at K University Hospital. For the constant control of the exogenous variables of this study, the humidity level, which could change the body temperature of the subject, was kept constant at 50% to 70% after 7:00 pm. In order to control the amount of light, ward lighting was set to less than 8 lux. Furthermore, the environments of the intervention group and the control group were kept the same by maintaining the room temperature above 23 °C in the morning, and at 23~24 °C in the afternoon during the experimental intervention.

### *Evaluation indexes*

#### *1) General characteristics lists*

The study participant's general characteristics survey consisted of 7 items, including age, gender, marital state, academic background, religion, care provider, and area of discomfort. Characteristics related to the disease of the study participants survey included diagnosis, current paraplegic region, number of stroke incidents, diagnosed period, present disease other than stroke, type of physical therapy, disturbance in urination, disturbance in defecation, tiring time zone, sleep-induced fatigue, use of alternative therapy to improve sleep, systolic blood pressure, diastolic blood pressure, heart rate, weight, and body temperature. There were 16 items in total.

#### *2) Depression*

The Beck Depression Inventory developed by Beck (16) was revised by Lee and Song (17) to correspond to its Korean version. The scale was used to measure the level of depression of the participants. This scale included physical, emotional, cognitive, and motive dimensions. It consisted of 21 questions by using a 3-point Likert scale. The range of score was 0 to 63 points. This scale was presented as 9 points and below (no depression), 10 ~ 15 points (slight depressive

state), 16~23 points (moderate depressive state), and 24 ~ 63 points (severe depressive state) by Lee and Song (17). The higher the score of the respondent, the higher the levels of depression. Reliability in this study were Cronbach's  $\alpha=0.92$ .

#### *3) Sleep state*

The sleep state scale was developed by Oh et al. (18) This scale was used to measure the level of sleep state of the participants. This scale included sleep pattern (8 items), evaluation of sleep (4 items), outcome of sleep (1 item), and causes of sleep disturbance (2 items). It consisted of 15 questions by using a 4-point Likert scale, and the range of score was 15 to 60 points. The higher the score of the respondent, the better the level of sleep state. In the present study, the Cronbach's alpha coefficients for sleep pattern, evaluation of sleep, outcome of sleep, and causes of sleep disturbance were 0.75, 0.76, 0.75, and 0.74, respectively, supporting its internal consistency reliability. In this study, total Cronbach's  $\alpha=0.89$ .

#### *4) Sleep satisfaction*

The sleep satisfaction scale used by Hwang et al. (19) was the graphic rating scale. This scale was used to measure the degree of sleep satisfaction of the participants. This scale included 10 stages, from zero (never satisfied) to 10 (very satisfied) points. The higher the score of the respondent, the higher the degree of sleep satisfaction.

#### *5) Fatigue*

The fatigue scale was created by Park and Shin (20) to correspond to its Korean version. This scale was used to measure the degree of fatigue of the participants. This scale included physical, mental, and neuro-sensory fatigues. It consisted of 30 questions by using a 4-point Likert scale, and the range of score was 30 to 120 points. The higher the score of the respondent, the higher the degree of fatigue. As for the fatigue scale, it showed an acceptable content validity with the construct validity being reported as moderate to high (20). In this study, Cronbach's  $\alpha=0.92$ .

### Procedure

The period for data collection was from Aug 2017 to Mar 2018. The researchers visited the hospital to obtain permission for the study, and explained the purpose of this study, participation details, and questionnaire to prospective study participants. In both the intervention group and the control group, questionnaires were measured for study variables, such as depression, sleep state, sleep satisfaction, and fatigue, before the intervention. After the application of the hot red bean bag was completed, both lower limbs were assessed to check the degree of redness and pain. After completing all the experimental intervention in this study, the intervention group was asked to fill out a questionnaire on depression, sleep state, sleep satisfaction, and fatigue the next morning, while the control group was asked to fill out the questionnaire in the same way. The questionnaire was completed by self-reporting, and a research assistant collected the completed questionnaire.

### Statistical analysis

The collected data were analyzed by using SPSS 23.0 (IBM Corp., Armonk, NY, USA). The participants' general characteristics and characteristics related to disease were analyzed in terms of frequency, percentage, and descriptive statistics. Homogeneity between the two groups in the participants' general characteristics, characteristics related to disease, and study variables at baseline was analyzed by using  $\chi^2$ -test or independent  $t$ -

test. The effects of the hot red bean bag were analyzed by independent  $t$ -test.

### Ethical consideration

For the purpose of ethical considerations, the Institutional Review Board of K University Hospital in South Korea approved this study. Participants were informed that they would voluntarily take part in this study and could withdraw from the study at any time. Participants were also informed of the confidentiality of the data. Researchers obtained completed written consent forms from the study participants.

## Results

### General characteristics of the study participants and homogeneity

The average age of the participants was 63.12 yr old (intervention: 61.68 yr old, control: 64.51 yr old). As for gender, there were more males (64.3%) in the intervention group, and there were more females (62.1%) in the control group. Regarding the use of a care provider, spouse (32.1%) was most common in the intervention group, and a caregiver (31.0%) was most common in the control group. As for the degree of discomfort, pain in the leg (28.6%) was the most common in the intervention group, while pain in the arm (27.6%) was the most common in the control group. As for the general characteristics of participants between the two groups, there were no group differences at baseline at a statistical significance level of  $P < 0.05$  (Table 1).

**Table 1:** General characteristics of the study participants and homogeneity (N = 57)

Variables	Intervention group	Control group	$\chi^2$ or $t$	P
	(n=28) n(%) or Mean $\pm$ SD	(n=29) n(%) or Mean $\pm$ SD		
Age(year)				
22 $\leq$ ~ < 65	13(46.4)	13(44.8)	0.041	0.980
65 $\leq$	15(53.6)	16(55.2)		
Each group	61.68 $\pm$ 16.86	64.51 $\pm$ 16.54	1.571	0.122
Total	63.12 $\pm$ 16.61			
Gender				
Male	18(64.3)	11(37.9)	3.959	0.053
Female	10(35.7)	18(62.1)		

Table 1: Continued...

Marital status				
Single	2( 7.1)	3(10.3)	5.073†	0.241
Married	25(89.3)	20(69.0)		
Separation	1( 3.6)	2( 6.9)		
Other	0( 0.0)	4(13.8)		
Academic background				
Elementary school or below	3(10.7)	11(37.9)	10.611†	0.144
Middle school	4(14.3)	1( 3.4)		
High school	14(50.0)	6(20.8)		
University or above	7(25.0)	11(37.9)		
Religion				
None	15(53.5)	12(41.5)	2.535†	0.638
Christianity	8(28.6)	7(24.1)		
Catholic	1( 3.6)	2( 6.9)		
Buddhism	4(14.3)	7(24.1)		
Other	0( 0.0)	1( 3.4)		
Care provider				
Spouse	9(32.1)	8(27.6)	7.379†	0.287
Parents	1( 3.6)	4(13.8)		
Children	8(28.6)	6(20.7)		
Caregiver	7(25.0)	9(31.0)		
Other	3(10.7)	2( 6.9)		
Area of discomfort				
Arm	7(25.0)	8(27.6)	13.891†	0.126
Leg	8(28.6)	2( 6.9)		
Chest	1( 3.6)	2( 6.9)		
Head	6(21.3)	3(10.3)		
Foot	0( 0.0)	2( 6.9)		
Waist	1( 3.6)	1( 3.4)		
Arm+Leg	1( 3.6)	6(20.8)		
Arm+Leg+Head	1( 3.6)	2( 6.9)		
Arm+Leg+Foot	2( 7.1)	0( 0.0)		
Other	1( 3.6)	3(10.3)		

† Fisher's exact test.

### *Characteristics related to disease and homogeneity*

As for the diagnosis, cerebral hemorrhage (50.0%) was the most common in the intervention group, and cerebral infarction (48.3%) was the most common in the control group. Regarding the number of incidences of stroke, most participants responded “one time” (intervention: 82.1%, control: 86.2%). As for present disease other than stroke, most participants had hypertension (intervention: 64.2%, control: 65.5%). As for the disturbances in urination or defecation, most participants had no disturbances in urina-

tion (intervention: 57.1%, control: 72.4%) or defecation (intervention: 67.9%, control: 62.1%). Regarding the period of tiredness, most participants responded “PM” (intervention: 85.7%, control: 86.2%). As for the use of alternative therapy to improve sleep, most participants had no experience (intervention: 96.4%, control: 96.6%). As for the characteristics related to disease between the two groups, as well as the study variables before the intervention, there were no group differences at baseline at a statistical significance level of  $P < 0.05$  (Tables 2 and 3).

**Table 2:** Characteristics related to disease and homogeneity (N = 57)

Variables	Intervention group	Control group	$\chi^2$ or t	P
	(n=28)	(n=29)		
	n(%) or Mean $\pm$ SD	n(%) or Mean $\pm$ SD		
Diagnosis				
Cerebral infarction	11(39.3)	14(48.3)	0.501†	0.780
Cerebral hemorrhage	14(50.0)	12(41.4)		
Both	3(10.7)	3(10.3)		
Current paraplegic region				
Left side	10(35.7)	12(41.4)	1.530†	0.677
Right side	14(50.0)	11(38.0)		
Both side	1( 3.6)	3(10.3)		
None	3(10.7)	3(10.3)		
Number of stroke incidents (time)				
1	23(82.1)	25(86.2)	0.182†	0.674
2	5(17.9)	4(13.8)		
Diagnosed period (month)				
$\leq 1$	24(85.7)	18(62.2)	8.131†	0.119
$> 1$	4(14.3)	11(37.8)		
Present disease other than stroke				
Diabetes Mellitus	1( 3.6)	5(17.2)	6.013†	0.198
Hypertension	18(64.2)	19(65.5)		
Hyperlipidemia	1( 3.6)	0( 0.0)		
Heart disease	0( 0.0)	1( 3.4)		
Other	8(28.6)	4(13.9)		
Type of physical therapy				
Movement	3(10.7)	2( 6.9)	16.670†	0.274
Movement+Occupation	8(28.6)	6(20.7)		
Movement+Occupation+Pain	1( 3.6)	5(17.2)		
Movement+Occupation+Speech	7(25.0)	10(34.5)		
Movement+Occupation+Speech+	3(10.7)	0( 0.0)		
Swallowing				
Movement+Occupation+Pain+Speech	1( 3.6)	2( 6.9)		
Other	5(17.8)	4(13.8)		
Disturbance in urination				
Yes	12(42.9)	8(27.6)	1.462	0.227
No	16(57.1)	21(72.4)		
Disturbance in defecation				
Yes	9(32.1)	11(37.9)	0.213	0.647
No	19(67.9)	18(62.1)		
Tiring time zone				
AM	4(14.3)	4(13.8)	3.071†	0.546
PM	24(85.7)	25(86.2)		
Sleep-induced fatigue				
Yes	18(64.3)	16(55.2)	0.402	0.483
No	10(35.7)	13(44.8)		
Use of alternative therapy to improve sleep				
Yes	1( 3.6)	1( 3.4)	0.001†	0.980
No	27(96.4)	28(96.6)		
Systolic blood pressure (mmHg)	115.00 $\pm$ 10.25	120.24 $\pm$ 14.05	-1.602	0.114
Diastolic blood pressure (mmHg)	70.36 $\pm$ 14.88	73.31 $\pm$ 11.17	-0.851	0.400
Heart rate (per minute)	74.04 $\pm$ 6.71	76.96 $\pm$ 7.54	-1.552	0.127
Weight (kg)	61.13 $\pm$ 9.97	58.65 $\pm$ 12.63	0.830	0.415
Body temperature (°C)	36.85 $\pm$ 0.27	36.45 $\pm$ 0.18	-1.402	0.672

† Fisher's exact test.

**Table 3:** Homogeneity test of study variables (N = 57)

<i>Variables</i>	<i>Intervention group</i> (n=28) Mean±SD	<i>Control group</i> (n=29) Mean±SD	<i>t</i>	<i>P</i>
Depression	22.32±9.34	19.82±12.40	0.855	0.396
Sleep state	29.28±10.87	35.06±11.01	-1.995	0.058
Sleep satisfaction	3.78±2.62	5.34±3.00	-2.082	0.156
Total fatigue	71.89±22.35	69.51±20.98	0.629	0.312
Physical fatigue	23.57±6.85	21.13±8.50	1.186	0.241
Mental fatigue	23.96±7.63	19.44±6.93	2.337	0.068
Neuro-sensory fatigue	21.89±7.41	19.65±7.51	1.131	0.263

### Effects of hot red bean bag

After the intervention, there were statistically significant differences in depression ( $t=-7.079$ ,  $P<0.001$ ), sleep state ( $t=8.037$ ,  $P<0.001$ ), sleep satisfaction ( $t=5.829$ ,  $P<0.001$ ), and total fatigue ( $t=-6.377$ ,  $P<0.001$ ) between the groups. Moreo-

ver, there were statistically significant differences in physical fatigue ( $t=-5.730$ ,  $P<0.001$ ), mental fatigue ( $t=-6.697$ ,  $P<0.001$ ), and neuro-sensory fatigue ( $t=-5.036$ ,  $P=0.001$ ) between the groups (Table 4).

**Table 4:** Effects of hot red bean bag (N = 57)

<i>Variables</i>	<i>Intervention group</i> (n=28) Mean±SD (Difference of post-pre)	<i>Control group</i> (n=29) Mean±SD	<i>t</i>	<i>P</i>
Depression	-16.28±7.61	0.62±10.18	-7.079	< 0.001*
Sleep state	15.21±6.76	-3.62±10.46	8.037	< 0.001*
Sleep satisfaction	2.57±1.77	-1.55±3.31	5.829	< 0.001*
Total fatigue	-23.78±17.49	10.51±22.68	-6.377	< 0.001*
Physical fatigue	-7.67±5.43	2.66±7.91	-5.730	< 0.001*
Mental fatigue	-9.25±6.61	3.58±7.78	-6.697	< 0.001*
Neuro-sensory fatigue	-8.25±6.21	1.79±8.60	-5.036	0.001*

\*  $P<0.05$ .

## Discussion

In this study, depression decreased, sleep pattern improved, and fatigue was reduced in the intervention group to which the hot red bean bag was applied, compared to the control group. This supports the study results of Sung et al. (21), reporting that applying warm thermotherapy to stroke patients is effective in stress reduction by relaxing the muscles and improving blood circulation (22-24). In the study of Son and Yoo (10), the application of thermotherapy to stroke patients who are complaining of cold sensation in the paralyzed area can maintain the thermal effect in the peripheral area, thereby promoting blood

circulation (25,26), reducing fatigue, as waste products and lactic acid accumulated in the body are discharged out of the body, and improving sleep patterns (7). In this study, by applying hot red bean bags to the legs, relaxation of peripheral blood vessels and muscles and circulation of blood and lymph are promoted, improving comfort, and reducing stress and fatigue, thereby reducing depression (6-8,24). Preventing depression, improving sleep patterns, and reducing fatigue in stroke patients are the most important nursing intervention factors that should not be overlooked. These bring comfort to stroke patients with permanent disabilities, as these can play a very important role in reducing the mortal-

ity rate among stroke patients (4,26,27). Based on the results of this study, stroke patients confined in hospitals can get positive relief from mental, psychological, and physical symptoms by applying hot bean bags. At the same time, stroke patients can continuously use hot bean bags in the community or at home as outpatients after discharge, and it will have a positive effect on reducing depression, improving sleep status and satisfaction, and relieving fatigue. The red bean bag used in this study is inexpensive, can be easily used anywhere, and has significance and value in terms of developing complementary and alternative therapies for rehabilitation nursing of stroke patients.

Hot red bean bags can be easily and inexpensive used in hospitals and at home after discharge to improve depression, sleep, and fatigue in stroke patients. This will improve life satisfaction or quality of life of stroke patients. The research results derived from this study provide useful literature information on the care of stroke patients. This can be used as evidence for health policy-related strategies. In the future, methods that can be systematically utilized should be sought by identifying the duration of more diverse and effective nursing interventions for stroke patients and the degree of their effectiveness. Besides, experimental studies are deemed necessary to verify the effect through additional health-related research variables for stroke patients in South Korea, as well as continuous nursing intervention program development studies.

The strengths of this study imply that the hot red bean bag can be used as a complementary and alternative therapy to improve sleep, as well as reduce depression and fatigue, of stroke patients at clinical practice. The results from this study may be beneficial in developing health strategies and intervention on complementary and alternative therapies.

### ***Study limitations***

The limitation of this study was that it was conducted on stroke patients only in South Korea. When a study is conducted on stroke patients living in other regions, different results may be

obtained from this study due to various influencing factors, such as demographic characteristics of the study participants and the environment, geography, culture surrounding the study participants. Therefore, it is necessary to be cautious when generalizing the results of the study. Moreover, it is necessary to conduct replication studies by increasing the number of subjects in the future. Moreover, the type and degree of rehabilitation treatment of study participants could not be completely controlled. Other thermotherapies might be applied to study participants, and they could not be completely controlled.

## **Conclusion**

The hot red bean bag has a positive effect on depression, sleep, and fatigue among stroke patients. The hot red bean bag used in this study can be utilized as a rehabilitation nursing intervention and as complementary and alternative therapy for stroke patients. This study is significant because the effects of hot red bean bags on depression, sleep, and fatigue among stroke patients were identified, and fundamental data were provided to develop rehabilitation nursing intervention programs that improve the physical and emotional well-being of stroke patients living in the community. It will ultimately contribute to the improvement of the quality of health care and nursing practice for stroke patients.

## **Journalism Ethics considerations**

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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## Conflict of interest

The authors declare that there is no conflict of interests.

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