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Comparing The Effectiveness of Mindfulness-Based Cognitive Behavioral Therapy and Electronic Muscle Stimulation on Balance, and Psychological Wellbeing in Elderly

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A B S T R A C T

The objective of this study was to compare the effectiveness of Mindfulness-Based Cognitive Behavioral Therapy (MCBT) and Electronic Muscle Stimulation (EMS) on balance and psychological well-being in elderly women aged between 60 and 75 years. This randomized controlled trial included 135 participants, divided equally among three groups: MCBT, EMS, and a control group. Each group comprised 45 participants. The interventions lasted for three months with a subsequent three-month follow-up. Balance was assessed using the Berg Balance Scale, and psychological well-being was measured using the Psychological General Well-Being Index. Data were analyzed using a mixed-model analysis of variance (ANOVA) with repeated measurements and Bonferroni post-hoc tests, employing SPSS-27 for statistical analysis. The interventions significantly improved both balance and psychological well-being from baseline to post-intervention. EMS showed a more significant improvement in balance, with scores increasing from a pre-test mean of 20.45 (SD = 3.60) to a post-test mean of 23.78 (SD = 4.12) ($p < .001$). MCBT was more effective in enhancing psychological well-being, with scores improving from a pre-test mean of 68.20 (SD = 5.50) to a post-test mean of 75.45 (SD = 6.34) ($p < .001$). Both interventions maintained their effects at the three-month follow-up. Both EMS and MCBT are effective interventions for improving balance and psychological well-being in elderly women, respectively. EMS may be more suited for physical balance enhancements, while MCBT may be more effective for mental health improvements. The results suggest that integrating these interventions could potentially offer comprehensive benefits in elderly care.

Keywords: *Elderly, Balance, Psychological Well-Being, Mindfulness-Based Cognitive Behavioral Therapy, Electronic Muscle Stimulation, Randomized Controlled Trial*.

1. Introduction

The significant elderly population globally presents a critical challenge for healthcare systems, particularly in the realms of maintaining physical balance and psychological well-being. As individuals age, they often face a decline in physical function, which can lead to decreased mobility and an increased risk of falls, thereby affecting their overall quality of life (Matsumura &

Ambrose, 2006). Concurrently, psychological well-being, encompassing facets such as stress, anxiety, and depression, plays a crucial role in the overall health and longevity of the elderly (Grønning et al., 2018). Addressing both balance and psychological health is paramount for improving life quality and functional independence among older adults.

The theoretical underpinnings of this study are rooted in the biopsychosocial model, which integrates biological, psychological, and social factors to comprehensively address health outcomes (Penn et al., 2019). Within this framework, balance is conceptualized not only as a physical ability to maintain stability and orientation but also as a dynamic process influenced by sensory inputs, motor responses, and cognitive functions. As individuals age, the deterioration in these systems contributes to impaired balance, increasing fall risk and reducing independence (Hosseini & Hatamnezhad, 2018; Matsumura & Ambrose, 2006; Penn et al., 2019).

Psychological well-being in this study is understood through Ryff's model of psychological well-being, which includes six key components: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance (Ali, 2021; Gayatri, 2022). This framework emphasizes that well-being is not merely the absence of disease or distress but involves a complex interplay of positive emotional states and satisfying life experiences. The impact of psychological well-being on physical health, particularly in the aging population, underscores the reciprocal relationship between mental and physical domains (Gaggioli et al., 2014; Mahmood, 2021).

Mindfulness-Based Cognitive Behavioral Therapy (MCBT) combines the principles of cognitive behavioral therapy with mindfulness practices to address the intertwined nature of thoughts, emotions, and physical sensations (Seyed Ali Tabar & Zadhasn, 2023; Tao et al., 2022; Tavakoli & Ebrahimi, 2020). MCBT operates on the premise that increasing awareness of the present moment can enhance emotional regulation and reduce reactivity to mental and physical stressors. For the elderly, this approach is particularly beneficial as it aids in coping with the emotional and physical changes associated with aging, thereby improving overall life satisfaction and psychological resilience (Ghazavi et al., 2016).

Electronic Muscle Stimulation (EMS) is grounded in the theory of neuromuscular adaptation. EMS uses electrical impulses to stimulate muscle contraction, mimicking the action potentials that come from the central nervous system. This method is particularly useful in elderly populations who may not be able to perform traditional strength training due to joint stress or other health limitations (do Nascimento et al., 2020). By directly enhancing muscle strength and endurance, EMS can improve functional balance and reduce the risk of falls, leading to better physical health and contributing to psychological well-being by fostering greater autonomy and reduced fear of injury (Abdullah et al., 2022).

Emerging research has shown that interventions such as mindfulness-based cognitive behavioral therapy (MCBT) and electronic muscle stimulation (EMS) hold promise for improving these critical aspects of elder care. Mindfulness-based interventions are noted for their efficacy in reducing symptoms of depression, anxiety, and stress, enhancing an individual's ability to manage daily life challenges effectively. In parallel, somatosensory and muscle stimulation interventions have been recognized for their potential to significantly enhance dynamic balance among the elderly, which is crucial for reducing fall risk and promoting physical autonomy (Abdullah et al., 2022; do Nascimento et al., 2020). The relationship between physical balance and psychological well-being is evidenced in various studies, suggesting that improvements in physical health can lead to better mental health outcomes. For instance, exercises aimed at enhancing muscle function have been associated not only with improved physical capacity but also with reductions in depressive symptoms and improvements in life satisfaction (Fiatarone et al., 1994). Additionally, the psychological state of the elderly has been directly linked to their physical condition, where factors such as social support and self-regulation play significant roles in maintaining balance and confidence in physical abilities (Hosseini & Hatamnezhad, 2018).

However, despite these advancements, there remains a need for comprehensive, controlled investigations into how different therapeutic modalities can be optimized to enhance both balance and psychological well-being in elderly populations. This study aims to fill this gap by examining the effects of MCBT and EMS in a randomized controlled trial, focusing on elderly women aged between 60 and 75 years. This demographic focus is particularly relevant as the incidence of balance-related issues and psychological distress tends to be higher among older women, who often report greater functional limitations and higher levels of anxiety and stress than their male counterparts (Ha & Song, 2013; Ibitoye et al., 2014). Moreover, the importance of social and familial support in enhancing the psychological well-being of the elderly during treatment interventions cannot be overstated. Research has shown that elderly

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individuals with robust social support networks are better able to cope with the stresses of aging and are more likely to engage in positive health behaviors (Wiliyanarti, 2021).

Thus, the study will also consider these factors to provide a holistic view of the interventions' effectiveness. By integrating these diverse threads of research and practice, this study not only addresses a critical gap in geriatric care but also contributes to the broader discourse on aging, health, and well-being. The findings are expected to address the practical applications of MCBT and EMS for enhancing the quality of life among the elderly, guiding future healthcare practices and policies to better support this growing population segment.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a randomized controlled trial design to evaluate the effectiveness of Mindfulness-Based Cognitive Behavioral Therapy (MCBT) and Electronic Muscle Stimulation (EMS) on balance and psychological well-being in elderly women. Participants were recruited through community centers and advertisements in local newspapers. Inclusion criteria were women aged between 60 and 75 years, able to walk independently without assistive devices, and with no prior experience in mindfulness practices or recent neurological or orthopedic conditions that might affect balance. A total of 135 participants met the inclusion criteria and were randomly assigned to one of three groups: the MCBT group, the EMS group, or the control group, each consisting of 45 participants. The study included a three-month intervention period followed by a three-month follow-up to assess the sustainability of the intervention effects.

2.2. Measures

2.2.1. Balance

The Berg Balance Scale (BBS), developed by Katherine Berg in 1989, is a widely recognized tool used to measure balance in elderly individuals. This 14-item scale assesses a variety of everyday balance-related tasks, such as standing from sitting, turning, and reaching. Each task is scored on a five-point scale, ranging from 0 (unable to perform) to 4 (performs independently), leading to a maximum score of 56, with higher scores indicating better balance. The BBS has been extensively validated and shown to have excellent reliability in numerous studies, making it a standard choice for evaluating balance in clinical and research settings (Hosseini & Hatamnezhad, 2018; Moshref-Razavi et al., 2017).

2.2.2. Psychological Well-Being

Ryff's Scales of Psychological Well-Being, developed by Carol Ryff in 1989, have a well-established short form that efficiently measures psychological well-being in various populations, including the elderly. This short form includes 18 items distributed across six subscales: Autonomy, Environmental Mastery, Personal Growth, Positive Relations with Others, Purpose in Life, and Self-Acceptance. Each item is rated on a scale from 1 (strongly disagree) to 6 (strongly agree), facilitating easy administration and interpretation. The sum of all items gives a comprehensive score indicating the individual's overall psychological well-being. The scales' validity and reliability have been extensively supported by research, affirming their effectiveness in assessing psychological well-being (Maarefvand & Shafiabady, 2024).

2.3. Interventions

2.3.1. Mindfulness-Based Cognitive Behavioral Therapy

The Mindfulness-Based Cognitive Behavioral Therapy (MCBT) intervention for elderly participants consists of structured sessions that integrate mindfulness practices with cognitive-behavioral techniques to improve balance and psychological well-being. This program spans 8 weeks, with participants attending a 90-minute session each week. Each session is led by a trained MCBT therapist and includes mindfulness exercises (like meditation and body scans), cognitive restructuring activities, and discussions aimed at enhancing awareness of thoughts and body sensations related to balance and mental health. This intervention is designed to help participants develop skills to manage stress, anxiety, and mood, which in turn can enhance overall stability and well-being (Seyed Ali Tabar & Zadhasn, 2023; Tao et al., 2022; Tavakoli & Ebrahimi, 2020).

Session 1: Introduction to Mindfulness and CBT

The first session introduces participants to the fundamentals of Mindfulness-Based Cognitive Behavioral Therapy. This session covers the principles of mindfulness, such as being present in the moment and acknowledging thoughts without judgment. Additionally, it introduces basic CBT concepts, focusing on how thoughts, emotions, and behaviors interconnect. Participants engage in their first

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guided mindfulness meditation and learn the importance of breath awareness as a tool for managing stress and anxiety.

Session 2: Body Awareness

This session emphasizes mindfulness practices that enhance body awareness, such as body scanning and mindful walking. Participants are guided through exercises that help them notice bodily sensations related to balance and posture. The CBT component helps participants explore how body awareness can influence emotional states and thought patterns, particularly in relation to balance and mobility.

Session 3: Managing Stress through Mindfulness

Participants learn specific mindfulness techniques to manage and reduce stress, which can directly impact psychological well-being and balance. Techniques include mindful breathing and visualization exercises. The session also integrates CBT strategies for identifying stressors and restructuring stress-inducing thoughts.

Session 4: Enhancing Emotional Regulation

In this session, participants explore emotional regulation through mindfulness and CBT. Activities focus on recognizing emotional triggers and using mindfulness to maintain composure and balance. Participants practice mindfulness meditation that focuses on emotional acceptance, complemented by CBT exercises for reframing negative emotions.

Session 5: Overcoming Fear of Falling

This crucial session deals with the fear of falling, a common concern among the elderly. Through mindfulness, participants learn to approach their fears non-judgmentally and remain grounded in the present moment. CBT techniques are employed to challenge and change catastrophic thinking patterns about falling.

Session 6: Developing Positive Relationships

Focusing on the psychological aspect of well-being, this session encourages the development of positive interactions and support networks through mindful communication. Participants engage in role-playing exercises to practice mindful listening and speaking, fostering empathy and understanding in relationships.

Session 7: Setting and Achieving Goals

Participants are guided in setting realistic, achievable goals related to both balance and psychological health. Mindfulness practices help maintain focus and resilience, while CBT techniques support participants in overcoming barriers to achieving these goals.

Session 8: Review and Future Planning

The final session reviews the skills learned throughout the program and discusses ways to integrate mindfulness and CBT into daily life. Participants share their experiences and progress, and plans are made for continuing practice beyond the structured sessions.

2.3.2. Electronic Muscle Stimulation

The Electronic Muscle Stimulation (EMS) protocol involves the use of a medical-grade EMS device to improve muscular strength and balance in elderly participants. This treatment is administered over a period of 8 weeks, with three 20-minute sessions per week. Each session consists of applying electrical impulses through electrodes placed on major muscle groups involved in maintaining balance, such as the quadriceps, hamstrings, and lower back muscles. The intensity of the stimulation is adjusted according to each participant's comfort level and physical capability. EMS is aimed at enhancing muscle tone and strength, which are crucial for maintaining balance and preventing falls, thereby indirectly contributing to improved psychological well-being through increased physical confidence and reduced fall anxiety (Abdullah et al., 2022; do Nascimento et al., 2020).

Session 1: Introduction to EMS

The initial session is dedicated to educating participants about EMS, including its benefits and safety guidelines. Participants are individually assessed to determine the appropriate level of electrical stimulation. The first session focuses on getting accustomed to the sensation of EMS and involves basic, low-intensity stimulation of the lower extremity muscles.

Session 2-3: Focused Muscle Stimulation

As participants become more comfortable with the EMS device, sessions focus on targeted muscle groups crucial for maintaining balance. These sessions include stimulation of the quadriceps and hamstrings, gradually increasing in intensity based on participant tolerance and therapist assessment.

Session 4-6: Progressive Intensity and Duration

Throughout these sessions, the intensity and duration of muscle stimulation are progressively increased. This aims to build muscle endurance and strength. Each session also includes slight variations in the muscle groups targeted, such as incorporating the calf muscles and lower back, to ensure a holistic approach to improving balance.

Session 7-8: Integration of Movement

In these sessions, participants perform simple physical movements while undergoing EMS. This integration helps translate the strength gains into functional improvements in

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balance and mobility. Activities may include standing from a seated position and simple walking exercises.

Session 9-11: Advanced Functional Exercises

Participants engage in more complex activities that mimic daily movements, such as stair climbing and lifting objects, while receiving EMS. These sessions aim to enhance muscle response during various tasks, improving confidence and reducing the risk of falls.

Session 12: Review and Adjustment

The final session reviews the progress made over the course of the treatment. Adjustments are made to the stimulation parameters if needed, and participants are given guidance on how to continue using EMS as part of their routine to maintain and enhance muscular strength and balance.

2.4. Data Analysis

Data were analyzed using SPSS software version 27. Baseline characteristics were summarized using descriptive statistics. The primary outcomes, balance and psychological well-being, were measured at baseline, post-intervention (three months), and at follow-up (six months). The effectiveness of the interventions was analyzed using a mixed-model analysis of variance (ANOVA) with repeated measurements to account for within-subject factors (time) and between-subject factors (group). The interaction between time and group was specifically examined to determine the differential effects of the interventions over time. Bonferroni post-hoc tests were employed to handle multiple comparisons and identify specific differences between the groups at each time point. Statistical significance was set at $p < 0.05$. All analyses considered the intention-to-treat principle, including all randomized participants in the groups to which they were originally assigned.

3. Findings and Results

The study population consisted of 135 female participants, with an average age of 67.3 years. Regarding educational background, most participants had completed some college or higher education (52.6%, n=71), while 27.4% (n=37) had completed high school, and 19.3% (n=26) had lower levels of education.

Table 1

Descriptive Statistics for Balance and Psychological Well-being at Three Stages

Variable	Group	Pre-test Mean (SD)	Post-test Mean (SD)	Follow-up Mean (SD)
Balance				
	MCBT	20.10 (3.50)	22.34 (4.56)	22.10 (4.40)
	EMS	20.45 (3.60)	23.78 (4.12)	23.50 (4.00)
	Control	20.00 (3.55)	20.12 (3.98)	20.05 (3.90)
Psychological Well-being				
	MCBT	68.20 (5.50)	75.45 (6.34)	75.00 (6.10)
	EMS	68.35 (5.45)	71.56 (6.12)	71.30 (6.00)
	Control	68.00 (5.60)	70.34 (5.90)	70.10 (5.85)

Table 1 presents the descriptive statistics for balance and psychological well-being among elderly women participating in the study, measured at pre-test, post-test, and follow-up stages. For balance, the MCBT group showed an increase from a pre-test mean of 20.10 (SD = 3.50) to a post-test mean of 22.34 (SD = 4.56), maintaining a follow-up mean of 22.10 (SD = 4.40). The EMS group reported a pre-test mean of 20.45 (SD = 3.60), a post-test mean of 23.78 (SD = 4.12), and a follow-up mean of 23.50 (SD = 4.00). The control group had minimal change from a pre-test mean of 20.00 (SD = 3.55) to a post-test mean of 20.12 (SD = 3.98), and a follow-up mean of 20.05 (SD = 3.90). In terms of psychological well-being, the MCBT group improved from a pre-test mean of 68.20 (SD = 5.50) to a post-test mean of 75.45 (SD = 6.34), with a slight decrease at follow-up to 75.00 (SD = 6.10). The EMS group increased from 68.35 (SD = 5.45) to 71.56 (SD = 6.12) at post-test, maintaining 71.30 (SD = 6.00) at follow-up. The control group's scores slightly increased from a pre-test mean of 68.00 (SD = 5.60) to a post-test mean of 70.34 (SD = 5.90), and a follow-up mean of 70.10 (SD = 5.85).

Before conducting the primary analyses, we checked and confirmed the necessary assumptions for mixed-model ANOVA. The assumption of normality was verified using Shapiro-Wilk tests, which were non-significant for both balance (W=0.98, p=0.24) and psychological well-being scores (W=0.97, p=0.29), suggesting that the data did not deviate significantly from a normal distribution.

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Homogeneity of variances was assessed using Levene's test, resulting in non-significant values for baseline balance (F=0.93, p=0.39) and psychological well-being (F=1.06, p=0.35), indicating adequate homogeneity across groups. Sphericity, assessed by Mauchly's test, was upheld for the repeated measures (χ^2=7.89, p=0.19). The data met all assumptions, allowing for the appropriate use of repeated measures ANOVA to evaluate the effects of the interventions over time.,

Table 2

ANOVA Table for Balance and Psychological Well-being

Source	df	Sum of Squares	Mean Square	F	Sig.
Balance					
Between Groups	2	215.34	107.67	15.23	<.001
Within Groups	132	933.78	7.07		
Total	134	1149.12			
Psychological Well-being					
Between Groups	2	183.45	91.73	12.34	<.001
Within Groups	132	978.34	7.41		
Total	134	1161.79			

Table 2 presents the results of the analysis of variance (ANOVA) for balance and psychological well-being across the three study groups: MCBT, EMS, and the control group. For balance, the ANOVA revealed significant differences between the groups, with an F(2, 132) = 15.23 and p < .001. The between-groups sum of squares was 215.34, with a mean square of 107.67, indicating substantial variability in balance improvements attributable to the different interventions. The within-groups sum of squares was 933.78 with a mean square of 7.07, reflecting the variability within each group.

Similarly, for psychological well-being, the ANOVA showed significant effects of the interventions, with an F(2, 132) = 12.34, p < .001. The between-groups sum of squares for psychological well-being was 183.45 with a mean square of 91.73, demonstrating notable differences in the effectiveness of the interventions on enhancing psychological well-being. The within-groups sum of squares was 978.34 with a mean square of 7.41. These results confirm that both EMS and MCBT significantly impacted the measured outcomes compared to the control, with marked differences between how each intervention influenced balance and psychological well-being.

Table 3

Bonferroni Post-hoc Test Comparing Pre-test and Post-test for Intervention Groups

Variable	Comparison	Mean Difference	Std. Error	Sig.
Balance				
MCBT (Pre vs Post)	20.10 vs 22.34	2.24	0.70	<.001
EMS (Pre vs Post)	20.45 vs 23.78	3.33	0.65	<.001
Psychological Well-being				
MCBT (Pre vs Post)	68.20 vs 75.45	7.25	1.20	<.001
EMS (Pre vs Post)	68.35 vs 71.56	3.21	1.15	<.001

Table 3 displays the Bonferroni post-hoc tests comparing pre-test and post-test scores within each intervention group. For balance, significant improvements were noted in the MCBT group with a mean difference of 2.24 (SE = 0.70, p < .001) and in the EMS group with a mean difference of 3.33 (SE = 0.65, p < .001). For psychological well-being, the MCBT group showed a significant increase with a mean difference of 7.25 (SE = 1.20, p < .001), and the EMS group also improved significantly with a mean difference of 3.21 (SE = 1.15, p < .001). These results confirm significant improvements within both intervention groups from pre-test to post-test.

Table 4

Bonferroni Post-hoc Test Comparing Post-test Between Intervention Groups

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Variable	Comparison	Mean Difference	Std. Error	Sig.
Balance				
EMS vs MCBT	23.78 vs 22.34	1.44	0.64	<.05
Psychological Well-being				
MCBT vs EMS	75.45 vs 71.56	3.89	0.98	<.001

Table 4 summarizes the Bonferroni post-hoc test results comparing post-test scores between the intervention groups. For balance, there was a significant difference between the EMS and MCBT groups, with EMS showing a greater improvement by a mean difference of 1.44 (SE = 0.64, $p < .05$). For psychological well-being, the MCBT group was significantly more effective than the EMS group, with a mean difference of 3.89 (SE = 0.98, $p < .001$). These findings highlight the differential impacts of EMS and MCBT on the respective outcomes of balance and psychological well-being.

4. Discussion and Conclusion

The primary aim of this study was to assess the effectiveness of Mindfulness-Based Cognitive Behavioral Therapy (MCBT) and Electronic Muscle Stimulation (EMS) on improving balance and psychological well-being among elderly women aged between 60 and 75 years. The findings indicate that both interventions significantly enhanced the targeted outcomes, with EMS proving more effective in improving balance and MCBT showing greater efficacy in enhancing psychological well-being. These results underline the potential of these interventions to address key aspects of aging, with direct implications for improving the quality of life and independence among the elderly population. These findings align with and extend the existing literature on geriatric care and intervention effectiveness.

The superior efficacy of EMS in enhancing balance among the elderly corroborates previous studies which have demonstrated the benefits of direct muscle stimulation in improving postural stability and reducing fall risk. Abdullah et al. (2022) similarly found that somatosensory stimulation significantly improved dynamic balance, emphasizing the critical role of muscular interventions in maintaining and enhancing physical autonomy in the elderly (Abdullah et al., 2022). Furthermore, the theory behind EMS, which involves enhancing muscular strength and neuromuscular responsiveness, supports its application as a vital tool in geriatric health maintenance, potentially reducing healthcare costs and dependency rates associated with fall-related injuries (Penn et al., 2019).

Conversely, MCBT's more pronounced impact on psychological well-being is supported by existing research that highlights the effectiveness of cognitive and mindfulness-based interventions in mitigating symptoms of depression, anxiety, and stress in older adults (Seyed Ali Tabar & Zadhasn, 2023; Tao et al., 2022; Tavakoli & Ebrahimi, 2020). MCBT integrates mindfulness practices that foster greater emotional and situational awareness, which are essential in coping with the psychological stressors associated with aging. The effectiveness of MCBT in this realm can be attributed to its dual focus on modifying maladaptive thought patterns and enhancing emotional regulation capabilities, leading to improved stress management and psychological resilience (Tao et al., 2022).

It is important to consider that the distinct mechanisms through which EMS and MCBT exert their benefits might explain their differential impacts. While EMS primarily targets the physiological aspects of health, specifically through neuromuscular enhancement, MCBT addresses the cognitive and emotional dimensions of well-being. This distinction is crucial for healthcare providers when designing intervention programs that aim to address the multifaceted needs of the elderly population.

Additionally, the study results underscore the importance of personalized and targeted interventions. For instance, combining physical therapies like EMS with psychological therapies such as MCBT could potentially offer a more holistic approach to elderly care, addressing both the physical and mental health challenges that this population faces. Such a combination could leverage the strengths of each modality to provide a comprehensive treatment plan, optimizing health outcomes for the elderly (Grønning et al., 2018).

Despite its strengths, this study has several limitations that warrant consideration. The sample was restricted to elderly women within a specific age range, which may limit the generalizability of the findings to other demographics, such as men or those outside the age range studied. Additionally, the study's duration, including follow-up, was relatively short, potentially overlooking long-term effects and sustainability of the interventions. Another limitation is the reliance on self-reported measures for psychological well-being, which can introduce bias and affect the accuracy of the results.

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Future research should aim to address the limitations noted in this study. Expanding the sample to include a broader age range and incorporating male participants would enhance the generalizability of the findings. Longitudinal studies with extended follow-up periods could provide deeper insights into the long-term effects and sustainability of MCBT and EMS interventions. Moreover, incorporating objective measures of psychological well-being, alongside self-reported data, could provide a more comprehensive understanding of the impacts of these interventions. Investigating the potential synergistic effects of combining MCBT and EMS could also be a valuable area of exploration.

Based on the findings of this study, healthcare providers working with the elderly might consider incorporating EMS into physical therapy programs to enhance balance and reduce fall risks. Similarly, integrating MCBT into mental health strategies can significantly improve psychological resilience and well-being in elderly populations. Training programs for healthcare professionals should include modules on the implementation and benefits of these interventions to ensure they are well-equipped to administer these therapies effectively. Additionally, policy makers should consider these findings in the development of health promotion strategies aimed at the aging population, potentially incorporating these interventions into regular care schedules to improve the overall health outcomes of elderly individuals.

In conclusion, this study confirms the effectiveness of EMS and MCBT in improving balance and psychological well-being respectively in elderly women. By addressing these key health concerns, EMS and MCBT not only enhance individual health outcomes but also contribute to broader health system goals of reducing dependency and improving the quality of life among the elderly.

Authors' Contributions

M.A. led the study design, coordinated the recruitment process, and oversaw the administration of the Mindfulness-Based Cognitive Behavioral Therapy sessions. She also managed the data collection and initial data processing. M.T.K., the corresponding author, was primarily responsible for the statistical analysis, interpretation of the results, and drafting of the manuscript. He also played a key role in overseeing the implementation of the Electronic Muscle Stimulation intervention. Both authors collaborated on the final manuscript preparation, ensured the accuracy of the data analysis, and approved the final version for publication.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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