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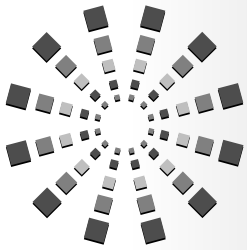

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AQ1

The Effects of Warm-Water Footbath on Relieving Fatigue and Insomnia of the Gynecologic Cancer Patients on Chemotherapy

KEY WORDS
Chemotherapy
Fatigue
Gynecological cancer patients
Insomnia
Warm-water footbath

Background: Most patients experience fatigue during chemotherapy. Ignoring this fatigue can contribute to worsening overall health of patients and a slowed recovery process. **Objective:** We investigated the effectiveness of a warm-water footbath on relieving fatigue and insomnia problems in patients undergoing chemotherapy. **Interventions/Methods:** This was a 2-group, longitudinal study design. Adults diagnosed with gynecologic cancer and receiving a 4-series platinum chemotherapy regimen were recruited and then followed up for 6 months. They completed fatigue and insomnia items on the 1st, 2nd, 4th, 7th, and 14th days after each scheduled chemotherapy. Participants in the experimental group soaked their feet in 41°C to 42°C warm water for 20 minutes every evening, starting from the eve of receiving the first chemotherapy, whereas participants in the comparison group did not do so. **Results:** There were 25 and 18 participants in the comparison and experimental groups, respectively, who completed the study. Participants in the experimental group reported a significant reduction in fatigue and improvement in sleep quality from the second session of chemotherapy and continued to improve during the study period. **Conclusions:** A warm-water footbath intervention resulted in reduced fatigue and insomnia symptoms for gynecologic cancer patients during chemotherapy. **Implications for Practice:** A warm-water footbath is local moist heat application. It is noninvasive and easy to apply at home. The findings provide empirical support that a warm-water footbath

AQ2

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Accepted for publication February 2, 2010.

relieves fatigue and insomnia problems of patients undergoing chemotherapy. It can be a nonpharmaceutical method to help patients overcome fatigue and sleep problems during chemotherapy.

Malignancy has been the leading cause of death in Taiwan since 1982.[1] Soon after a diagnosis, patients face various interventions, including 4 to 6 months of chemotherapy, and may experience many physiological and psychological discomforts that interfere with living and can result in depression and a poor quality of life.[2] Prue et al[2] pointed out that 65% to 95% of patients experience fatigue during chemotherapy. Such fatigue is mostly encountered in the late afternoon[3] and was perceived as reasonable during chemotherapy by patients.[2] It was also ignored or left untreated by 80% of healthcare professionals.[4] Lack of attention to treatment can allow the fatigue to worsen in intensity and prolong patients' recovery process.[5]

There are several hypotheses regarding the development of fatigue in cancer patient undergoing chemotherapy. Most frequently mentioned factors include metabolites from cancer cell degradation, increased metabolism, and insomnia. Recent studies report the complex interaction between sleep and fatigue.[6] In a study of the symptom cluster of pain, sleep disturbance, and fatigue in a sample of 84 patients with cancer-related pain, Beck and colleagues[7] found that sleep disturbance was significantly associated with fatigue ($r = 0.474$, $P < .001$), and 20% of the variance in fatigue was explained by pain, with 35% of such variance mediated by sleep disturbance. The authors pointed out the importance of effective intervention of disturbed sleep disturbance for optimal management of pain and fatigue. Palesh and associates[8] conducted a prospective study of sleep difficulties in 823 patients with cancer receiving chemotherapy and found that patients showing persistence of insomnia during the first 2 cycles of chemotherapy and those with insomnia complaints had significantly more fatigue than good sleepers. In a study of 86 breast cancer survivors with insomnia, Dirksen and colleagues[9] noted significant differences in insomnia severity among 3 groups of women: the exhausted, tired, and restored-fatigue groups.

There are various interventions for fatigue reported in the literature, but there is almost no information on fatigue of gynecologic cancer patients.[2] Because pharmaceutical interventions may bring adverse effect to cancer patients, nonpharmaceutical methods are encouraged. A warm-water footbath was reported by Uebaba and Xu[10] to be a fatigue-relieving intervention as documented by electrocardiogram, hearing rate variability, and subjective reports. The purpose of this study was to evaluate the effect of a warm-water footbath on relieving the fatigue of gynecologic cancer patients undergoing chemotherapy.

A footbath means to soak the feet in warm water. Miyazato[11] reported that a 41°C warm-water footbath effectively improved the circulation and relieved pain in women in labor during the first stage of delivery. Liao et al[12] reported that a footbath with water at 41°C was better than at 40°C in elevating the body temperature, dilating peripheral vessels, and promoting sleep. It was also reported that an elevation in the peripheral temperature higher than the core temperature was effective in helping subjects go to sleep.[13,14] Hu and Chen[15] once applied meridian and collateral theory of traditional Chinese medicine to explain the effect of warm-water soaking on sleep. They pointed out that there are more than 60 acupoints on the foot. A warm-water footbath has a similar effect of moxibustion therapy, which promotes circulation and removes metabolites resulting in relief of fatigue. Lee[16] gave rats a 15-minute, 42°C water bath for 7 days and reported that a habitual warm-water bath decreased the generation of tumor necrosis factor α, interleukin 6, and interleukin 10 after hemorrhagic shock and limited injury to the intestinal mucosa. Such biomarker evidence may also help explain the effect of a warm-water bath in improving fatigue during chemotherapy.

Because insomnia is also reported in cancer patients and is related to fatigue, an improvement in sleep may help reduce fatigue. The current study was proposed to evaluate both effects of promoting sleep and relieving fatigue of a warm-water footbath for female gynecologic cancer patients undergoing chemotherapy.

■ Methods and Materials

Research Design

This was a pre-post, 2-group prospective cohort study. Participants were followed up during their 4-series chemotherapy over 6 months. Participants in the comparison group who did not receive warm-water footbaths were enrolled first. Experimental group participants were enrolled after the comparison group participants had been enrolled. This was done to prevent the comparison group participants from observing the intervention that participants received.

Sampling and Sample Size

Participants were recruited from a gynecologic ward of a medical center in northern Taiwan. The inclusion criteria were (1) aged 20 to 70 years and with a first diagnosis of cervical cancer, ovarian cancer, endometrial sarcoma, or other gynecologic malignancy; (2) receiving platinum chemotherapy in a 4-series chemotherapy regimen; (3) conscious and able to communicate in Mandarin or Taiwanese; and (5) able to remain in a sitting position to soak the feet in warm water for 20 minutes. The exclusion criteria were (1) a history of diabetes mellitus and neuropathy; (2) skin breaks or a fracture of the foot; (3) receiving Lipo-Dox as chemotherapy; (4) receiving medication that might intensify the adverse effects of peripheral neuropathy

of platinum chemotherapy, such as vincristine or vinblastine medication; (5) having been diagnosed with stage IV cancer; and (6) having been assessed as having a severe case of nausea and vomiting by a score on the Rhodes Index of Nausea and Vomiting[17] within 48 hours of chemotherapy.

The statistical power and effect size in this study were determined using G power software (Grant Devilly, Australia) and PASS (Kaysville, Utah). We set the Cronbach α as .05, the effect size (F) as 0.6, and the power as 0.7 for our repeated level of 4 statistical procedures. A consistent result of a sample size of 18 for both groups was obtained. Considering an attrition rate of 10% in repeated-measures research, we decided on an expected sample size of 21 for both groups.

The Intervention

The footbath device (Tokuyo, Taipei, Taiwan) is 40 × 27 × 45 cm and provides 41°C to 42°C water to soak the feet to a depth of 10 cm above the ankle. Subjects soaked their feet between 8:00 and 9:00 PM for 20 minutes and went to bed within 1 hour after completing foot soaking. On the first day of foot soaking, assistance and guidance were provided by the investigator. Subjects agreed to implement foot soaking at home by themselves on the following days. Their compliance was monitored by daily telephone calls by the investigator. The footbath device was a gift to the participants at the completion of the study for their participation.

Measurements

The fatigue levels were evaluated by the Brief Fatigue Inventory–Taiwan Form (BFI–Taiwan Form). It was developed by the Anderson Center of Cancer Research and is an easy-to-administer and reliable assessment tool.[18] This form includes 9 items inquiring about the levels of fatigue in the past 24 hours (3 items) and its interference with daily life (6 items). A higher score indicates more severe fatigue. This form was translated into Chinese by Chang,[19] and permission from that group was obtained to use this version in this study. It took 1 to 2 minutes to complete this form and Cronbach α was .95 for the fatigue level items and was .96 for interference items in the current study.

Sleep quality was evaluated by the Verran and Snyder-Halpern (VSH) sleep scale, developed by Snyder-Halpern and Verran.[20] The scale has 15 items regarding self-perception of nondisturbed sleep the previous night, effective sleep, and compensatory sleep during the day. Higher scores for nondisturbed sleep and effective sleep indicate better sleep, and a higher score for compensatory sleep indicates poorer night sleep. The total score is the sum of the 3, and a higher score indicates better sleep quality. It uses a 10-cm horizontal visual analog scale to obtain a 0- to 100-point score as the response to each item. The scale was translated into Chinese by Lin and Tsai,[21] and we were granted permission by them to use it in this study. It took 2 to 3 minutes to finish this form, and Cronbach α was .91 in this study.

Data Collection

After approval was received from the ethical review board of the study hospital, subjects were recruited and enrolled from a gynecologic ward between 2006 and 2008. After signing informed consent, participants in the experimental group began their foot-soaking protocol. Before a footbath, a participant rested quietly for 5 minutes. After vital signs were taken, participants put their feet into the footbath device, which contained water at 41°C to 42°C to cover the feet up to 10 cm above the ankle. The soaking time was 20 minutes as measured by a timer. Participants were observed for any sweating, skin color change, and consciousness change. Vital signs were again taken at the end of the footbath and 20 minutes later. Then, the participant was helped to bed for sleep. This process was done to ensure the safety of the participant using the footbath and to help prepare the participant to use the footbath at home.

Demographic information was collected upon enrollment. Every participant in both groups filled out the BFI–Taiwan Form and the VSH sleep scale on the 1st, 2nd, 4th, 7th, and 14th days after receiving chemotherapy. A note of the date was put on each scale, and a call was made to remind subjects to fill out the BFI–Taiwan Form in the morning and the VSH sleep scale between 5:00 and 7:00 PM. The completed forms were sent to the investigator by mail.

Data Processing

Data were processed by SPSS 13.0 for Windows (SPSS Inc, Chicago, Illinois). The major statistical procedures applied were frequencies and percentages, χ^2 test, independent-samples t test, and repeated-measures analysis of variance (ANOVA). A $P < .05$ was taken as significant for all statistical procedures.

■ Results

Background Information of Subjects

In total, 50 women enrolled in the study. There were 26 in the comparison group initially, and 1 woman withdrew in the fourth month because of physical discomfort. There were initially 24 women in the experimental group, 3 of whom refused to continue at the time of the first session, 2 more who refused at the time of the second session because of inconvenience performing the footbath at home, and 1 woman withdrew at the time of the fourth session because of deteriorating illness. All the remaining 18 participants reported conducting daily foot soaking, and such compliance was confirmed by daily telephone checks by the investigator. Participants' demographic data are listed in Table 1.

Fatigue Levels During Chemotherapy Sessions

Fatigue levels are listed in Table 2. There was no significant difference in fatigue levels at the time of the first session between

Table 1 • Background Information of the Subjects[a]

	Control Group (n = 26)	Experimental Group (n = 24)	*P*
Age, mean (SD), y	50.6 (11.5)	47.1 (11.2)	.29
20–40	4 (19.1)	5 (21.0)	
41–60	19 (72.8)	17 (70.9)	
≥61	3 (8.1)	2 (8.1)	
Education			.37
≤ Junior high	12 (46.2)	8 (33.3)	
≥ Senior high	14 (53.8)	16 (66.7)	
Employed			.51
No	25 (96.2)	22 (91.7)	
Yes	1 (3.8)	2 (8.3)	
Status			.04[b]
Single	4 (15.4)	10 (41.7)	
Married	22 (84.6)	14 (58.3)	
Caregiver			.75
Couple	9 (34.6)	9 (37.5)	
Children	8 (30.8)	4 (16.7)	
Others	9 (34.6)	11 (45.8)	
Religion			.22
No	3 (11.5)	6 (25.0)	
Yes	23 (88.5)	18 (75.0)	
Soak bath habit			.61
No	24v	23 (95.8)	
Yes	2 (7.7)	1 (4.2)	
Sleeping pills			.82
No	21 (80.8)	20 (83.3)	
Yes	5 (19.2)	4 (16.7)	
Cancer			.97
Cervix	3 (11.5)	3 (12.5)	
Ovary	18 (69.2)	16 (66.7)	
Others	5 (19.2)	5 (20.8)	
Stage			.77
I	10 (38.5)	9 (37.5)	
II	4 (15.4)	6 (25.0)	
III	12 (46.1)	9 (37.5)	
Hgb, mean (SD)	11.5 (0.3)	11.3 (1.4)	.62
Chemotherapy day			.62
1	19 (73.1)	19 (79.2)	
≥2	7 (26.9)	5 (20.8)	

[a]Values are presented as n (%), unless specified otherwise.
[b]$P > .05$.

the 2 groups (41.7 [SD, 1.9] vs 41.0 [SD, 1.8]; $P > .05$). The difference became significant at the time of the second session (44.1 [SD, 2.0] vs 33.7 [SD, 1.9]; 48.6 [SD, 2.1] vs 32.0 [SD, 2.3]; and 46.7 [SD, 2.1] vs 25.8 [SD, 1.8]; all $P < .001$).

Without a footbath (comparison group), the lowest fatigue level was in the first session, and fatigue increased as chemotherapy proceeded. The highest fatigue level was in the third session and then decreased in the fourth session. The difference among the 4 sessions was significant as evaluated by repeated-measures ANOVA ($P < .05$). In each session, the worst fatigue level appeared on the second day. Differences among the 5 measures were also significant as evaluated by repeated-measures ANOVA ($P < .05$).

With a footbath (experimental group), the lowest fatigue level was in the first session, and then fatigue decreased as chemotherapy proceeded. The difference was significant as evaluated by repeated-measures ANOVA ($P < .05$). In the same chemotherapy session, the greatest fatigue occurred in the first 2 days and significantly subsided thereafter ($P < .05$).

Fatigue levels of the 2 groups at each time point were examined by *t* test. Except in the first session, the fatigue level of the experimental group was significantly lower than that in the comparison group ($P < .001$).

Sleep Quality During Chemotherapy

The sleep characteristics of participants in both groups are listed in Table 3. Of the 4 sessions, the comparison group had lower sleep scores than the experimental group. The lowest score was in the second session in the comparison group and in the first

Table 2 • Fatigue Levels During Chemotherapy[a]

	Control Group	Experimental Group	*t*/*P*[b]
First session	n = 26	n = 21	
Mean	41.7 (1.9)	41.0 (1.8)	0.27/.79
First day	47.8 (4.9)	53.3 (3.6)	−0.91/.37
Second day	48.7 (4.5)	48.4 (3.0)	0.05/.96
Fourth day	46.3 (5.0)	37.7 (3.8)	1.36/.18
Seventh day	34.4 (4.3)	30.1 (3.9)	0.57/.57
14th Day	33.4 (4.3)	32.0 (4.0)	0.24/.81
F/*P*[c]	9.6/<.001[d]	4.9/.008[d]	
Second session	n = 25	n = 19	
Mean	44.1 (2.0)	33.7 (1.9)	3.60/<.001[d]
First day	50.7 (3.9)	40.1 (3.9)	1.53/.13
Second day	52.0 (4.4)	43.6 (4.3)	1.33/.19
Fourth day	47.1 (4.9)	32.9 (3.9)	2.16/.04[d]
Seventh day	37.5 (4.1)	26.5 (3.6)	1.94/.06
14th Day	32.7 (4.6)	23.4 (4.1)	1.5/.13
F/*P*[c]	3.8/.02[d]	7.3/.002[d]	
Third session	n = 25	n = 19	
Mean	48.6 (2.1)	32.0 (2.3)	5.34/<.001[d]
First day	52.8 (4.2)	38.0 (5.1)	2.25/.03[d]
Second day	60.0 (3.9)	42.6 (5.2)	2.74/.009[d]
Fourth day	52.9 (4.5)	32.0 (4.9)	3.15/.003[d]
Seventh day	43.0 (4.8)	24.9 (4.4)	2.70/.01[d]
14th Day	34.4 (4.4)	22.7 (4.7)	1.79/.08[d]
F/*P*[c]	8.9/<.001[d]	5.9/.005[d]	
Fourth session	n = 24	n = 18	
Mean	46.7 (2.1)	25.8 (1.8)	7.78/<.001
First day	51.4 (4.7)	33.4 (3.9)	2.80/.008
Second day	54.0 (4.3)	33.7 (4.0)	3.80/.002
Fourth day	47.2 (4.6)	24.6 (3.9)	3.74/.001
Seventh day	41.7 (4.4)	21.1 (3.8)	3.41/.002[d]
14th Day	39.2 (4.7)	16.3 (2.7)	3.84/<.001[d]
F/*P*[c]	5.1/.005[d]	6.4/.004[d]	

[a]Values are presented as mean (SD). A higher score indicates more s evere fatigue.
[b]Independent *t* test.
[c]Repeated-measures ANOVA.
[d]$P < .05$.

Table 3 • Sleep Quality at Each Chemotherapy Session[a]

	Control Group	Experimental Group	*P*
First session	n = 26	n = 21	
Total score	743.0 (26.4)	805.5 (29.3)	.11
Nondisturbed sleep	405.2 (17.4)	460.6 (20.8)	.04[b]
Effective sleep	223.7 (9.7)	247.4 (9.8)	.09
Compensatory sleep	114.0 (7.3)	97.5 (7.2)	.11
Second session	n = 25	n = 19	
Total score sleep	750.2 (26.7)	894.6 (26.4)	<.001[b]
Nondisturbed	419.7 (17.6)	512.0 (18.9)	<.001[b]
Effective sleep	216.0 (9.4)	276.5 (7.9)	<.001[b]
Compensatory sleep	114.5 (7.2)	106.1 (8.5)	.45
Third session	n = 25	n = 19	
Total score	753.8 (25.5)	894.5 (26.2)	<.001[b]
Nondisturbed sleep	428.7 (15.8)	523.4 (18.4)	<.001[b]
Effective sleep	218.5 (9.4)	273.1 (9.1)	<.001[b]
Compensatory sleep	106.6 (7.9)	98.0 (7.8)	.45
Fourth session	n = 24	n = 18	
Total score	763.2 (25.6)	944.9 (21.7)	<.001[b]
Nondisturbed sleep	433.2 (17.7)	557.9 (15.7)	<.001[b]
Effective sleep	216.0 (9.8)	290.3 (0.9)	<.001[b]
Compensatory sleep	114.2 (8.1)	96.8 (7.6)	.12

[a]Values are presented as mean (SD). The higher scores of nondisturbed sleep and effective sleep indicate better sleep, and a higher score of compensatory sleep indicates poorer night sleep. Total score was the sum of the 3 and the higher score indicates better sleep quality.
[b]$P < .05$.

session in the experimental group. Although both groups had increased sleep scores as chemotherapy proceeded, the increment was wider in the experimental group. Differences in sleep scores between the 2 groups were significant ($P < .05$) beginning from the second session.

Of the 4 sessions, women in the experimental group had significantly better "nondisturbed sleep" and "effective sleep" scores than did women in the comparison group ($P < .001$). Women in the comparison group seemed to have higher "supplemental sleep" scores; however, the difference was not significant between the 2 groups ($P > .05$).

The sleep scores of the 5 measurement days in each session are listed in Table 4. Without a footbath (comparison group), the poorest sleep was on the second day, and the poor sleep did not improve much as chemotherapy proceeded. In the same session, sleep quality showed significant improvements in the first and second sessions, but showed no significant improvement in the third and fourth sessions ($P > .05$), as examined by repeated-measures ANOVA.

With a footbath (experimental group), the poorest sleep was also on the second day, but sleep improved as the chemotherapy proceeded. In the same session, the sleep quality had a significant improvement in the 4 sessions, as examined by repeated-measures ANOVA.

Comparing the sleep scores at each measurement time point, the experimental group had higher sleep scores than the comparison group, and the differences were significant ($P < .05$), except in the first session.

Table 4 • Sleep Quality During Chemotherapy[a]

	Control Group	Experimental Group	
	Mean (SD)	Mean ± SEM	*t*/*P*[a]
First session	n = 26	n = 21	
Mean	743.0 (26.4)	805.5 ± 29.3	−1.59/.11
First day	653.6 (61.7)	669.8 ± 73.5	−0.17/.87
Second day	760.2 (63.1)	748.7 ± 67.4	0.12/.90
Fourth day	679.1 (59.2)	801.6 ± 68.9	−1.37/.02
Seventh day	807.9 (47.3)	899.4 ± 52.0	−1.30/.20
14th Day	813.9 (60.0)	907.9 ± 55.8	−1.12/.27
F/*P*[b]	3.0/.02[b]	3.7/.002[b]	
Second session	n = 25	n = 19	
Mean	750.2 (26.7)	894.6 ± 26.4	−3.77/<.001[b]
First day	738.3 (65.6)	813.5 ± 67.1	−0.79/.44
Second day	597.4 (57.5)	784.5 ± 66.7	−2.13/.04[b]
Fourth day	747.6 (60.7)	936.8 ± 47.8	−2.45/.02[b]
Seventh day	817.9 (54.8)	962.2 ± 54.2	−1.83/.07
14th Day	849.7 (50.4)	976.1 ± 48.0	−1.77/.08
F/*P*[b]	3.9/.006[b]	5.1/.008[b]	
Third session	n = 25	n = 19	
Mean	753.8 (25.5)	894.5 ± 26.2	−3.80/<.001[b]
First day	751.6 (64.9)	802.2 ± 73.5	−0.52/.61
Second day	648.0 (61.1)	772.4 ± 67.7	−1.36/.18
Fourth day	744.2 (49.3)	878.0 ± 48.3	−1.90/.07
Seventh day	808.3 (58.2)	989.5 ± 37.9	−2.43/.02[b]
14th Day	817.0 (48.0)	1,030.4 ± 35.7	−3.57/.001[b]
F/*P*[b]	1.9/.14	4.7/.012[b]	
Fourth session	n = 24	n = 18	
Mean	763.2 (25.6)	944.9 ± 21.7	−5.20/<.001[b]
First day	771.8 (49.8)	896.6 ± 57.0	−1.65/.11
Second day	702.9 (64.2)	883.67 ± 57.5	−2.02/.05[b]
Fourth day	734.8 (61.7)	958.0 ± 46.5	−2.72/.01[b]
Seventh day	761.8 (56.3)	938.5 ± 45.9	−2.31/.03[b]
14th Day	848.1 (52.3)	1,048.0 ± 23.5	−3.43/.002[b]
F/*P*[b]	1.0/.43	3.6/.01[b]	

[a]Total scores were included in the table. The higher score indicates better sleep quality.
[b]$P < .05$.

Changes in Vital Signs Before and After Foot Soaking

Vital signs of women receiving a footbath on the eve of the first chemotherapy session were monitored, and data are listed in Table 5. Changes in body temperature, heart rate, and blood

Table 5 • Vital Signs Before and After Footbath[a] (n = 24)

	Before	1 min After	20 min After	*P*
Temperature	36.4 (0.4)	36.7 (0.4)	36.3 (0.4)	<.001[b]
Heart rate	80.9 (14.0)	81.6 (13.4)	79.2 (13.7)	<.001[b]
Systolic BP	111.6 (15.1)	109.0 (13.7)		<.001[b]
Diastolic BP	70.9 (9.3)	68.6 (11.4)		<.001[b]

Abbreviation: BP, blood pressure.
[a]Values are presented as mean (SD).
[b]$P < .05$.

pressure readings were significant, but all were within normal limits.

■ Discussion

Changes in Fatigue During Chemotherapy

In our study, participants had increased fatigue up to moderate levels in the first week that gradually subsided to mild in each chemotherapy session. This was similar to the findings of Gong's[22] study on breast cancer subjects and those of the study of Chang et al[23] on ovarian cancer patients during chemotherapy. A decrease in fatigue levels was associated with a deceased serum concentration of medication.[24] Although fatigue levels in our study gradually decreased after the first week, women in our experimental group had significant improvement in fatigue levels beginning in the second chemotherapy session (Table 2). Our study findings demonstrate that a better improvement in fatigue could be achieved by performing a daily foot soaking before sleep.

Effects of Foot Soaking on Improving Sleep

In our study, participants in the comparison group had severe sleep problems during the 4 chemotherapy sessions (Tables 3 and 4). In contrast, warm-water foot soaking improved sleep, and the difference in sleep quality in the intervention group was significant ($P < .001$) from the second session. The positive effects of a warm-water footbath on sleep was reported by Sung and Tochihara[25] in their study of 9 young women with findings of shortened latency of sleep and improved sleep quality.

In our study, 5 patients in the comparison group and 4 in the experimental group had a habit of taking sleeping pills before chemotherapy. During chemotherapy, the total number of women taking sleeping pills was 11 in the comparison group. They described difficulty in getting to sleep and poor sleep efficiency (3–4 hours). Eight women in the experimental group took sleeping pills in the first week of the first session, with 2 women discontinuing them in the second week. They described how the warm-water footbath effectively helped them fall asleep, and taking sleeping pills became unnecessary.

Changes in Vital Signs During Warm-Water Foot Soaking

In our study, participants performing warm-water foot soaking had a significant increase in body temperature and decrease in blood pressure (Table 5). Such data indicate that 20 minutes of a 41°C to 42°C warm-water footbath had significant effects on metabolism and circulation. This finding is similar to that of the study of Liao et al[12] on the elderly. Liao et al[12] proposed that it was the increment in the peripheral temperature that had the effect of improving sleep. In our study, women reported that they experienced sweating after warm-water foot soaking. This phenomenon may support Heller's[13] proposal that sweating at room temperature has the effect of promoting sleep. Therefore, elevations in body temperature and sweating could be surrogate effective indicators that warm-water foot soaking promotes sleep and relieves fatigue.

Limitation of the Study

There are several limitations of this study. First, participant compliance was monitored by telephone follow-up by the investigator instead of by direct observation. The levels of compliance with elements of the intervention (water temperature, length of the footbath, and the timing of going to bed) are unknown. Second, there was no monitoring phone call to the participants in the comparison group; thus, the effect of the phone call cannot be excluded. Third, this study is the first investigation on the effect of warm-water foot soaking on promoting sleep and relieving fatigue in women with gynecologic cancer. More studies are needed to confirm our findings.

■ Conclusions

A warm-water footbath is a local moist heat application. It is noninvasive and easy to apply at home. Our study demonstrates its effectiveness in reducing fatigue and promoting sleep for gynecologic cancer patients undergoing chemotherapy. It can be a nonpharmaceutical method to help patients overcome fatigue and sleep problems during chemotherapy.

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