

Investigating The Impact of Footbath Therapy on Body Composition and Meridian Energy for Health Enhancement



Chih-Hung Lin^{1*} and Hsiao-Hui Chen²

¹Department of Pharmacy, Chia Nan University of Pharmacy & Science, Taiwan

²Public Health Bureau, Tainan City Government, Taiwan

Submission: December 21, 2023; **Published:** January 24, 2024

***Corresponding author:** Chih-Hung Lin, Department of Pharmacy, Chia Nan University of Pharmacy & Science, Tainan 71710, Taiwan

Abstract

This study delves into the potential benefits of footbath therapy, incorporating traditional practices alongside the meridian energy concepts derived from traditional Chinese medicine. Employing a mixed-methods approach, we explore the influence of footbaths on body composition and meridian energy systems. The study's design encompasses a six-week footbath intervention, with participants assigned to three groups: Warm Footbath (WFB, n=9), Hot Footbath (HFB, n=9), and Contrast Footbath (CFB, n=10). Assessment parameters include body composition, calf volume, flexibility, and meridian energy. While a modest reduction in calf volume is observed across all groups, the CFB group stands out with substantial improvements in flexibility, body water distribution, and segmental lean body water composition. Significantly, the CFB group exhibits noteworthy alterations in meridian energy, showcasing enhancements in the autonomic nervous, skeletal muscle, and respiratory systems. Our findings indicate that footbath therapy, particularly in the case of contrast footbaths, yields positive effects on body composition, meridian energy, and various physiological systems. This study contributes valuable insights to the understanding of footbaths as a potential method for home healthcare maintenance, particularly in the context of managing occupational stress.

Keywords: Footbath; Meridian energy; Body composition; Health promotion

Introduction

Chronic edema often manifests in the distal parts of limbs, affecting not only the foot and talocrural joint but also the calf, knee joint, and thigh. Patients with chronic edema may experience physical symptoms such as pain, discomfort, and heaviness, as well as associated conditions like cellulitis, insomnia, and immobility [1,2]. Chronic edemas of the lower limbs are incurable, debilitating, and progressive conditions that significantly impact an individual's physical, psychological, emotional, and social well-being [3,4]. The limbs, especially the lower limbs, are common sites for edema, leading to local complications like pain, changes in motion and joint contracture, limited range of motion, and limb atrophy [3]. Chronic lower limb edema poses a high risk, decreasing arterial, venous, and lymphatic flow, compromising oxygenation and nutrition to the skin and supporting tissues, and increasing the risk of ulceration [1].

Wounds and chronic edema are common disorders, with

controlled swelling associated with a 50% lower risk of wounds [5]. Patients with chronic edema often face reduced quality of life, with implications for physical, psychological, and social well-being [4]. Lower limb chronic edema has been associated with significant psychological, social, and physical implications for individuals' quality of life [3]. It is crucial to address these issues, as the symptoms can lead to functional impairments, lower self-esteem, depression, fear, and shame. Physical and psychological impairments can significantly impact social relationships [1,4].

Therapies employed to reduce edema are divided into two categories: pharmacological and non-pharmacological. Common non-pharmacological methods include limb elevation, massage, cryotherapy, and compression. Recent research by Kapusta & Irzmański (2022) highlighted the benefits of individually planned training supplemented with hydrotherapy as thermal therapy in reducing swelling of the lower limbs and increasing the range of foot movements [6].

While the majority of research studies on the impact of chronic edema on quality of life focus on the upper limb and lymphedema, there is limited literature on the lower limb and the broader concept of chronic edema. A condition-specific validated questionnaire distributed to a purposive sample in Ireland indicated that patients with lower limb chronic edema have significantly reduced psychological, social, and physical implications for their quality of life due to their chronic condition. Self-management has been suggested as a significant aspect of the management of chronic edemas [3].

Research has consistently demonstrated the historical effectiveness of hot water footbaths in addressing various health issues. Saeki's study (2007) provided evidence that hot water footbaths increased parasympathetic activity, decreased sympathetic activity, raised white blood cell count, and enhanced natural killer cell cytotoxicity, leading to an improvement in immune status [7]. In summary, hot water footbaths have contributed to health promotion by reducing stress through autonomic nervous system modulation, boosting immune function, and ultimately enhancing the overall quality of life.

Hydrotherapy has been used in medical fields, a recognized healthcare program widely used as Complementary and Alternative Medicine (CAM) in Asian regions, encompasses the special healthcare practice of foot reflexology [8]. This practice, known for stress reduction and pain relief, triggers endorphin release, reduces sympathetic activity, and boosts parasympathetic responses, contributing to enhanced well-being [8,9]. Fu et al. demonstrated the effectiveness of footbaths combined with acupoints massage in treating diabetic peripheral neuropathy, yielding positive outcomes across various parameters [10]. Additionally, Choi & Song's findings on footbaths for post-partum fatigue in South Korea suggest that footbaths are a good preventative strategy for post-partum women [11]. Furthermore, foot reflexology has been linked to improved sleep health [12] and significant reductions in sleep disturbances [13,14].

A prior study on Taiwanese workers in high-tech and banking industries emphasized occupational stress-related issues. Addressing these problems, simple healthcare practices were explored, considering space, equipment, maintenance costs, and professional guidance [15]. In a recent study focusing on physiological parameters and meridian energy in healthy young volunteers, findings aimed to establish a suitable footbath model for home use. Results suggested that a contrast water footbath can be recommended as a home healthcare maintenance method for managing occupational stress [16].

The other hands, to investigate the healthcare effects of hydrotherapy intervention, researchers, following traditional Chinese medicine (TCM), considered meridians as pathways for the flow of life-energy (chi), forming an interconnected network of acupoints [17]. Analyzing data from the LOHAS program at King's resort hotel in Taiwan [18]. Findings indicated increased

meridian energy in the hiking group, with a slight decrease in the hydrotherapy group. However, immediate post-hiking hydrotherapy restored meridian energy. Meridians and acupoints exhibit diverse biophysical characteristics, including electric, acoustic, thermal, optical, magnetic, isotopic, and myoelectric aspects [17]. Meridians display low resistance and high capacitance, indicating electrical properties [19,20]. Researchers suggest connections between meridians and connective tissue planes, highlighting the integrative role of interstitial connective tissue [17,21,22]. Nevertheless, the scientific evidence supporting the existence of meridians remains a debated subject among researchers.

TCM recognizes 12 standard meridians, classified as Principal Meridians, each linked to specific organs and functions. Colbert et al. investigated electrodermal activity (EDA) at acupuncture points, suggesting a correlation between decreased skin conductance and fatigue [23]. The skin electrical conductance test (ARDK), a modification of electrodermal screening, measured skin conductance in patients with Qi vacuity (QV), revealing lower values compared to healthy controls [16]. The study proposed ARDK as a safe and effective method for assessing QV [24].

In conclusion, our research has historically demonstrated the positive effects of hot water footbaths, hydrotherapy, and foot reflexology on various health issues. The integration of traditional Chinese medicine principles, such as meridians and acupoints, provides a holistic approach to understanding the physiological mechanisms underlying the health promotion and wellness effects of these interventions. Building on these findings, our study aims to further explore the potential physiological mechanisms underlying the health promotion and wellness effects of footbaths. As we move forward, research aims to delve deeper into the potential impact of footbaths on body composition and meridian energy effects, offering valuable insights for home healthcare maintenance, especially in managing occupational stress.

Materials and Methods

Subjects

This study, approved by the Institutional Review Board (IRB: 103075), recruited participants aged 20 to 25 from Chia Nan University of Pharmacy and Science. After completing a health assessment (Brief Symptom Rating Scale, BSRS-5) and a brief physical examination, volunteers who passed the screening provided consent. Thirty-three participants were initially enrolled and categorized into three groups based on decreasing body mass index (BMI) in sequential order, with each group comprising 11 participants. However, five participants were unable to complete the experiment. Consequently, the warm water footbath group (WFB, $n = 9$), hot water footbath group (HFB, $n = 9$), and contrast footbath group (CFB, $n = 10$) were included in the study. Throughout the study, participants' lifestyles were recorded, with no imposed restrictions [16].

Methods

The study was conducted as a single-blind trial, with participants undergoing a 15-minute footbath once a week for six consecutive weeks at a room temperature of 25 ± 2 °C. In accordance with previous research [16], water temperatures were set at 10 °C for cold water, 30 °C for warm water, and 40 °C for hot water. To assess psychological stress, skin electrical conductance was measured, while meridian energy was evaluated using the ARDK® on 24 specific acupoints in the wrists and ankles. These acupoints primarily represented the originating points of the 12 meridians, including the lung, large intestine, stomach, spleen, heart, small intestine, urinary bladder, kidney, pericardium, triple burner, gallbladder, and liver meridians [16,24]. Calf volume was measured using Archimedes' volume measurement bucket, and body composition was assessed with the InBody® 3.0 device. Blood pressure and flexibility were measured using appropriate devices.

Data were collected before and after the footbaths over the six-week period. The study compared the long-term effects of footbath intervention by assessing values before (W0) and after (W7). Net value change was utilized for statistical comparison to evaluate the weekly impact of footbaths. This process involved subtracting the value of each subsequent week from the initial week (W1) and then adding 1 to prevent the occurrence of a 0 value that could potentially hinder statistical calculations. The analysis utilized inferential statistics, such as ANOVA and paired t-tests, with a significance level set at $p < 0.05$.

Results

Evaluation of Body Composition

The objective of the current study was to explore the impact of footbath therapy on various aspects of body composition, including body water composition, calf volume, and flexibility. The study involved the assessment and comparison of three distinct footbath groups.

Table 1: Long-term footbath interventions mediated body composition changes between three groups.

Parameters		WFB (n=9)	HFB (n=9)	CFB (n=10)
Calf Volume	Before (w0)	24.40 \pm 0.919	24.70 \pm 0.750	24.68 \pm 0.978
	After (w7)	24.41 \pm 0.929	24.81 \pm 0.720*	24.62 \pm 1.009
Flexibility	Before (w0)	28.39 \pm 10.676	30.31 \pm 9.726	29.06 \pm 2.695
	After (w7)	29.89 \pm 11.752	32.53 \pm 9.253*	32.33 \pm 2.409*
Body Weight	Before (w0)	59.86 \pm 15.188	63.76 \pm 15.313	57.43 \pm 15.744
	After (w7)	59.82 \pm 15.156	63.74 \pm 15.325	57.39 \pm 15.715
Skeletal Muscle Mass	Before (w0)	40.69 \pm 9.549	43.53 \pm 8.390	39.23 \pm 10.150
	After (w7)	40.78 \pm 9.556	43.73 \pm 8.221	40.54 \pm 10.423*
Bone Mass	Before (w0)	2.45 \pm 0.435	2.58 \pm 0.381	2.39 \pm 0.465
	After (w7)	2.46 \pm 0.436	2.59 \pm 0.377	2.40 \pm 0.476
Body Fat mass	Before (w0)	16.71 \pm 9.045	17.66 \pm 8.295	15.79 \pm 6.759
	After (w7)	16.62 \pm 9.130	17.42 \pm 8.343	14.46 \pm 6.551*

Segmental Lean Analysis	Right Arm	Before (w0)	1.49 ± 0.546	1.64 ± 0.431	1.46 ± 0.517
		After (w7)	1.50 ± 0.552	1.65 ± 0.420	1.69 ± 0.537*
	Left Arm	Before (w0)	1.49 ± 0.583	1.62 ± 0.443	1.69 ± 0.537*
		After (w7)	1.50 ± 0.591	1.61 ± 0.431	1.71 ± 0.544*
	Trunk	Before (w0)	13.63 ± 3.309	14.53 ± 2.664	13.20 ± 3.256
		After (w7)	13.68 ± 3.340	14.50 ± 2.598	13.88 ± 3.345*
	Right Leg	Before (w0)	4.85 ± 1.274	5.11 ± 1.035	4.56 ± 1.400
		After (w7)	4.85 ± 1.284	5.52 ± 1.040*	4.54 ± 1.436
	Left Leg	Before (w0)	4.83 ± 1.272	5.12 ± 1.024	4.54 ± 1.389
		After (w7)	4.83 ± 1.278	5.63 ± 1.031*	4.53 ± 1.427
	Total Body Water	Before (w0)	29.82 ± 7.001	31.91 ± 6.152	28.76 ± 7.459
		After (w7)	29.84 ± 6.998	32.04 ± 6.041	29.98 ± 7.639*
Intracellular Water		Before (w0)	20.16 ± 4.746	21.53 ± 4.129	19.42 ± 5.015
		After (w7)	20.18 ± 4.768	21.59 ± 4.059	19.77 ± 5.274
Extracellular Water		Before (w0)	9.70 ± 2.279	10.36 ± 2.062	9.36 ± 2.445
		After (w7)	9.70 ± 2.262	10.46 ± 2.027	10.20 ± 2.353*

Note: WFB (warm water footbath), HFB (hot water footbath), CFB (contrast water footbath), w=weeks, n=participants, data presented M±SD, significant: p < 0.05, *=pair t-test.

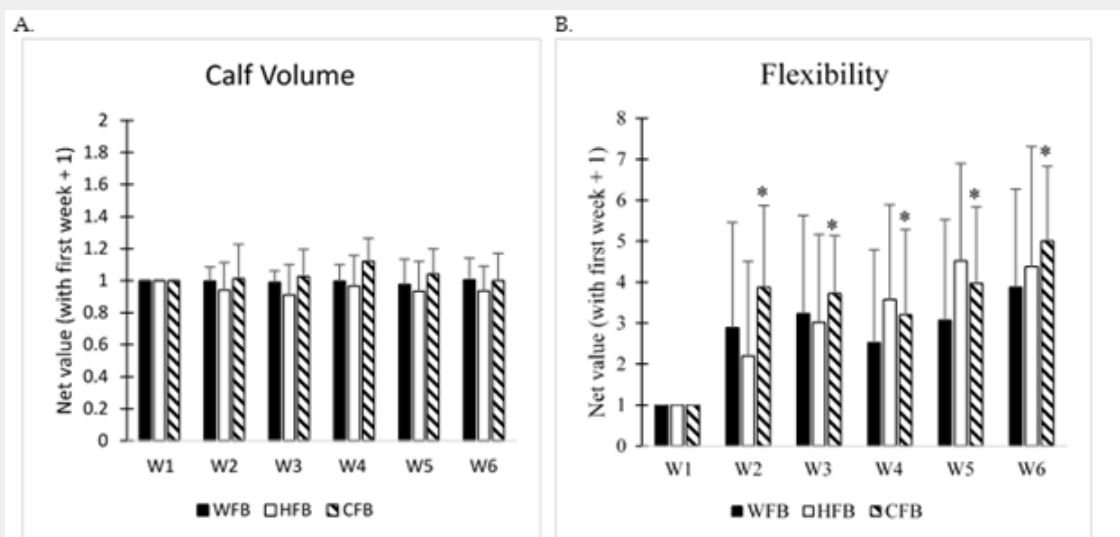


Figure 1: Comparison of footbath interventions on calf Volume and flexibility in three groups. This bar graph depicts the evaluation of calf volume (A) and flexibility (B) among the Warm Water Footbath (WFB), Hot Water Footbath (HFB), and Contrast Water Footbath (CFB) groups. The net values were obtained by subtracting the baseline value of W1 from the results of each week (W2-W6) and adding 1 to represent the net values for each week. The results are presented as M±SD. Pairwise t-tests were conducted to compare the differences between each week (W2-W6) and W1. Statistical significance is denoted by p < 0.05 (*). Notably, the findings reveal a significant correlation between changes in flexibility of the CFB group from W2-W6, while no significant effects were observed in the other groups. Furthermore, there were no significant changes in calf volume among the groups.

Figure 1 depicts the intervention-related changes in calf volume among the groups. While slight variations were observed in the weekly footbath changes across the three groups, no statistically significant differences were noted. However, upon conducting ANOVA analysis to compare values among the groups, it was revealed that the Contrast Footbath (CFB) group exhibited a modest reduction in calf volume from the first to the sixth week of the intervention. Post hoc tests indicated that the decrease in the CFB group was more significant than that in the Warm Footbath (WFB) and Hot Footbath (HFB) groups. In terms of long-term effects on calf volume change (refer to Table 1), only the HFB group demonstrated significant differences between the before (W0) and after (W7) periods. Furthermore, significant differences were identified in flexibility based on the long-term follow-up results of the CFB and HFB groups. Paired t-tests conducted between the W0 and W7 flexibility assessments revealed statistically significant increases in mean flexibility of 2.22 cm (HFB) and 3.27 cm (CFB) from before the intervention to the end of the experiment (Table 1). The impact on flexibility change in the CFB group was evident from the 2nd to the 6th weeks of the experiment, while the changes were minimal in the WFB and HFB groups (Figure 1). Nevertheless, ANOVA analysis, used to compare values among the three groups, did not reveal statistically significant differences in flexibility.

As indicated in Table 1, the experimental period did not result in significant changes in body weight and bone mass between the pre-(W0) and post(W7)-intervention phases. However, noteworthy differences were observed in Skeletal Muscle Mass and Body Fat Mass for the Contrast Footbath (CFB) group when comparing the values before and after the intervention, whereas the Warm Footbath (WFB) and Hot Footbath (HFB) groups exhibited no significant differences. Post-experiment data revealed a notable increase of 1.31 in Skeletal Muscle Mass and a corresponding decrease of 1.33 in Body Fat Mass in the CFB group. Footbath intervention also influenced body water distribution, with statistically significant changes observed in the CFB group. In contrast, the HFB group showed slight variations, and the WFB group exhibited no statistically significant differences. Specifically, the contrast footbath intervention resulted in a significant increase of 1.22 in total body water, notably affecting the volume with a significant increase of 0.84 in extracellular water. The change in intracellular water was minimal across all three groups. Furthermore, the increased extracellular water in the CFB group was particularly evident in the right arm, left arm, and trunk, but not in the right leg or left leg. Conversely, the HFB group experienced changes and increased water values specifically in the right leg and left leg.

As depicted in Figure 2, the data were prepared for the comparison of footbath interventions over six weeks regarding body water composition in the three groups. The findings notably demonstrate a significant correlation between changes in skeletal muscle mass and total body water in the CFB group from week 3 to week 5, with minimal effects on extracellular water observed

in the WFB group. However, ANOVA analysis for total body water, extracellular water, and intracellular water did not reveal statistically significant differences among the three groups.

In Figure 3, the data were prepared for the comparison of footbath interventions over six weeks on segmental lean body water composition in the three groups. The findings reveal a significant correlation between changes in segmental lean body water composition in the legs of the CFB group from week 3 to week 5, with some effects observed in the arms of the CFB group. ANOVA analysis aimed at comparing values among the groups showed significant differences in segmental lean water analysis. Post hoc tests indicated that the change in the CFB group was more pronounced than that in the WFB and HFB groups, especially in the right arm at week 4, left arm at week 2, right leg from week 2 to week 6, and left leg from week 2 to week 6.

Evaluation of meridian energy

Table 2 presents the results of meridian energy changes induced by footbaths in the three groups. It is important to note that long-term energy changes were assessed by comparing the energy levels before (w0) and after (w7) intervention. The paired t-test analysis revealed that the CFB group had significant improvements in the long-term energy of the autonomic nervous system, skeletal muscle system, and respiratory system. Similarly, the WFB group showed significant improvements in the long-term energy of the total energy, endocrine system, and systemic report. However, it should be noted that the HFB group did not exhibit any significant changes in the energy levels of any physiological system.

Discussion

The ancient practice of footbath therapy, deeply rooted in historical health traditions, has endured over time. Specifically, hot water footbath therapy has demonstrated effectiveness in enhancing overall health and well-being by alleviating symptoms such as pain, fatigue, and insomnia, improving circulation, and fostering an enhanced sense of wellness [25,26].

Previous findings have highlighted the positive impact of warm footbaths on systolic blood pressure during a 15-minute intervention Program [16]. In contrast, contrast footbaths showed the most significant impact on diastolic blood pressure during a 7-week continuous footbath, suggesting enduring benefits. This underscores footbath therapy as an effective method for managing occupational stress and promoting health self-management goals. Notably, contrast footbath emerges as a particularly recommended home health maintenance method [16]. Subsequent findings reveal a reduction in calf volume following contrast footbaths, while the warm footbath group displayed notable improvements in total energy and cardiovascular system energy levels. An intriguing discovery from this experiment unveils a continuous increase in flexibility within the CFB group, starting from the 2nd week and persisting until the 7th week. This increase in flexibility

did not correlate with any adjustment in calf volume; rather, it corresponded to an increase in muscle weight. Analyzing body water distribution, encompassing total body water, extracellular water, and upper limbs, a proportional increase was observed.

Table 2: Long-term footbath interventions mediated body composition changes between three groups.

Parameters		WFB (n = 9)	HFB (n = 9)	CFB (n = 10)
Total energy	Before (w0)	15.00 ± 14.697	21.78 ± 18.747	25.30 ± 21.618
	After (w7)	33.44 ± 19.456*	34.33 ± 20.512	38.50 ± 25.439
Mental state	Before (w0)	11.44 ± 16.127	23.22 ± 21.776	2.90 ± 6.332
	After (w7)	21.44 ± 20.616	13.33 ± 14.414	14.10 ± 19.644
Autonomic nervous system	Before (w0)	37.33 ± 7.228	44.78 ± 21.851	33.30 ± 7.103
	After (w7)	45.11 ± 13.606	36.67 ± 8.775	47.60 ± 23.109*
Thyroid function	Before (w0)	40.22 ± 30.854	37.33 ± 37.533	42.40 ± 33.774
	After (w7)	40.22 ± 32.372	30.22 ± 30.536	57.80 ± 27.912
Skeletal muscle system	Before (w0)	57.22 ± 13.433	57.11 ± 13.486	48.10 ± 21.121
	After (w7)	64.22 ± 20.951	55.44 ± 10.537	59.10 ± 15.322*
Liver function	Before (w0)	56.67 ± 19.092	55.67 ± 22.433	50.00 ± 16.405
	After (w7)	59.22 ± 18.640	57.67 ± 14.612	53.30 ± 20.672
Digestive system	Before (w0)	61.00 ± 19.755	58.11 ± 15.112	53.00 ± 16.533
	After (w7)	66.22 ± 15.998	61.67 ± 11.726	60.50 ± 18.609
Respiratory system	Before (w0)	65.44 ± 15.709	68.33 ± 15.692	59.30 ± 18.839
	After (w7)	70.00 ± 18.520	59.33 ± 20.845	69.90 ± 17.227*
Endocrine system	Before (w0)	59.22 ± 26.748	59.33 ± 20.845	58.80 ± 26.682
	After (w7)	87.11 ± 19.075*	81.44 ± 14.587	70.30 ± 28.837
Immune system	Before (w0)	47.78 ± 31.256	61.00 ± 20.316	47.80 ± 26.046
	After (w7)	71.22 ± 16.998	61.00 ± 22.288	60.10 ± 23.867
Cardiovascular system	Before (w0)	70.22 ± 18.192	65.22 ± 16.123	63.70 ± 18.768
	After (w7)	73.89 ± 16.915	59.44 ± 16.210	66.50 ± 19.260
Reproductive system	Before (w0)	64.00 ± 20.488	66.11 ± 17.324	56.80 ± 19.809
	After (w7)	69.44 ± 19.184	64.56 ± 7.108	50.00 ± 33.980
Kidney function	Before (w0)	65.44 ± 26.149	60.67 ± 27.663	59.40 ± 22.955
	After (w7)	65.44 ± 26.149	62.11 ± 16.443	60.90 ± 25.115
Urologic function	Before (w0)	61.22 ± 16.851	62.44 ± 16.433	55.30 ± 16.760
	After (w7)	60.89 ± 18.711	62.89 ± 15.260	59.40 ± 22.692
Metabolic function	Before (w0)	17.00 ± 10.075	17.11 ± 7.801	13.80 ± 8.979
	After (w7)	21.22 ± 13.535	14.89 ± 8.880	16.90 ± 8.863
Systemic report	Before (w0)	48.67 ± 12.845	50.78 ± 14.856	44.50 ± 13.385
	After (w7)	57.33 ± 10.283*	50.33 ± 8.426	52.30 ± 16.667

Note: WFB (warm water footbath), HFB (hot water footbath), CFB (contrast water footbath), w=weeks, n=participants, data presented M±SD, significant: p < 0.05,*=pair t-test.

Despite the general belief that lower limb edema is detrimental to physical health [2,3], our study reveals that, despite an increase in extracellular water content, the CFB group experienced a statistically significant increase in lower limb water content from

the 3rd week onwards, with a less pronounced effect on the upper limbs and body water. However, by the 7th week, the lower limb water content had returned to its original level, while the water content in the upper limbs and body increased.

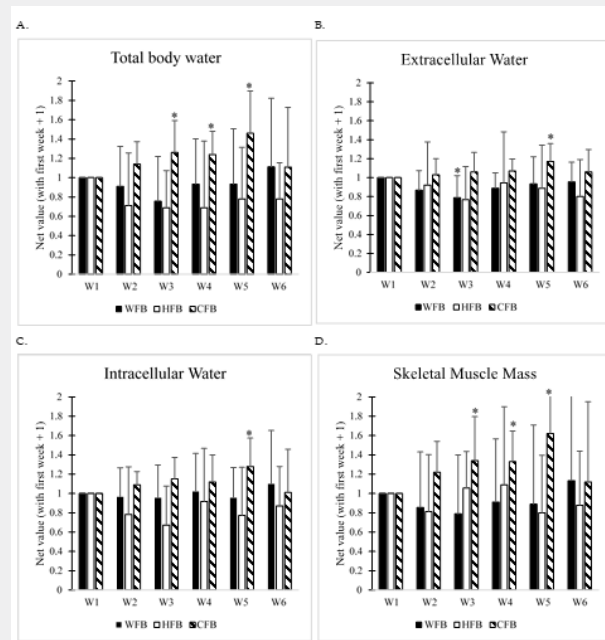


Figure 2: Comparison of footbath interventions on body water composition in three groups. This bar figure depicts the assessment of total body water (A), including extracellular water (B) and intracellular water (C), among the Warm Water Footbath (WFB), Hot Water Footbath (HFB), and Contrast Water Footbath (CFB) groups. The net values were obtained by subtracting the baseline value of W1 from the results of each week (W2-W6) and adding 1 to represent the net values for each week. The results are presented as $M \pm SD$. Pairing t-tests were conducted to compare the differences between each week (W2-W6) and W1. Statistical significance is denoted by $p < 0.05$ (*). Notably, the findings reveal a significant correlation between changes in skeletal muscle mass (D) and total body water (A) in the CFB group from W3-W5, with minimal effect of extracellular water observed in the WFB group.

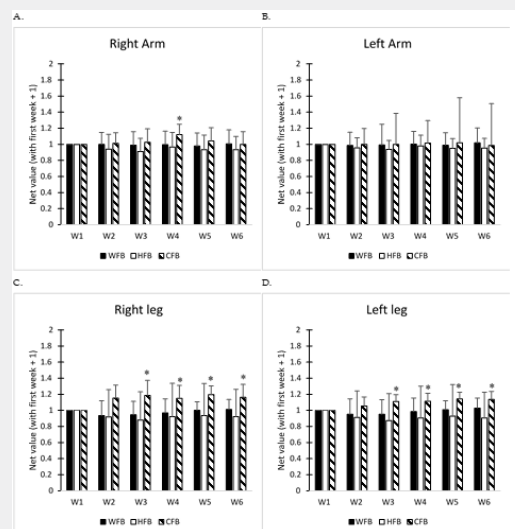


Figure 3: Comparison of footbath interventions on segmental lean body composition in three groups. This bar figure illustrates the evaluation of segmental lean body composition in the right arm (A), left arm (B), right leg (C), and left leg (D) among the Warm Water Footbath (WFB), Hot Water Footbath (HFB), and Contrast Water Footbath (CFB) groups. The net values were obtained by subtracting the baseline value of W1 from the results of each week (W2-W6) and adding 1 to represent the net values for each week. The results are presented as $M \pm SD$. Pairwise t-tests were conducted to compare the differences between each week (W2-W6) and W1. Statistical significance is denoted by $p < 0.05$ (*). Notably, the findings reveal a significant correlation between changes in lean body composition in the legs of the CFB group from W3-W6, with some effects observed in the arms of the CFB group, but no significant effects were observed in the other groups.

Contrastingly, the HFB group experienced an increase in calf volume after the experiment (W7), corresponding to an increase in lower limb water content in W7. Contrast water therapy induces significant fluctuations in lower-leg blood flow [27], and warm water immersion acutely improves arterial stiffness and coronary perfusion [28]. The speculation arises that hot water footbaths may cause blood vessels in the lower limbs to relax and expand, potentially contributing to lower limb edema. In contrast, CFB is generally believed to have a stress-inducing effect on the cardiovascular system [27]. Previous study findings indicated that contrast footbaths can reduce diastolic blood pressure[16]. This study suggests that contrast footbaths can potentially adjust body composition, with observed water content redistribution influencing lower limb circulation. This could potentially include enhancing blood vessel elasticity, as evidenced by the reduction in diastolic blood pressure in the CFB group. Consequently, this improvement in blood circulation in the lower limbs may address issues of water accumulation in the joint cavity, leading to an overall enhancement in body flexibility.

Contrast footbath seems to adjust the elasticity of blood vessels. Although short-term use of contrast footbaths may increase lower limb water content, these transient phenomena contribute to the long-term redistribution of body water content, positively impacting body circulation. Additionally, CFB's meridian energy detection data exhibit a correlation with body composition analysis. Prolonged use of contrast footbaths increases respiratory energy, skeletal muscle energy, and autonomic nerve activity energy. These increments positively correlate with increased skeletal muscle weight and water content but inversely with body fat. Foot health is intricately linked to overall physical health, with foot blood circulation playing a crucial role in systemic blood circulation and metabolism [7]. In summary, these results underscore the efficacy of footbath therapy in managing occupational stress, with contrast water footbaths emerging as a particularly beneficial strategy for home health promotion.

Conclusion

Our study emphasizes the historical effectiveness of footbath therapy by seamlessly integrating traditional practices with contemporary research methodologies. The specific focus on contrast footbaths demonstrates substantial positive effects on key aspects such as flexibility, body water composition, and meridian energy. The observed enhancements in meridian systems, encompassing the autonomic nervous, skeletal muscle, and respiratory systems, underscore the holistic potential of footbaths in promoting overall health. The results from our study substantiate the multifaceted benefits of footbaths, positioning them as a comprehensive approach to health promotion. Moreover, the positive outcomes highlighted in our research shed light on the utility of footbath therapy in addressing occupational stress. Among various footbath strategies, contrast water footbaths

emerge prominently as an effective and advantageous method for home health promotion. These findings provide valuable insights for individuals seeking practical and holistic strategies to manage stress and enhance their overall well-being through accessible home-based interventions.

References

1. Morgan PA, Franks PJ, Moffatt CJ (2005) Health-related quality of life with lymphoedema: a review of the literature. *Int Wound J*. Mar 2(1): 47-62.
2. Stout N, Partsch H, Szolnoky G, Cordero IF, Mosti G, et al. (2012) Chronic edema of the lower extremities: International consensus recommendations for compression therapy clinical research trials. *International angiology : a journal of the International Union of Angiology* 31(4): 316-329.
3. Greene A, Meskell P (2017) The impact of lower limb chronic oedema on patients' quality of life. *International Wound Journal* 14(3): 561-568.
4. Herberger K, Blome C, Heyer K, Ellis F, Münter KC, et al. (2017) Quality of life in patients with primary and secondary lymphedema in the community. *Wound Repair and Regeneration* 25(3): 466-473.
5. Burian EA, Karlsmark T, Nørregaard S, Møller KK, Kirsner RS, et al. (2022) Wounds in chronic leg oedema. *International Wound Journal* 19(2): 411-425.
6. Kapusta J, Irzmański R (2022) The Impact of Controlled Physical Training with Hydrotherapy on Changes in Swelling and Claudication Distance in Patients with Atherosclerotic Ischemia of the Lower Limbs. *Int J Environ Res Public Health* 19(23): 15715.
7. Saeki Y, Nagai N, Hishinuma M (2007) Effects of footbathing on autonomic nerve and immune function. *Complementary Therapies in Clinical Practice* 13(3): 158-165.
8. Eidson R (2009) *Hydrotherapy for Health and Wellness: Theory, Programs & Treatments*. Erin O'Connor, Clifton Park, NY.
9. Cider Å, Schaufelberger M, Sunnerhagen KS, Andersson B (2003) Hydrotherapy-a new approach to improve function in the older patient with chronic heart failure. *European Journal of Heart Failure* 5(4): 527-535.
10. Fu Q, Yang H, Zhang L, Liu Y, Li X, et al. (2020) Traditional Chinese medicine foot bath combined with acupoint massage for the treatment of diabetic peripheral neuropathy: A systematic review and meta-analysis of 31 RCTs. *Diabetes/Metabolism Research and Reviews* 36(2): e3218.
11. Choi E, Song E (2017) Efficacy of a footbath for post-partum fatigue in South Korea: A quasi-experimental study. *Japan Journal of Nursing Science* 14(2): 126-134.
12. Ashtoghiri M, Ghodsi Z (2012) The effects of Reflexology on sleep disorder in menopausal women. *Procedia - Social and Behavioral Sciences* 31:242-246.
13. Cai DC, Chen CY, Lo TY (2022) Foot Reflexology: Recent Research Trends and Prospects. *Healthcare (Basel)* 11(1): 9.
14. Valizadeh L, Seyyedrasooli A, Zamanazadeh V, Nasiri K (2015) Comparing the Effects of Reflexology and Footbath on Sleep Quality in the Elderly: A Controlled Clinical Trial. *Iran Red Crescent Med J* 17(11): e20111.
15. Hsu YY, Bai CH, Yang CM, Huang YC, Ting T, et al. (2019) Long Hours' Effects on Work-Life Balance and Satisfaction. *BioMed Research International* 5046934.

16. Chen HH, Lin CH (2023) The Effects of Footbath Therapy Proved with Physiology Parameters, including Meridian Energy for Health Promotion. *Engineering Proceedings* 55(1): 74.
17. Li J, Wang Q, Liang H, Dong H, Li Y, et al. (2012) Biophysical characteristics of meridians and acupoints: a systematic review. *Evid Based Complement Alternat Med* 2012: 793841.
18. Lin CH, Chu PH, Lin CC, Yu KC, Hsu HH (2010) Improved Body Systemic Energy by the LOHAS Program on Spa Industry in Taiwan. In: *Forum AT*, ed. Asia Tourium Forum. Vol Hualien, Taiwan: Asia Tourium Forum 1041-1049.
19. Ahn AC, Colbert AP, Anderson BJ, Martinsen OJ, Hammerschlag R, et al. (2008) Electrical properties of acupuncture points and meridians: a systematic review. *Bioelectromagnetics* 29(4):245-256.
20. Kramer S, Winterhalter K, Schober G, Becker U, Wiegele B, et al. (2009) Characteristics of electrical skin resistance at acupuncture points in healthy humans. *J Altern Complement Med* 15(5): 495-500.
21. Langevin HM, Yandow JA (2002) Relationship of acupuncture points and meridians to connective tissue planes. *The Anatomical Record* 269(6): 257-265.
22. Maurer N, Nissel H, Egerbacher M, Gornik E, Schuller P, et al. (2019) Anatomical Evidence of Acupuncture Meridians in the Human Extracellular Matrix: Results from a Macroscopic and Microscopic Interdisciplinary Multicentre Study on Human Corpses. *Evid Based Complement Alternat Med* 2019: 6976892.
23. Colbert AP, Spaulding KP, Ahn AC, Cutro JA (2011) Clinical utility of electrodermal activity at acupuncture points: a narrative review. *Acupunct Med*. Dec 29(4): 270-275.
24. Chen MF, Yu HM, Li SF, You TJ (2009) A complementary method for detecting qi vacuity. *BMC Complement Altern Med* 9: 12.
25. Liao W-C, Wang L, Kuo CP, Lo C, Chiu MJ, et al. (2013) Effect of a warm footbath before bedtime on body temperature and sleep in older adults with good and poor sleep: An experimental crossover trial. *International Journal of Nursing Studies* 50(12):1607-1616.
26. Liao WC, Chiu MJ, Landis CA (2008) A warm footbath before bedtime and sleep in older Taiwanese with sleep disturbance. *Research in Nursing & Health* 31(5): 514-528.
27. Fiscus K, Kaminski T, Powers M (2005) Changes in Lower-Leg Blood Flow During Warm-, Cold-, and Contrast-Water Therapy. *Archives of physical medicine and rehabilitation* 86(7): 1404-1410.
28. Sugawara J, Tomoto T (2021) Acute Effects of Short-Term Warm Water Immersion on Arterial Stiffness and Central Hemodynamics. *Front Physiol* 12: 620201.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/CTBEB.2024.22.556084](https://doi.org/10.19080/CTBEB.2024.22.556084)

Your next submission with Juniper Publishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats
(Pdf, E-pub, Full Text, Audio)
- Unceasing customer service

Track the below URL for one-step submission

<https://juniperpublishers.com/online-submission.php>