KMAN PUBLISHING INSTITUTE
Journal Website

Article history:
Received 27 August 2024
Revised 02 November 2024
Accepted 14 November 2024
Published online 28 November 2024

Journal of Assessment and Research in Applied Counseling

In Press

E-ISSN: 3041-8518

Developing and Compiling a Mindfulness-Based Stress Reduction Program and Evaluating its Effectiveness on Relieving Chronic Pain in the Elderly: A Case Series

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A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Soukhtanlou, M., Pourhosein, R., & Afrooz, Gh.A. (IN PRESS). Developing and Compiling a Mindfulness-Based Stress Reduction Program and Evaluating its Effectiveness on Relieving Chronic Pain in the Elderly: A Case Series. *Journal of Assessment and Research in Applied Counseling*.
http://dx.doi.org/10.61838/kman.jarac.7.x.x

A B S T R A C T

Objective: This study was conducted to develop and compile a mindfulness-based stress reduction (MBSR) program within a context of physiotherapy rehabilitation to manage chronic pain in the elderlies in an Iranian clinical setting.
Methods and Materials: The 8-session MBSR treatment protocol was translated, revised for the Iranian elderly, and compiled as a one-on-one therapy using a unique protocol with 20-session physiotherapy. Two volunteers aged 65 (male) and 71 (female) with knee and ankle chronic pain were selected and received the program for 8 consecutive weeks with a 3-month follow-up. Treatment satisfaction levels, adherence to treatment sessions, and patient-reported clinical outcome measures were used at baseline, immediately post-intervention, and three months following the intervention, measuring pain, anxiety, fatigue, sleep disturbance, pain interference levels, and kinesiophobia.
Findings: Participants rated high satisfaction with the treatment and protocol, attending all treatment sessions and assessments. The Patient-Reported Outcomes Measurement Information System results indicated that there was a decrease in anxiety, fatigue, sleep disturbance, and pain interference for both participants.
Conclusions: A brief, one-on-one MBSR program, adapted for the elderly with chronic pain, can be integrated with physiotherapy intervention in an Iranian clinical setting. The program has the potential to alleviate pain severity, kinesiophobia, anxiety, fatigue, sleep disturbances, and pain interference. High treatment satisfaction levels indicate the feasibility of evaluating the program in a future randomized controlled clinical trial to assess its effect on clinical outcomes.
Keywords: *Mindfulness-Based Stress Reduction, Chronic pain, Elderly, Physiotherapy.*

1. Introduction

Chronic pain significantly affects the quality of life (Schumann et al., 2020), and it is a common health problem (Goli, 2024; Nahin, 2015), with a prevalence ranging from 51% to 83% in older adults (Eggermont et al., 2014; Gerteis et al., 2014; Lapane et al., 2013; Patel et al.,

2013). It is believed that, the world's geriatric population will be increased from 9% to 16% by 2030, and in Iran, 17.5% of the population will be older than 65 (Sharifi & Refahi, 2013).

Chronic pain affects older adults' psychological and social aspects (Javadzade et al., 2024). It is well known that a robust and positive bi-directional relationship exists between mental health and somatic health (Tatta et al., 2022). Therefore, a holistic approach to chronic pain using biopsychosocial programs could result in better outcomes (Schumann et al., 2020). In Iran, elderlies with chronic pain access medical services to ease their pain (Alemi et al., 2021) in most cases, they report using three or more analgesics for pain relief (Schumann et al., 2020), and some receiving physiotherapy while the psychological pain managements are not so common (Alemi et al., 2021). Physiotherapy is also a common therapeutic procedure for chronic musculoskeletal pain, particularly in the elderly (Dagnino & Campos, 2022).

Physiotherapists have been using several treatment techniques for managing individuals with pain. Physiotherapy treatments are strongly supported by the somatic framework, whereby it is believed that addressing the bodily tissues could improve health outcomes (Suzuki, 2017). Although the somatic approach is popular, it ignores the idea of mind and body in perceiving illness. Therefore, the psychosomatic approach alongside somatic-focused rehabilitation could be a better framework for defining and responding to chronic pain (Dagnino & Campos, 2022). In a psychosomatic approach, mind and body are integrated to shape illness and disorders and contribute to the persistence of illness (Suzuki, 2017). As pain is a complex phenomenon, there is an increasing need in this area to use psychosomatic approaches in addition to somatic approaches to manage patients more effectively and thoroughly (Suzuki, 2017).

Mindfulness-Based Stress Reduction (MBSR), a form of psychosomatic approach, was developed for individuals with chronic physical problems like pain, low mood, and health-related anxiety (Alsubaie et al., 2020). Mindfulness is defined as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 2013). The MBSR program has been used since 1979 to help individuals relieve pain and distress resulting from various chronic health problems (Kabat-Zinn, 2013). Two studies illustrated that MBSR could lead to decreased anxiety, worry, and depression in a randomized controlled trial for individuals with anxiety disorders (Hoge et al., 2015; Vøllestad et al., 2011). Recently, a group of researchers (Javadzade et al., 2024) showed that MBSR significantly reduced depression and enhanced emotion regulation and sleep quality among elderly individuals. In terms of treating chronic pain, some studies have demonstrated the positive effects of MBSR on pain intensity, medical and psychological symptoms, coping ability, and daily activity inhibition (Rosenzweig et al., 2010), (on daily functioning and pain (Cherkin et al., 2016), pain severity knee or hip osteoarthritis (Marais et al., 2022), and tension headache (Omidi & Zargar, 2014). Another study showed significant effects of interdisciplinary therapy on different aspects of physical and emotional functioning related to pain (Scott et al., 2017). Also, a study investigated the effectiveness of an interdisciplinary pain rehabilitation program that combined opioid treatment and showed similar enhancements with opioid dose reductions (Alemi et al., 2021; Darchuk et al., 2010). indicated that when mindfulness therapy was combined with massage and aromatherapy, it could be effective in reducing pain and enhancing the quality of life and sleep quality.

Integrating somatic (i.e., physiotherapy) and psychosomatic approaches into the management of chronic musculoskeletal pain could help improve outcomes in individuals with chronic pain in Iran. However, there is no Iranian adaptation of the originally described MBSR approach to be delivered alongside the physiotherapy intervention. There is also a need to explore the potential influence of adapted MBSR and physiotherapy on patient-reported outcomes. The primary and secondary aims of the investigation include:

1(a). Developing and compiling an MBSR program to be added to a physiotherapy rehabilitation for managing chronic pain in the elderlies.

1(b). Exploring the acceptability of the Patient Global Assessment of Treatment Satisfaction (PGATS) scale in the adapted MBSR treatment protocol alongside physiotherapy rehabilitation for managing chronic pain in the elderly.

2. Evaluating the influence of the adapted MBSR treatment protocol alongside physiotherapy rehabilitation on reducing pain, kinesiophobia, and comorbid depression and anxiety in a sample of elderly individuals with chronic musculoskeletal pain.

2. Methods and Materials

2.1. Study Design and Participants

This paper presents a case series of two older adults who received care at an outpatient physiotherapy clinic in

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E-ISSN: 3041-8518

Mashhad, Iran. The study participants were received eight MBSR training sessions (see below for more details about the treatment) alongside 20 sessions of physiotherapy. Patient-reported outcome measures were administered before and after each treatment session. In addition, participants were encouraged to share their experiences with the treatment and its effects.

Two older adults receiving physiotherapy care at a clinic in Mashhad, 2023, volunteered after the research advertisement to participate in the study. The inclusion criteria to participate in this study included aged 65 years or older, , having chronic musculoskeletal pain (persistent bothersome pain occurring on ≥45 days out of the past 90 days) confirmed by medical records, reporting an average pain rating of ≥ 4 in the past seven days on a Numeric Rating Scale-11 (NRS-11) (0 = no pain; 10 = worst pain imaginable), being able to read and write in Persian, and signing the written inform constant form. The exclusion criteria was scoring ≤ 23 on the Mini-Mental State Examination (MMSE).

After these considerations, one female (71 years old with chronic ankle pain, referred to as Participant One in this study) and one male (65 years old with chronic knee pain, referred to as Participant Two in this study) volunteered to participate in the research.

Patient-reported outcome measures were collected at baseline, immediately following interventions, and three months after the intervention. All outcomes were collected by an M.Sc. psychology student unaware of the study's primary objective. The number of sessions attended by participants was recorded to evaluate any absences or resistance for the program.

In the first session, the research program and plans for outcome assessment were introduced. The participants then signed the research agreement form and were interviewed to obtain information about their pain (i.e., duration, location, and course), their medication(s), and demographics. This was followed by the first 70-80-minute physiotherapy session. After the first physiotherapy session, participants received their initial MBSR with a trained therapist. Finally, three months after the last study session, they were asked to return to the clinic for the follow-up assessment to complete patient-reported outcome measures.

2.2. Measures

2.2.1. Cognitive Function

The MMSE (Folstein et al., 1975) was used in this study for descriptive purposes and to screen for participation. The MMSE, a commonly used screening measure of cognitive function, contains 11 questions to assess five areas of cognitive function: Orientation, registration, attention and calculation, recall, and language. Evidence supports the reliability and validity of the MMSE, as evidenced by high internal consistency (Cronbach's alphas generally) (Khodamoradi et al., 2020). The MMSE score can range from 0 to 30, and getting a score of 23 or lower illustrates significant cognitive impairment (Khodamoradi et al., 2020).

2.2.2. Treatment Satisfaction

Treatment satisfaction was assessed with six questions asking the participants to rate six domains of treatment satisfaction using a 5-point Likert scale ranging from 0 ("Very dissatisfied") to 4 ("Very satisfied"). Specifically, satisfaction with the combined physiotherapy and MBSR protocol, the duration of the entire protocol, the duration of each treatment session, the content of the treatment sessions, and homework assignments were measured using this tool. Participants were also asked to rate their overall satisfaction with the treatment on the same Likert scale (Shields et al., 2024).

2.2.3. Pain Intensity

Average pain intensity in the past week and post-session current pain intensity were assessed at the end of each session using the Numerical Rating Scale-11 (NRS-11) (0 = "no pain" and 10 = "worst pain imaginable") (Jensen, 2008). This measure has shown high test-retest reliability from before to just after a medical consultation in literate and illiterate patients with rheumatoid arthritis (r = 0.96 and 0.95, respectively) (Jensen, 2008). Before and after medical consultation and construct validity, the NRS-11 has also been shown to be highly correlated (Ferraz et al., 1990).

2.2.4. Other Reported Outcomes

Physical function, anxiety, depression, fatigue, sleep disturbances, ability to participate in social roles, and pain interference were assessed using the 4-item short form version of the Patient Reported Outcomes Measurement

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E-ISSN: 3041-8518

Information System (PROMIS-29 v2.0). The PROMIS-29 v2.0 has undergone extensive validation for use across various clinical populations, including individuals with physical disabilities, such as spinal cord injury (Cook et al., 2016). Each of the 29 items in the PROMIS-29 provides 6 response options, although the specific anchors listed in the response options are not all the same. Responses to the items are summed and then transformed (i.e., mean = 50 and standard deviation [SD] = 10 in the normative sample). For all scales, higher scores indicate more of the domain being assessed (e.g., more anxiety severity for the anxiety scale). A growing body of evidence supports the reliability and validity of each domain assessed by the PROMIS-29 (Oskouie et al., 2023).

2.2.5. Kinesiophobia

Fear of movement (i.e., kinesiophobia) was assessed using the brief (11-item) version of the Tampa Scale Kinesiophobia (TKS-11) (Woby et al., 2005). Respondents are asked to indicate agreement with each item on a Likert scale from ("strongly disagree") to 4 ("strongly agree). The items are summed into a total score ranging from 11 to 44. Higher scores indicate a greater fear of movement. Most, but not all, factor-analytic studies indicate that the TSK items assess two domains across various pain conditions related to fear of movement (Roelofs et al., 2004; Roelofs et al., 2007; Roelofs et al., 2011; Woby et al., 2005); Activity avoidance [assessed by the Activity Avoidance scale (TSK-AA)]-the belief that activity may result in (re)injury or increased pain; Somatic focus [assessed by the Somatic Focus scale (TSK-SF)]-a belief that pain is a sign of an underlying and serious medical issue.

2.3. Interventions

2.3.1. Physiotherapy

Both participants received 20 physiotherapy sessions. The sessions were provided three times per week for the first five weeks and then two sessions per week for the final three weeks of treatment. During each session, the physiotherapist administered the following electrotherapy modalities per standardized protocols in the clinic: Transcutaneous electrical nerve stimulation (TENS), low-level laser therapy (LLLT), and ultrasound therapy to the painful body region. In addition, they engaged in 15-20 minutes of exercise during each session.

2.3.2. Mindfulness-Based Stress Reduction Program

The MBSR program was based on Jon Kabat-Zinn's method (Kabat-Zinn, 2013), usually a weekly 1.5-hour per session group intervention (Alsubaie et al., 2017). The following procedures were conducted to adapt the original MBSR program to satisfy to the specific needs of the elderly population with chronic pain in an Iranian clinical settings. The intervention was first translated into Persian by an expert Persian interpreter. The lead author and the research team members reviewed the translation and made any necessary changes. Recognizing that elderly individuals preferred individual MBSR approximately two times per week (Harris et al., 2023), the sessions were made shorter to be delivered immediately after their physiotherapy sessions. Therefore, the program's content was simplified to last 60 to 70 minutes in each session instead of the standard 90-minute session. The design of each session was planned to involve discussing the homework assignments for the past week, followed by a discussion of the session's content, and then a meditation practice. The sessions concluded with a summary of the material covered, followed by an overview of the homework assignments for the following week. Also, the number of homework assignments was reduced so that they could be completed in about 20 minutes daily at most. Finally, there was no full-day retreat. The primary focus of the first session was to cultivate awareness through breathing exercises, aiming to change their perception of their body and pain, ultimately reducing their pain. However, thoughts, emotions, communication, and self-compassion were all targeted to reduce stress. They were then given their assignments for the first week, consisting of the content of that MBSR session. They were also asked to practice the mindfulness exercise they were taught during the session for at least 30 minutes each day before the next session. Sessions 2 through 8 of the MBSR program had the same format as the first session, except that each session began with a discussion of their experience with the assignment and their meditation practice. The only differences were: (1) The content of the information presented differed for each session, (2) checking the homework assignments, and (3) different meditation.

2.4. Data analysis

Basic descriptive statistics were calculated for each participant. A blinded assessor who is not one of the research team extracted the results from the raw data.

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3. Findings and Results

Both participants show general satisfaction with the treatment and protocol (Table 1).

Both participants attended all treatment sessions and assessments without any absences or resistance for the program. Table 1 illustrates that both participants experienced treatment satisfaction in all aspects which they were asked and the PGAST is high.

Table 1

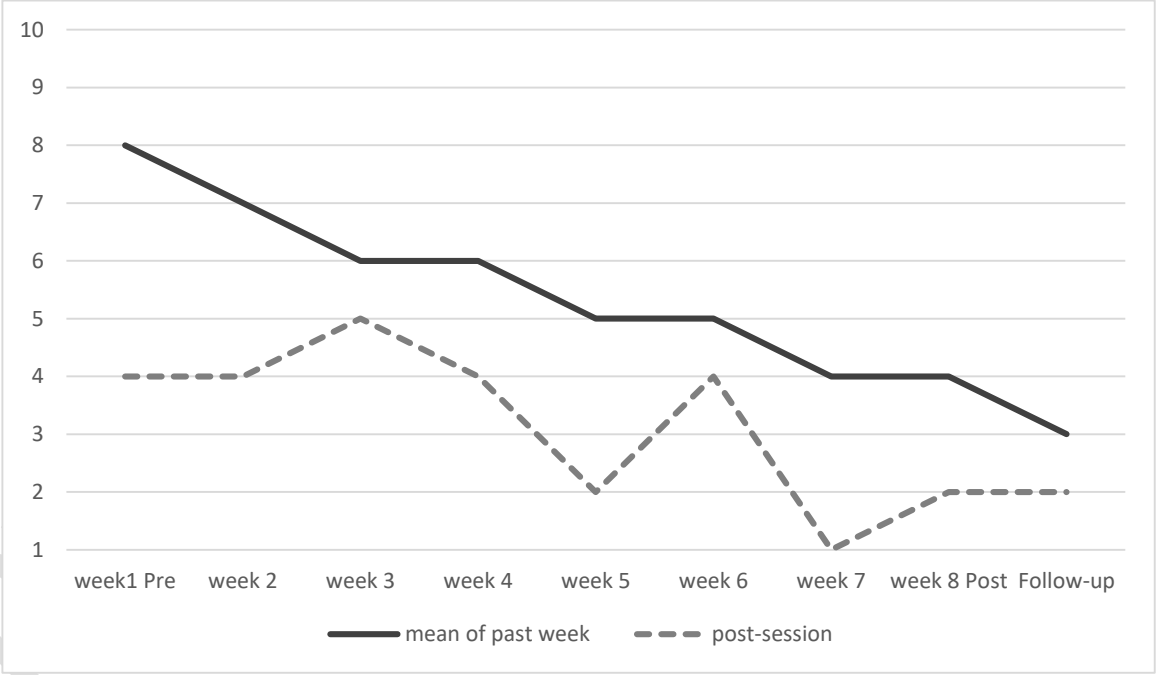
Treatment/protocol satisfaction

Questions	Participant one	Participant two
Combination of MBSR and physiotherapy	3	4
Length of protocol	3	3
Length of each session of MBSR	3	4
Content of each session of MBSR	3	3
Homework of MBSR	4	3
PGAST	3	3

As the Figure 1 shows, the participant one reported a significant reduction in mean of past week and post-session NPI scores in post-intervention and follow-up assessments compared to baseline.

Figure 1

Numerical Pain Index (female participant)



Also, the mean of past week and post-session scores in post-intervention and follow-up assessments in the male participant showed a significant decrease compared to baseline (see Figure 2). However, the reduction in NPI scores was not very high.

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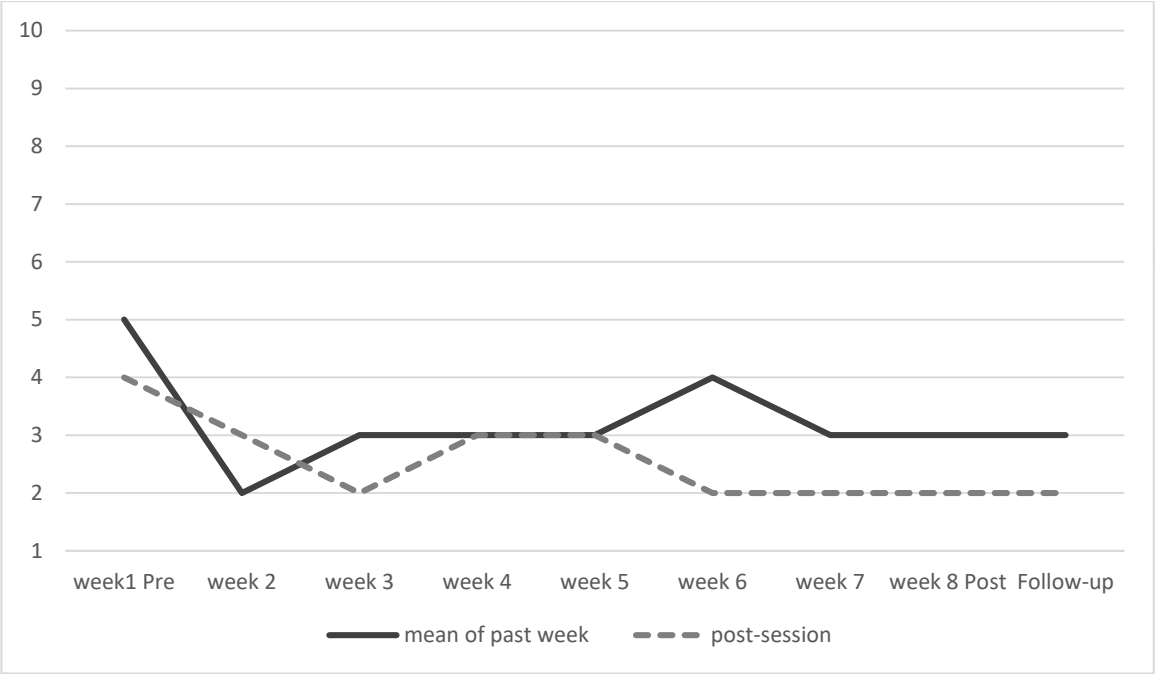
E-ISSN: 3041-8518

Figure 2

Numerical Pain Index (male participant)



Reduction in all subscales of the PROMIS-29 was observed after the 8-week program (see Table 2). However, the data illustrated that the ability to satisfaction with participation in social roles (participant one), sleep disturbances, fatigue, and anxiety decreased more in the post-test than in the baseline. The results of the follow-up assessment revealed no significant differences from those of the post-intervention assessment.

Table 2

PROMIS-29 results

Variable	T-score pre	T-score post	T-score Follow
Physical function 1	43.4	40.4	41.8
Physical function 2	30.7	29.1	29.1
Anxiety 1	71.2	63.4	65.3
Anxiety 2	53.7	40.3	48
Depression 1	57.3	55.7	53.9
Depression 2	41	41	49
Fatigue 1	66.7	57	55.1
Fatigue 2	43.1	33.7	33.7
Sleep Disturbance 1	61.7	54.3	50.5
Sleep Disturbance 2	50.5	32	37.5
Ability to Satisfaction in participation in social roles 1	53.7	38.8	38.8
Ability to Satisfaction in participation in social roles 2	27.5	27.5	31.8
Pain Interference 1	65.2	63.8	61.2
Pain Interference 2	59.9	53.9	55.6

The Table 3 indicates the TKS-11 data for both participants. The baseline total scores are 35 and 31 in participant one and participant two respectively, which indicates high kinesiophobia. The score was decreased dramatically in both participants in the post-test and remained approximately the same after three months in the follow-up, indicating moderate kinesiophobia. Declines in the subscales (the somatic focus and the activity avoidance) were same as the total score in participants and the dropping

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after 8-week program remained unchanged in follow-up phase.

Table 3

TKS-11 results

Participants	Total score Pre	Somatic Focus Pre	Activity Avoidance Pre	Total score Post	Somatic Focus Post	Activity Avoidance Post	Total score Follow	Somatic Focus Follow	Activity Avoidance Follow
One	35	18	17	26	14	12	24	12	12
Two	31	16	15	11	6	5	13	7	6

4. Discussion and Conclusion

This study developed and compiled an 8-session MBSR program consisting of 20 sessions of physiotherapy rehabilitation for managing chronic pain in older adults and assessed the acceptability of this modified program when delivered in an interdisciplinary clinical setting.

The fundamental changes to the MBSR program included reducing the duration of each session, decreasing assignments, and eliminating the full-day retreat. In addition to weekly physiotherapy sessions, participants were required to spend three hours in the physiotherapy clinic to receive the MBSR program and engage in nearly three hours of MBSR practice at home. The program was found to be acceptable by a sample of older adults with chronic musculoskeletal pain. No dropouts were observed during the treatment sessions. More importantly, their overall satisfaction scores were three out of four, indicating their satisfaction with the program. Therefore, it could be possible to change the regular and one-dimensional therapy for chronic pain in the elderly to an interdisciplinary program. However, more studies on various age groups and other types of chronic pain will be needed.

The secondary aim of this study was to evaluate the program's influence on clinical outcomes. The program produced some meaningful changes in pain severity; the PROMIS-29 sub-scales and the TKS-11 scores were reduced in both participants following eight sessions of the program and after a 3-month follow-up compared to the baseline assessment. These data suggest that the program may be effective in reducing the pain of the elderly, but further researches with control group is required. The program was effective in reducing anxiety, sleep problems, and pain interference; however, a noticeable change was not observed in the depression subscale. It should be considered that depression in elderlies could have various causes other than chronic pain (Zis et al., 2017). One other significant observation is that the program was effective in reducing kinesiophobia post-intervention and in follow-up. Moreover, the ability to satisfaction participation in social participants showed different trends in their reduction. The difference between their age and gender could be a possible explanation for that (Dagnino & Campos, 2022). These results indicate that an interdisciplinary program could enhance psychological effects on well-being. In the follow-up phase, when we asked them, “Did you have any supplementary therapy during these three months?” both participants reported using MBSR techniques and mindfulness as much as they did in their natural environments, suggesting improved self-efficacy.

This investigation suggests that an 8-session MBSR program delivered alongside physiotherapy sessions could enhance treatment satisfaction among older adults with chronic musculoskeletal pain. The program resulted in a significant decrease in pain levels, fear of movement, anxiety, pain interference, fatigue, and sleep disturbances. The findings highlight the necessity for a randomized controlled clinical trial to evaluate the program's effectiveness on clinical outcomes in elderly individuals dealing with chronic pain.

5. Limitations & Suggestions

One of the limitations of this study is the small sample size, which includes only two participants, limiting the generalizability of the findings to the broader elderly population with chronic pain. Additionally, the study is based on a single clinical setting in Iran, which may not reflect the efficacy or feasibility of the MBSR program in other cultural or healthcare contexts. The lack of a control group further restricts the ability to draw definitive

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E-ISSN: 3041-8518

conclusions about the specific effects of the MBSR program compared to other interventions or no intervention. Finally, the three-month follow-up period may not be sufficient to assess the long-term sustainability of the program's benefits.

Future research should aim to include a larger, more diverse sample of elderly individuals with chronic pain to enhance the generalizability of the findings. Studies with randomized controlled trials (RCTs) are needed to more rigorously evaluate the effectiveness of the MBSR program compared to other treatment approaches, including physiotherapy alone or alternative complementary therapies. Additionally, longer follow-up periods should be implemented to assess the long-term impact of MBSR on chronic pain and related outcomes, and future research should explore the feasibility of incorporating this program into other healthcare settings, both within Iran and internationally.

This study provides important implications for the integration of mindfulness-based interventions, specifically MBSR, into the physiotherapy rehabilitation process for elderly individuals with chronic pain. The positive outcomes observed in this pilot study suggest that MBSR can be a valuable adjunct to traditional physiotherapy, potentially improving patient adherence, satisfaction, and overall well-being. The feasibility and adaptability of the program in an Iranian clinical context highlight the potential for broader implementation in similar healthcare settings, contributing to the development of more holistic and patient-centered care models for elderly patients with chronic pain.

Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. The Research Ethics Committee of the Faculty of Psychology and Education at University of Tehran approved this study (IR.UT.PSYEDU.REC.1402.042). Participants consented to participate in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

Authors' Contributions

All authors equally contributed in this article.

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