



WATER IMMERSION CONTRAST BATH TRAINING FOR MUSCLE AND JOINT PAIN IN OLDER ADULTS

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Abstract :

The growing number of older adults in Indonesia is accompanied by a higher prevalence of degenerative musculoskeletal complaints, particularly muscle and joint pain. In Senden, Tohudan Village, Colomadu, Karanganyar, older residents have limited knowledge of independent, non-pharmacological pain management. This community service programme aimed to improve the knowledge and independence of integrated health post cadres and older adults in applying the water immersion contrast bath method. The programme was delivered through health education, demonstration, hands-on practice, and mentoring across four sessions involving 32 participants. Understanding was measured before and after the programme using a five-item questionnaire with a four-point scale, programme benefit was assessed with a six-item questionnaire, and suggestions were collected through an open-ended question. Data were analysed descriptively and with the Wilcoxon signed rank test. The mean understanding score increased from 8.91 to 17.38 out of 20, and all participants moved from the two lowest categories into the understanding and fully understanding categories ($Z = -4.963$; $p < 0.001$; $r = 0.62$). The benefit index reached 91.1%, and most participants expected the programme to become a routine activity of the integrated health post for older adults.

Keywords : contrast bath, older adults, musculoskeletal pain, community empowerment, physiotherapy

INTRODUCTION

Progress in health development has raised life expectancy and, with it, the number of older adults in the population. In 2013, 8.9% of the Indonesian population was aged 60 years or over, and this proportion is projected to reach 21.4% by 2050 (Kementerian Kesehatan Republik Indonesia, 2016). A similar trend is observed globally, where the proportion of people aged 65 years and over is expected to rise from 8% in 2010 to 16% in 2050 (National Institutes of Health & World Health Organization, 2011).

A larger older population brings a greater burden of degenerative health complaints. Pain is one of the most frequent complaints in this age group and is estimated to affect almost 60% of older adults (Herr & Garand, 2001). Inadequate pain assessment, the presence of comorbidities, and physiological and metabolic changes associated with ageing may lead to suboptimal pain management (Davis & Srivastava, 2003). Age-related changes in pharmacokinetics and pharmacodynamics also require analgesics to be prescribed cautiously in this population, so that combining pharmacological treatment with non-



pharmacological approaches is a rational strategy for improving quality of life (Karp, Shega, Morone, & Weiner, 2008).

One physiotherapy-based, non-pharmacological modality that is simple and easy for communities to apply is the *water immersion contrast bath*, in which a limb is immersed alternately in warm and cold water. The alternating thermal stimulus induces intermittent vasoconstriction and vasodilatation that produces a vascular pumping effect, increases tissue blood flow and oxygenation, assists the removal of metabolic waste, reduces joint stiffness, and improves limb function (Shadgan, Pakravan, Hoens, & Reid, 2018). Recent evidence indicates that contrast therapy reduces pain intensity, improves joint range of motion, and decreases swelling in a range of musculoskeletal conditions, although temperature and duration protocols still vary considerably across studies (Leonardi et al., 2025). Objective measurements have likewise demonstrated changes in blood flow, muscle tone, and pressure pain threshold following contrast bath application (Kim, Jung, & Yim, 2020). The health effects of hydrotherapy arise through thermal, mechanical, and chemical mechanisms, with warm immersion generally ranging from 38 to 48 °C and cold immersion usually maintained below 15 °C (An, Lee, & Yi, 2019).

A preliminary survey in Senden, Tohudan Village, Colomadu District, Karanganyar Regency showed that many older residents experience muscle and joint pain related to ageing and limited physical activity, while their knowledge of independent management of musculoskeletal problems remains limited. Community-based promotive and preventive activities, as well as public awareness of safe non-pharmacological therapies, are still suboptimal. This community service programme therefore aimed to improve the knowledge and independence of integrated health post (Posyandu Lansia) cadres and older adults in applying the *water immersion contrast bath* method to relieve muscle and joint pain. The choice of this method was based on evidence from Indonesian communities showing that contrast bath significantly reduces knee joint pain among older adults at integrated health posts (Rusminingsih, Agustina, & Wulan, 2020), and on findings that health education combined with training effectively improves the knowledge and skills of health cadres (Fitriani & Purwaningtyas, 2020).

RESEARCH METHOD

The programme applied a community empowerment approach consisting of health education, demonstration, hands-on practice, and mentoring. The target group comprised integrated health post (Posyandu Lansia) cadres and older residents of Senden, Tohudan Village, Colomadu District, Karanganyar Regency, Central Java Province. A total of 32 participants attended the full series of activities and completed all measurements.

The activities were organised in four stages: (1) coordination with village officials, cadres, and the partner group, including permission procedures; (2) health education on muscle and joint pain in older adults, risk factors, and warning signs requiring referral; (3) demonstration and supervised practice of

the contrast bath in small groups, preceded by a simple screening of each participant; and (4) mentoring for independent application at home. Immersion was performed alternately in warm water (approximately 38-40 °C) and cold water (approximately 10-15 °C), with the duration and number of cycles following the taught protocol.

Three instruments were used for evaluation. First, an understanding questionnaire of five core items rated on a four-point scale (1 = not understanding, 2 = poorly understanding, 3 = understanding, 4 = fully understanding), giving a total score of 5 to 20, with categories of 5-8 not understanding, 9-12 poorly understanding, 13-16 understanding, and 17-20 fully understanding. The five items covered the concept of muscle and joint pain in older adults and its warning signs, the definition and benefits of the contrast bath, preparation of the therapy, the sequence of procedural steps, and safety and independent application at home. Second, a six-item programme benefit questionnaire rated from not beneficial to highly beneficial (total score 6 to 24). Third, an open-ended question on participants' suggestions and expectations.

The understanding questionnaire was completed by the same respondents before (pre-test) and after (post-test) the programme. Data were analysed descriptively as means, standard deviations, medians, and category frequency distributions. Normality was examined with the Shapiro-Wilk test, and the difference between pre-test and post-test scores was analysed with the Wilcoxon signed rank test at a significance level of 0.05, complemented by the effect size r and the N-Gain score. Responses to the open-ended question were analysed using simple thematic analysis.

FINDINGS AND DISCUSSION

The programme was attended by 32 participants consisting of integrated health post cadres and older residents. The results of the understanding measurement before and after the programme are presented in Table 1.

Table : 1 Descriptive statistics of participants' understanding scores (n = 32)

Statistic	Pre-test	Post-test	Difference
Mean $\pm$ SD	8.91 $\pm$ 2.45	17.38 $\pm$ 2.12	8.47 $\pm$ 1.48
Median (Q1-Q3)	10 (6.75-11)	18 (15-19)	8 (7-10)
Minimum-maximum	5-12	13-20	5-11
Mean value (%)	44.5	86.9	42.3
Mean N-Gain	—	0.78 (high)	—

The mean understanding score rose from 8.91 $\pm$ 2.45 (44.5%) to 17.38 $\pm$ 2.12 (86.9%), an average increase of 8.47 $\pm$ 1.48 points. All participants (100%) improved their scores, and the mean N-Gain of 0.78 falls within the high category, indicating that the improvement was substantial relative to the room for improvement available. The distribution of understanding categories is presented in Table 2.

Table : 2 Distribution of understanding categories before and after the programme (n = 32)

Category	Score range	Pre f	Pre %	Post f	Post %
Not understanding	5-8	12	37.5	0	0.0
Poorly understanding	9-12	20	62.5	0	0.0
Understanding	13-16	0	0.0	12	37.5
Fully understanding	17-20	0	0.0	20	62.5
Total		32	100.0	32	100.0

Before the programme, all participants were in the lower categories, with 12 participants (37.5%) classified as not understanding and 20 participants (62.5%) as poorly understanding. After the programme, all participants moved into the higher categories, with 12 participants (37.5%) classified as understanding and 20 participants (62.5%) as fully understanding, as shown in Figure 1.

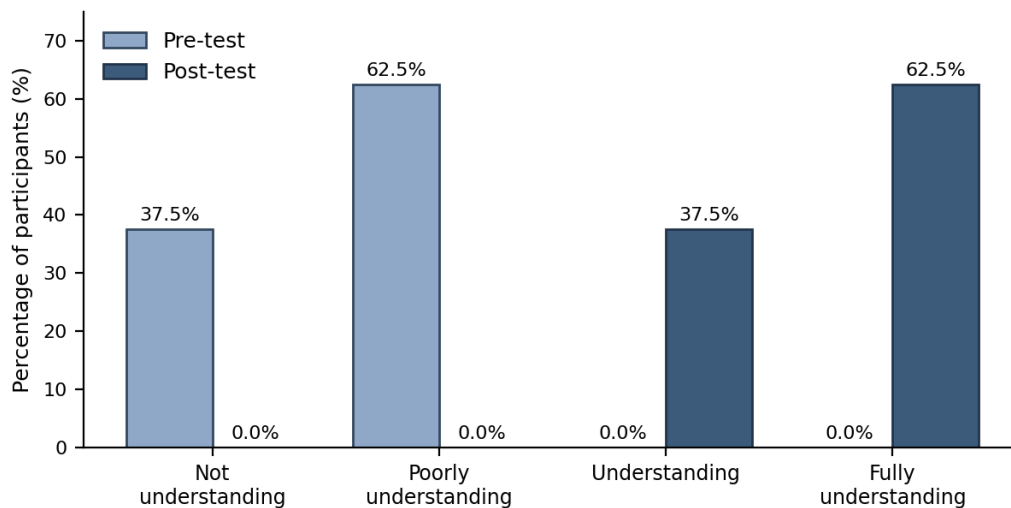


Figure 1 : Distribution of understanding categories before and after the programme

Table : 3 Normality and difference tests of understanding scores (n = 32)

Test	Test statistic	p	Conclusion
Shapiro-Wilk, pre-test score	W = 0.879	0.002	Not normal
Shapiro-Wilk, post-test score	W = 0.906	0.009	Not normal
Wilcoxon signed rank test	Z = -4.963	< 0.001	Significant difference
Paired t-test	t = 32.35; df = 31	< 0.001	Significant difference

The distribution of understanding scores was not normal, so the Wilcoxon signed rank test was used to examine the difference. The test yielded $Z = -4.963$ with $p < 0.001$, with positive ranks for all 32 respondents and no negative ranks or ties, and an effect size r of 0.62, which is considered large. The paired t-test, used as a supporting analysis, led to the same conclusion. Participants' understanding therefore differed significantly before and after the programme.

Table : 4 Participants' assessment of the programme benefit (n = 32)

No	Aspect assessed	B (f)	HB (f)	B+HB (%)	Index (%)
1	Health education material delivered	11	21	100.0	91.4

No	Aspect assessed	B (f)	HB (f)	B+HB (%)	Index (%)
	by the team				
2	Demonstration and hands-on contrast bath practice	8	24	100.0	93.8
3	Educational media used (leaflet/poster/video)	15	17	100.0	88.3
4	Mentoring by the team during the activities	10	22	100.0	92.2
5	Change in pain complaints after practising the contrast bath	17	15	100.0	86.7
6	Continuation of the programme at the integrated health post	7	25	100.0	94.5
	Mean of all items			100.0	91.1

Note: B = beneficial; HB = highly beneficial. No participant rated any aspect as not beneficial or poorly beneficial.

All aspects of the programme were rated within the highly beneficial category, with a mean score of 3.65 out of 4 and a benefit index of 91.1%. Based on total scores, 27 participants (84.4%) rated the programme as highly beneficial and 5 participants (15.6%) as beneficial, with a mean total score of 21.88 ± 1.48 out of a maximum of 24. The highest ratings were given to the continuation of the programme at the integrated health post and to the hands-on practice, while the lowest index was recorded for the perceived change in pain complaints.

Table : 5 Themes of participants' suggestions and expectations (multiple response, n = 32)

No	Theme of suggestions and expectations	f	%
1	Continuing the programme as a routine integrated health post activity	21	65.6
2	Providing more practice equipment (immersion basins and water thermometers)	14	43.8
3	Adding other health topics (elderly exercise, knee pain, fall prevention)	11	34.4
4	Providing illustrated take-home guides or leaflets	9	28.1
5	Holding sessions in the morning with a longer duration	7	21.9
6	Home visits for older adults with limited mobility	5	15.6
7	Involving family members or carers in the training	4	12.5

Twenty-nine of the 32 participants (90.6%) provided suggestions, generating 71 responses in total. The most frequent theme was the expectation that the programme would continue as a routine integrated health post activity, which is consistent with the highest benefit rating being given to programme continuation.

The significant improvement in understanding is consistent with community empowerment activities elsewhere that reported higher knowledge and skill scores after health education and training (Fitriani & Purwaningtyas, 2020), and indicates that combining education, demonstration, hands-on

practice, and mentoring is effective for older learners. Working in small groups allowed participants to perform the immersion procedure themselves and receive immediate correction, while repeating the material and using illustrated media helped to accommodate limitations in vision, hearing, and memory.

Correct understanding of water temperature, immersion duration, number of cycles, and contraindications is a prerequisite for the safe independent use of the therapy, particularly in older adults with sensory impairment or peripheral vascular disorders (Shadgan et al., 2018). Comparable findings have been reported in a randomised controlled trial combining the contrast bath with an exercise programme in patients with knee osteoarthritis, which improved pain, joint range of motion, and functional disability (Fokmare & Phansopkar, 2023).

The relatively lower rating for the perceived change in pain complaints can be understood from the fact that the effects of alternating immersion require repeated application over time, whereas measurement was carried out at the end of the activity series. This is in line with the cumulative nature of the thermal effects of hydrotherapy, which depend on temperature, duration, and frequency of immersion (An et al., 2019; Leonardi et al., 2025). The lower index for educational media is reinforced by participants' requests for illustrated take-home guides, indicating that simple printed media are a genuine need in this target group.

The expectation that the programme should become a routine integrated health post activity indicates acceptance of a non-pharmacological therapy that is simple, inexpensive, and self-administered. Programme sustainability is therefore directed at strengthening the role of cadres as facilitators, providing practice equipment, and integrating contrast bath practice into routine integrated health post sessions.

CONCLUSION

The community service programme comprising education, demonstration, practice, and mentoring in the *water immersion contrast bath* method significantly improved participants' understanding, with the mean score rising from 8.91 (44.5%) to 17.38 (86.9%) and all participants moving from the not understanding and poorly understanding categories into the understanding and fully understanding categories ($Z = -4.963$; $p < 0.001$; $r = 0.62$). The programme was rated beneficial by all participants, with a benefit index of 91.1%, and most participants expected it to continue as a routine integrated health post activity. Sustainability is recommended through strengthening the facilitator role of cadres, providing practice equipment and illustrated educational media, and offering mentoring for older adults with limited mobility. Further activities are recommended to measure changes in pain intensity and functional capacity over a longer observation period.

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